Gestalt Perception in Schizophrenia Spectrum Disorders

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ABSTRACT

The research examined the hypothesis that schizophrenia spectrum disorders are characterized by impairments in Gestalt perception. Participants with elevated levels of schizotypy, acute and chronic schizophrenia patients, and non-schizophrenia psychotic disorders were assessed on three measures of Gestalt perception. The hypothesis was that schizophrenia spectrum disorders are characterized by reduced responsiveness to Gestalt properties of visual stimuli. A pattern of performance on experimental tasks was predicted that would produce both impaired and enhanced task performance in schizophrenia spectrum disorders on measures of Gestalt perception. Impairments in Gestalt perception were hypothesized to correlate with symptoms of the disorganisation syndrome and with a specific aspect of social cognition, Theory of Mind (ToM), in schizophrenia spectrum disorders.

The results of the research confirmed the main hypotheses. Schizophrenia spectrum disorders displayed in all studies reduced responsiveness to Gestalt properties of stimuli. Dysfunctional Gestalt perception emerged not as general feature of schizophrenia spectrums disorders, however. Cognitive deficits were specifically related to the disorganisation syndrome and statistical comparisons between participants with elevated and reduced levels of thought disorder found that dysfunctional Gestalt perception was only present in thought disordered participants with schizophrenia spectrum disorders. Dysfunctional Gestalt perception resulted consistently in both impaired and enhanced task performance in disorganised forms of schizophrenia spectrum disorders. It is concluded that the experimental results reflect a specific deficit

in the perceptual organisation of stimuli based on context. Furthermore, the hypothesis was confirmed that dysfunctional Gestalt perception is correlated with impaired ToM in chronic and acute schizophrenia.

The findings of the research are discussed from the perspective of recent models of cognition in schizophrenia spectrum disorders where impaired Gestalt perception is viewed as the result of a comprehensive impairment in the cognitive coordination of neural and cognitive activity. It is proposed that dysfunctional Gestalt perception may be related to a specific subtype of schizophrenia, neurodevelopmental schizophrenia, which is characterised by poor premorbid functioning, disorganised symptoms, and poor outcome. Further issues for research are discussed.

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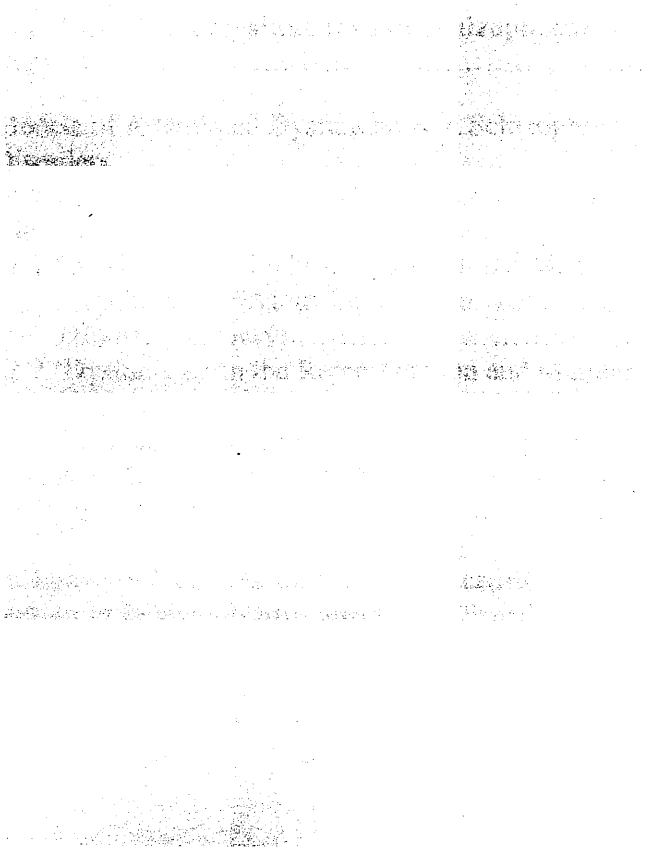


1. INTRODUCTION

1.1 The Concept of Schizophrenia

1.1.1 Historical Perspectives

Although the term 'schizophrenia' describes a relatively new disease which found its way into the textbooks of psychiatry only at the end of 19th century, the symptoms which belong to it were described at least as early as 460 BC. Hippocrates of Cos (1737, cited in Roccatagliat, 1991) described a syndrome 'stupiditas' with the following symptoms: "...The ill person often weeps without reason... he is frightened without reason... he takes interest in subjects of which he is obviously ignorant...often in things which only interests scholars...sometimes he sees images as if in dreams..."

Further detailed descriptions which closely resemble the symptoms of schizophrenia can be found throughout the centuries in history, art, and literature (see Bark, 1988, for a review). The description of 'Poor Mad Tom' in Shakespeare's *King Lear,* for example, has been considered a classic description of schizophrenia (Bark, 1985). The following excerpt (Act III, Scene 4) is reminiscent of the characteristic disorder of thought in schizophrenia: 'derailment' and perhaps 'neologisms', as in:

> "Still through the hawthorn blows the cold wind; says suum, mun, hey no nonny, Dolphin my, my boy; sessa! Let him trot by."

There are other examples of hallucinations and paranoia:

> "The foul fiend haunts Poor Tom in the voice of a nightingale. Hopdance cries in Tom's belly for two white herring."

and

> "...five fiends have been in poor Tom at once; of lust as Obidicot; Hobbididance, prince of dumbness; Mahu, of stealing; Moho, of murder; Flibbertigibbet, of mopping and mowing; who since possesses chambermaids and waiting women..."

Yet, some theorists (e.g., Torrey, 1980) suggest that although descriptions of individual symptoms of schizophrenia can be found, none of these describe schizophrenia according to the present definition. Rather, schizophrenia is seen as a relatively new disease which only emerged in the 19the century.

1.1.2 Dementia Praecox (E. Kraepelin)

The 'modern' concept of schizophrenia and the systematic study of this disorder in the history of psychiatry is associated with Emil Kraepelin. First in his lectures in Heidelberg in 1886 and later in the sixth edition of his textbook in 1899, Kraepelin linked several psychotic syndromes to propose a new disease entity, *dementia praecox.* Dementia praecox subsumed the syndrome *hebephrenia* which was described by Hecker in 1871, *catatonia*, a syndrome defined by Kahlbaum in 1868, and *paranoid* which was first described by Sander in 1868. These previously independent syndromes served as the basis for the 3 subgroups which constituted dementia praecox. The three subgroups[1] were defined by the following clinical characteristics:

[1] In 1913, Kraepelin added a fourth group, *dementia simplex,* which described a clinical picture characterized by mainly mild negative symptoms

1. *Paranoid-Hallucinatory* (pronounced delusions, hallucinations)
2. *Hebephrenia (*thought disorder, delusions, avolition, apathy, flattened affect, inappropriate affect, bizarre behavior)
3. *Catatonia* (motoric symptoms such as stupor, alogia, stereotypy, mutism, thought disorder but also hallucinations and delusions in the early phase)

The defining feature of dementia praecox was the early onset of the disorder and a general intellectual decline[2]. These two features distinguished dementia praecox from a large group of other psychiatric disorders, the affective disorders. Kraepelin considered these two groups to be distinct. Schizophrenia as a disorder with an early onset and intellectual decline was not Kraepelin's discovery, however. In his emphasis on these features, Kraepelin followed the work of Morel who, in 1852, had described a case of a boy who suffered from premature dementia, *démence précoce.* Morel had another profound influence on Kraepelin, and, as a result, on modern psychiatry. Kraepelin adopted Morel's principal task of psychiatric investigation by focusing, on the one hand, on the precise description and delineation of diseases and the search for anatomic lesions, on the other (Sedler, 1991). Thus, Kraepelin's nosology was the first comprehensive attempt to arrive at a fundamental classification of psychiatric disorders where previously only a multitude of loosely defined syndromes existed. His emphasis on psychiatric disorders as distinct disease entities with a specific organic pathology provided the blueprint for modern biological psychiatry.

[2] 'Dementia' (Loss of Intellectual Functioning), 'Praecox' (Early Onset)

Kraepelin's work also contains the uncertainties and contradictions which trouble the concept of schizophrenia to this day. In his early attempts, Kraepelin failed to identify an organic pathology of dementia praecox. Nor was the concept of dementia praecox clearly defined. For example, Kraepelin (1909, p. 945) concluded that "Unfortunately, in the field of psychiatric disturbances there is not a single symptom which is pathognomic for any particular illness." In addition, dementia praecox soon proved not always to follow the postulated general deterioration. In his later research, Kraepelin reported that out of 127 cases he found 16 where "...it was unreservedly stated that the patients fully recovered" (1909, p. 865).

1.1.3 Dementia Praecox or the Group of Schizophrenias (E. Bleuler)

The concept of dementia praecox underwent significant revisions with the publication of Eugen Bleuler's *Dementia Praecox or the Group of Schizophrenias* in 1911. Bleuler adopted the subgroups of Kraepelin's dementia praecox but departed in fundamental ways. In contrast to Kraepelin, Bleuler rejected the notion of dementia and endorsed a more optimistic outlook regarding the course of the disease. He suggested that "In no other disease is the disturbance of intelligence more inadequately designated by the terms 'dementia' and 'imbecility' than in schizophrenia" (1911/1950, p. 69). Accordingly, the defining pathological feature of dementia praecox had to lay elsewhere. The new terminology for dementia praecox was supposed to represent the essence of the pathology. Bleuler coined the term *schizophrenia*[3] to capture the splitting or fragmentation of mental processes which, in his view, constituted the *primary*

[3] Schizophrenia: 'Schizo' (Split), 'Phrene' (Mind)

disturbance in schizophrenia. The symptoms which dominated the clinical picture, such as delusions and hallucinations, were considered to be *secondary* or *accessory symptoms.* Both symptom groups represented distinct etiologies. Bleuler (1908, cited by Hoenig, 1983) summarized his view as follows: "We thus differentiate not only between the disease process and its symptoms, but amongst the latter between primary symptoms, directly caused by the disease process, and secondary symptoms brought about by certain psychic mechanisms." Bleuler thus distinguished between an organic pathology of the primary symptoms whereas the secondary symptoms were psychogenically determined.

Bleuler distinguished 4 primary symptoms:

1. *Disturbances of Association* The pathological change of thinking in schizophrenia is characterized by *a loosening of association.* "The disease disrupts the thousand threads which guide our thinking. These interruptions are irregular, only occasionally, sometimes frequently, and, at times, they are interrupted for the most part" (Bleuler, 1911/1950, p. 10). Disturbances of association in schizophrenia further include the condensation of two separate thoughts, perserveration, poverty of thought, and increased distractibility.
2. *Affectivity* Bleuler suggested that in schizophrenia, several changes in affect occur. Changes in affect subsume the reduction of affect which Bleuler considered to be pronounced in chronic patients. Disturbances of affect are also characterized by the lack of integration. Affective states lack the depth of normal emotional states and are sometimes inappropriate to the context of behaviour. Finally, disturbances of affect include the affective lability of patients and their reduction in modulating affective states.

3. *Ambivalence* The schizophrenic mind is characterized by the existence of mutually exclusive mental states which occur in three different areas. Ambivalence includes *affective ambivalence*, for example, a husband may both love and hate his wife. *Ambivalence of the will* refers to the fact that a patient may engage in two actions which are incompatible. "A patient may want both to eat or not to eat; he tries several times to use the spoon but does not succeed and engages in a series of unnecessary behaviors" (Bleuler, 1911/1950, p. 43). Finally, ambivalence extends to the thinking of patients, *intellectual ambivalence.* The patient may combine two mutually exclusive ideas, i.e., God and the devil are the same person.
4. *Autism* Autism describes the predominance of the internal over the external world. The patient is withdrawn into his own world which is dreamlike, dominated by wish-fulfillment and persecutory ideations. As a result, the patient may conflict with reality and may consider his internal world to be the 'real' and the external world to be a 'fiction'.

The distinctions between the primary symptoms are far from clear, however, nor is their status. Bleuler (1911/1950, p. 276) conceded: "We do not know with certainty the primary symptoms of the schizophrenic cerebral pathology." Among the primary symptoms, Bleuler assigned the loosening of associations a special status. In his view, they represented an impairment which was most likely indicative of the disease process and its most consistent manifestation since the loosening of association is "always present during the disease" (p. 9) and itself sufficient for a diagnosis of schizophrenia. In a different context, Bleuler suggested that the loosening of association causes ambivalence,

a primary symptom, underlining the vagueness in the distinction between the primary symptoms.

Bleuler's theory of schizophrenia was also guided by a dimensional approach to psychiatric delineation and classification of mental diseases, foreshadowing later developments in psychiatry (Claridge, 1972). Under the subgroup of *schizophrenia simplex*, Bleuler described a group of patients who exhibited mostly the primary symptoms without the secondary symptoms of schizophrenia. The large number of such cases, however, was not found in hospitals but in the community at large. Relatives of patients and individuals with personality disorders were found to exhibit all the essential symptoms of the disorder. Although Bleuler never intended to create a diagnostic approach, the observation that this 'latent' form of schizophrenia was the most frequent group of the schizophrenias led to some unforeseen consequences. In the following decades, psychiatrists in the United States, for example, endorsed a diagnosis of schizophrenia which was increasingly unspecific and broad (Davidson & Neale, 1996).

1.1.4 First Rank Symptoms (K. Schneider)

The concept of schizophrenia as defined by Kraepelin and Bleuler left many questions unresolved. A somatic pathology was not demonstrated nor was there clarity regarding the diagnostic criteria and the boundaries of the disease. Kurt Schneider's contribution to the concept of schizophrenia was an attempt to overcome some of these difficulties. Influenced by Japser's (1959) position on the relevance of phenomenology for an 'understanding' of abnormal mental states, Schneider emphasized the importance of the study of the inner life of the patient. The result was an a-theoretical diagnostic

system which differentiated schizophrenic symptoms into symptoms of first and second rank. A list of these symptoms can be found in Table 1.1. Unlike Bleuler, Schneider did not attempt to postulate any aetiological factors involved although he left the hypothesis of an organic pathology unchallenged.

Table 1.1

First and Second Rank Symptoms According to Schneider (1967)

Symptom Group	First Rank Symptoms	Second Rank Symptoms
1. Hallucinations	Voices Commenting on One's Action	Other Auditory Hallucinations
		Optical Hallucinations
	Voices Conversing	Olfactory Hallucinations
	Audible Thoughts	Gustatory Hallucinations
2. Ego Disturbances	Somatic Passivity	
	Thought Withdrawal	
	Thought Broadcasting	
	Thought Insertion	
3. Delusions	Delusional Perception	Paranoia
		Delusions of Grandeur

Schneider believed that all first rank symptoms were especially important in the diagnosis of schizophrenia. Second rank symptoms were considered non-specific to schizophrenia and did not entail a diagnosis of schizophrenia. Nonetheless, a diagnosis of

schizophrenia in the absence of first rank symptoms could still be made if second rank symptoms occurred frequently and included symptoms such as stilted and inappropriate affect (Schneider, 1967).

Schneider's contribution provided a strict and reliable source of diagnostic criteria which proved more consistent than many of the previous symptoms, such as Bleuler's primary symptoms, but the status of first rank symptoms as pathognomic to schizophrenia has been questioned by empirical work. First rank symptoms can also occur in psychiatric disorder other than schizophrenia, such as manic-depressive disorder (Carpenter, Strauss, & Muleh, 1973), and are not useful in differentiating schizophrenia from other psychotic disorders (Peralta & Cuesta, 1999). The relationship between first rank symptoms and outcome is also unclear. Bland and Orn (1979) suggested that the presence of some first rank symptoms correlates positively with good outcome, whilst others did not suggest such a relationship. However, in two large international studies (WHO, 1973) there was a greater than 90% probability that in the presence of first rank symptoms the diagnosis would be schizophrenia. Furthermore, the importance of first rank symptoms for the diagnosis of schizophrenia is reflected in the fact that in the current version of the Diagnostic and Statistical Manual of Mental Disorder (DSM-IV) (American Psychiatric Association, 2000), the presence of one first rank symptom is sufficient for a diagnosis of schizophrenia.

1.1.5 The Concept of Schizophrenia: Current Perspectives

The current concept of schizophrenia contains many of the ideas and views proposed by Kraepelin, Bleuler, and Schneider. The DSM-IV reflects the importance of

first rank symptoms as well as the primary symptoms described by Bleuler. Thus, a person can be diagnosed with schizophrenia if, for example, only commenting auditory hallucinations are present. This also depends on meeting other criteria, such as a functional criterion, a Kraepelinian concept. Similarly, a diagnosis of schizophrenia is made if a person is exhibiting a negative symptom, i.e., flattening of affect, and disorganised speech corresponding to two Bleulerian primary symptoms.

This lack of an underlying paradigm has been criticized (Maj, 1998) and raises questions concerning the validity of the concept as a whole (Bentall, 1990). Different diagnostic systems, for example, are poorly correlated with each other. Dollfus, Petiti, Menard, and Lesieur (1993) compared 13 diagnostic systems in a cross-sectional study in residual and acute patients with schizophrenia. Diagnostic criteria, specifically those based on the approaches by Schneider and Bleuler, displayed few relationships. Although the diagnosis of schizophrenia has been improved in reliability with the development of the DSM and the International Classification of Diseases (ICD), the current concept of schizophrenia has a poor construct validity as demonstrated by the fact that the large majority of criteria are not specific to schizophrenia and can be found frequently in other psychiatric disorders (Peralta & Cuesta, 1999). Nor is the current diagnostic system predictive of the outcome of the disorder. Kraepelin's hypothesis that schizophrenia has a chronic deteriorating course, has been disproved in a number of large longitudinal studies (Huber, Gross, Shuttler & Linz, 1980; McGlashan, 1988). These studies suggest that outcome is enormously variable, ranging from a chronic course in one third of patients to almost complete recovery in 20-30% of patients.

The boundaries of the concept also remain disputed. Crow (1990), for example, argued that a continuum of psychoses exists that crosses diagnostic boundaries. In his view, schizophrenia, schizoaffective disorder, and affective illnesses exist along one or more such continua. Common to all these disorders is a genetic deficit located in the pseudoautosomal region of the sex chromosome. Although Crow rejects distinct etiologies, he accepts the concept of prototypical entities corresponding to schizophrenia and affective illness. Several genetic linkage studies have demonstrated that a broad phenotypic definition, that included schizophrenia, schizoaffective disorder, and other afffective disorders, provided stronger evidence for genetic linkage (Tsuang, Stone, & Faraone, 1999). The DSM-IV remains contradictory on this issue. Schizophrenia is, on the one hand, defined as a discrete condition yet it is also stated that "...there is no assumption that each category of mental disorder is a completely discrete entity" (p. xxxii).

The uncertainty regarding the validity, definition, and scope of the current concept of schizophrenia has led a number of theorists to propose alternatives. Bentall (1990) proposed, for example, to discard the "meaningless concept of schizophrenia" (p. 48). Instead, research should focus on the symptoms of schizophrenia, i.e., delusions or hallucinations, from which cognitive and biological hypotheses of abnormal mental processes can be derived. This approach has led to a number of theories regarding the etiology of hallucinations (Hoffman & Rappaport, 1994) and delusions (Bentall, 1994).

Others (i.e., Andreasen, 1999; Tsuang et al., 2000) have focused on reformulating the diagnosis of schizophrenia by proposing alternative frameworks. Tsuang et al. (2000) suggested that future diagnostic criteria should incorporate neuropsychological and

biological abnormalities of the disorder instead of relying on psychotic symptoms. From this viewpoint, the underlying biological and neurobiological impairments represent the underlying clinical syndrome or schizotaxia (Meehl, 1962). The focus on these symptoms could lead to the identification of the more specific expression of schizophrenia as opposed to overt psychotic symptoms influencing treatment and approaches to research.

1.2. Syndromes of Schizophrenia

1.2.1 Classical Subtypes of Schizophrenia (E. Kraepelin & E. Bleuler)

"The Differentiation of the Groups of Schizophrenia is a Task for the Future"

(Bleuler, 1911/1950, p. 228)

From its very beginnings, the disease was not considered a homogenous entity. Kraepelin had subsumed phenomenologically different syndromes under dementia praecox which served as the main subgroups. This classification into three main types was, at best, a provisional solution. Kraepelin (1904, p.192, my translation) suggests that "As long as we do not have the necessary foundations for a better system, I am allowed to continue the usage of the common subtypes, which are only meant for clarification, but do not have any independent clinical value." In later editions of his textbooks, Kraepelin introduced up to 36 (!) types of dementia praecox with numerous independent symptoms.

Bleuler adopted the four subgroups of Kraepelin but differed in his views on their interrelationship. In contrast to Kraepelin, Bleuler emphasized that schizophrenia consists

of a *Group of Schizophrenias*. Indeed, Bleuler went as far as to suggest that the concept of schizophrenia is "...of temporary value only inasmuch as it may be later have to be reduced" (1911, p. 8). The variation in the clinical picture which "...may be extremely varied..." (p. 4) led Bleuler to conclude "It is not yet clear what sort of entity the concept of dementia praecox actually represents" (p. 279).

The uncertainty regarding the subtype classification of schizophrenia has led to major alterations. Kleist and Leonhard proposed classification schemes with 19 types of chronic schizophrenia (Fish, 1962). In American psychiatry, patients were diagnosed according to a distinction between non-paranoid vs. paranoid forms of schizophrenia. Patients were also differentiated according to their level of functioning prior to the outbreak of the disease and the rapid vs. insidious onset of the first episode (Buss & Buss, 1969).

Despite attempts to provide alternative frameworks for the subtype classification of schizophrenia, the original classification has survived. The current version of the DSM continues to list the four subtypes identified by Kraepelin and Bleuler describing approximately the same syndromes. Despite this, the validity of the subtypes remains uncertain. Carpenter, Bartko, Carpenter, and Strauss (1976) examined the validity of the original classification in the International Pilot Study of Schizophrenia (WHO, 1973). Patients (n=501) from six different countries were recruited and diagnosed with paranoid, hebephrenic, catatonic or simple schizophrenia. Symptoms profiles were computed for each group and compared across the different subtypes. The results showed that the four subtypes were roughly similar in level and composition of psychopathology, suggesting

that the classical subtypes may not provide a strong heuristic approach to identify distinct syndromes.

More recent studies have investigated the stability of schizophrenia subtypes longitudinally. Fenton and McGlashan (1991) examined the DSM-III-R subtype criteria in a sample of unmedicated, acute patients with schizophrenia and at a follow up 5 years later. Overall, 66% of all patients retained the same diagnosis but the subtypes had distinct profiles across time. Whereas undifferentiated and paranoid schizophrenia remained relatively stable, the hebephrenic subtype usually became evident only years later after the onset. The classic subtypes could be distinguished by several clinical variables. Genetically, non-paranoid forms of schizophrenia had a stronger contribution. Age and form onset differentiated three subtypes. Hebephrenic schizophrenia was characterized by an earlier onset, insidious early course and nonreactive, compared to paranoid and undifferentiated schizophrenia. Data from a study by Deister and Marneros (1993) which investigated 148 patients longitudinally for 23 years on average indicated that long-term stability of subtypes in schizophrenia is not as frequent.

The evidence suggests that the classical subtypes characterized by Kraepelin and Bleuler do not allow sharp distinctions to be made. Although the data by Fenton and McGlashan indicate that schizophrenic subtypes may be characterized by different genetic contributions, age of onset and course, the stability of these clinical syndromes of schizophrenia is, at best, modest. In recent attempts to reduce the heterogeneity of schizophrenia at the level of signs and symptoms, the possibility has been examined that different symptoms occur regularly together to form syndromes, a procedure which may constitute a more useful approach.

1.2.2 Positive vs. Negative Symptoms

The proposition of independent pathophysiological processes underlying different signs and symptoms (Bleuler, 1950/1911) has been reinforced by models which suggest that schizophrenia is characterized by two major dimensions of psychopathology: positive symptoms and negative symptoms. The distinction between positive and negative symptoms originated with Jackson (1887) who argued that the effects of disintegration of higher mental processes in mental illness could result in either 'negative' mental symptoms, involving deficiencies of mental processes such as volition, control, consciousness, and reasoning or more directly, in 'positive' symptoms such as hallucinations, delusions, or impulsive and automatic behaviour patterns. An influential version of this two-syndrome model has been proposed by Crow (1980). He proposed two types of schizophrenia: type I is characterized by positive symptoms, such as delusions, hallucinations and thought disorder, that tend to occur mainly in acute forms of the disorder, while type II is characterized by negative symptoms, such as affective flattening, poverty of speech that are pronounced in chronic forms. Crow hypothesized that the two types involve different underlying pathological processes: a neurohumoral disturbance involving increased dopamine transmission causes the type 1 while cell loss and structural changes in the brain result in the type II syndrome. Despite distinct pathological processes, Crow (1980) holds the view that a single etiology is responsible for both syndromes.

Evidence from studies which examined the negative:positive dichotomy points to different conclusions. Owen and Johnstone (1980), for example, reported that in a population of chronic institutionalized patients, negative and positive symptoms

represented independent dimensions of symptomatology. Yet, studies by Bilder, Mukherjee, Rieder, and Pandurangi (1985) and Lewine, Fogg, and Meltzer (1983) did not to replicate these results. However, from a clinical point of view, it is questionable to assume that these dimensions are completely independent. Most patients will present with both positive and negative symptoms during the course of the disease. Positive and negative symptoms may thus characterize groups of symptoms rather than groups of patients (McKenna, 1994).

The clinical correlates of positive and negative symptoms have also not found unequivocal support in the literature. Crow (1980) suggested that the type II syndrome is caused by ventricular enlargement and is related to poor response to neuroleptic treatment. In a review of computerised tomography studies, Lewis (1990) concluded that only 5 out of 18 relevant studies found a significant relationship between negative symptoms and ventricular enlargement. In addition, negative symptoms are partially responsive to pharmacological interventions (e.g., Feinberg et al., 1988). Another finding which undermined conceptions of the negative syndrome in schizophrenia was reported by Kay (1990). In a sample of recently admitted acute schizophrenia patients, outcome was not related to negative symptoms, which is in contrast to the assumption that negative symptoms characterize a 'defect state' in schizophrenia.

1.2.3. Factorial Models of Schizophrenic Symptoms

Despite the initial enthusiasm for the positive:negative dichotomy of schizophrenia, further evidence suggested that this distinction represents, at best, a simplified approach. Researchers early on reported that some symptoms did not fit easily

into any of these categories, such as thought disorder (Wing, 1978). Others suggested a third syndrome of *disorders of relating* (Strauss, Carpenter, & Bartko, 1974) or a *mixed syndrome* (Wing, 1978). Positive and negative symptoms also showed varying degrees of internal consistency. Negative symptoms, as measured by a variety of scales, have demonstrated a high internal consistency (.85- Andreasen & Olsen, 1982). Conversely, studies measuring intercorrelations among positive symptoms (Andreasen & Olsen, 1982; Mortimer, Lund & McKenna, 1990) reported low internal consistency (.45- Andreasen & Olsen), suggesting that the positive syndrome is not homogenous. Finally, Andreasen, Flaum, Swayze, Tyrell, and Arndt (1990) reported that only 26 out of 110 patients with a diagnosis of schizophrenia could be assigned clearly to either the positive or negative category. From this finding, one can conclude that the clinical picture of a large number of patients is not adequately captured by this distinction.

In a seminal paper, Liddle (1987a) examined the symptomatology in chronic patients with schizophrenia using factor analysis. Factor analysis reduces a large number of independent variables to a smaller, conceptually more coherent set of variables (Kim & Mueller, 1978). Liddle conducted a factor analysis of the individual items of the Scale for the Assessment of Negative Symptoms (SANS) (Andreasen, 1984a) and the Scale for the Assessment of Positive Symptoms (SAPS) (Andreasen, 1984b), to examine whether schizophrenic symptoms can be appropriately summarized into a positive and negative syndrome. Thus, this approach made no prior assumption which symptoms should be assigned to a positive and negative syndrome. The results showed that the positive:negative dichotomy did not describe adequately the symptoms in the sample of chronic patients. Instead, Liddle found three syndromes:

1) *Psychomotor Poverty* (poverty of speech, blunted affect, and decreased movement)

2) *Reality Distortion* (various delusions and hallucinations)

3) *Disorganisation* (formal thought disorder, inappropriate affect, and poverty of speech)

The major finding of this study was that the positive syndrome consisted of two groups of symptoms, the reality distortion and disorganisation syndromes, whereas the psychomotor poverty syndrome subsumed symptoms which were similar in character to the negative symptom group as defined by Andreasen and Arndt (1982) and Crow (1980). Statistical relationships between the three syndromes indicated that syndromes were overlapping in some patients. Following the earlier formulation by Crow (1980), Liddle concluded that "...these syndromes do not represent distinct types of schizophrenia, but instead reflect discrete pathological processes occurring within a single disease" (Liddle, 1987a, p. 150) The different syndromes were also characterized by distinct clinical correlates. In a second study, Liddle (1987b) reported that both the psychomotor poverty and disorganisation syndrome were characterized by poor outcome and neuropsychological deficits. In support of Crow's hypothesis that type 1 schizophrenia shows more cognitive impairment, the reality distortion syndrome was associated with less cognitive impairment.

Initial studies confirmed the division of schizophrenic symptoms into three syndromes. Studies employing the SANS items, Krawiecka rating scales or the Manchester scale confirmed this pattern (Mortimer, Lund, & McKenna, 1990; Liddle & Barnes, 1990). These and previous studies have been criticized on methodological

grounds. The study by Liddle (1987a), for example, was based on a sample size which did not meet even liberal criteria for the ratio of subjects per variable (Buchanan & Carpenter, 1994). However, the majority of studies, regardless of the number of patients, reported the presence of three factors, hallucination and delusions, negative symptoms and cognitive impairment. In a review by Buchanan and Carpenter (1994), 11 out of 15 studies which examined the symptom structure of schizophrenia reported factor solutions that were compatible with the three-factor model but the studies differed in the composition of the individual factors. The composition of the 'cognitive' factor, in particular, has varied across studies. In addition to the items identified by Liddle (1987) (formal thought disorder, inappropriate affect, and poverty of speech), Bilder, Mukherjee, Rieder, and Pandurangi (1985) reported that attentional impairment loaded along with positive formal thought disorder, bizarre behaviour, and alogia on a cognitive factor. In other studies, (e.g., Andreasen & Olsen, 1982), attentional impairment was associated with a negative factor. More recent studies reported factor solutions that differed from a three factor model. Lindenmayer, Bernstein-Hyman, and Grochowski (1994) obtained a five factor solution with a sample of 240 chronic patients with schizophrenia. The study is notable as the factor model was also applied to a sample of outpatients as well as to a schizophrenic inpatient sample after a one week wash-out medication phase. Across all samples, a 5-factor model was obtained which replicated the three factor solution but identified two additional factors, a depression and an excitement factor.

Studies using a prospective research design have arrived at different conclusions. Peralta, Cuesta, Martinez-Larrrea, and Serrano (2001) assessed the stability of symptom structures in neuoleptic-naïve patients with schizophrenia before and after neuroleptic

treatment. A three factor structure composed of psychotic, disorganisation, and negative dimensions was found at both assessment points. While the overall symptom structures were found to be stable, the composition of the negative and disorganisation factors after neuroleptic treatment was somewhat different in that attention and inappropriate affect loaded on the negative factor instead on the disorganisation factor. Salokangas (1997) examined the symptom structure in newly admitted first-episode patients with schizophrenia at admission and after two and five years. In this study, symptomatology of schizophrenia was found to change according to the duration of the illness. A five factor structure was obtained at admission consisting of a negative, delusion, manic grandiosity, hallucination, and depressive syndrome. In the second year, a disorganisation factor was obtained which was also present after five years, suggesting that the disorganisation factor may not appear as a separate dimension until the chronic phase. Correlations between other factors at different stages of the study showed that symptom structures varied considerably between different stages of the illness. Contrary to these findings, Kulhara and Chandiramani (1990) reported that a negative and cognitive component factor was relatively unchanged in a sample of patients with schizophrenia who were assessed at baseline and after 18-30 months. The positive factor in this study with time developed into a mixed factor with positive loadings not only on hallucinations and delusions, but also on negative symptoms and bizarre behaviour.

1.2.4 Syndromes of Schizophrenia: Discussion

Bleuler's call for the differentiation of the group of schizophrenias has led to numerous models which distinguish clinical dimensions of schizophrenia. Various

criteria for meaningful subgroups have been proposed starting with the four classical subtypes identified by Kraepelin and Bleuler. As discussed, support for the validity of this classification is modest. Recent attempts have focused on schizophrenic symptomatology to provide alternative approaches to the identification of subtypes of schizophrenia. In summary, the studies reviewed suggest that schizophrenia can be separated into meaningful, distinct clinical syndromes. The most consistent evidence has been for a negative and a positive factor. Although the large majority of studies has demonstrated that two factors are insufficient to capture the complex clinical picture of schizophrenia, there is inconsistency regarding the composition of the third factor which has been labeled as a disorganisation (Liddle, 1987a) or a cognitive factor (Peralta et al., 1992). Thought disorder has been identified across the majority of studies as a component of this third syndrome. It is uncertain, at present, whether thought disorder should be combined with measures which assess impairments in information processing. Cuesta and Peralta (1995) suggested, for example, that exclusion of the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1989) item 'attention' from the factor disorganisation improved the model fit. A number of studies also identified more than three factors (Jorgensen & Parnas, 1990) or failed to replicate the three-dimensional model. In the largest study yet, White, Harvey, Opler, and Lindemayer (1997) applied confirmatory factor analysis to a sample of 1,233 patients to examine the goodness of fit of 20 previously published models using the PANSS. The sample consisted of a heterogeneous set of patients with a diagnosis of schizophrenia or schizoaffective disorder which differed in age, duration, phase of illness, and other clinical characteristics. All previous models failed to meet statistical criteria of adequate fit for

these data. The most common factorial PANSS models (3 and 5 factor models) were among the models with the poorest fit. A new model was generated by the authors until fit criteria were met and replicated in an independent sample. The new model used 5 factors (negative, positive, activation, dysphoric mood, and autistic preoccupation). Four of the 5 factors resembled previous factor analytic studies of other rating scales. Significantly, the model did not include a factor 'disorganisation'. The PANSS item 'conceptual disorganisation' was dropped from the model since the item had a positive load on a negative and autistic preoccupation factor which were themselves positively correlated. Interestingly, the symptom structure did not differ between different subsets of patients, such as acute vs. chronic patients, and was not influenced by the length of illness or age.

Support for models which categorize schizophrenic symptoms into three factors comes from studies which have investigated schizotypal symptoms in relatives of schizophrenia patients and in clinical and non-clinical personality disorder samples (Kendler, McGuire, Gruenberg, & Walsh, 1995; Raine et al., 1994). Schizotypy has been defined by Meehl (1962) as the behavioural manifestation of an integrative neural deficit (schizotaxia) which represents the underlying genetic predisposition for schizophrenia. The evidence from these studies overall suggests that schizotypal symptom structure is characterized by a cognitive-perceptual, interpersonal, and disorganisation factor which is similar to the three factor model of schizophrenia. However, not all studies have precisely replicated this factor (Battaglia, Cavallini, Macciardi, & Bellodi, 1997), and the structure of schizotypal symptoms in relatives of schizophrenia patients and clinically selected

personality disorder patients may not be the same (Bergman, Silverman, Harvey, Smith, & Siever, 2000).

Peralta and Cuesta (2001) suggested that these contradictory findings on the number of factors and item-composition of individual syndromes in schizophrenia spectrum disorders[4] can be attributed to methodological issues influencing the delineation of symptom dimensions. Among the methodological issues are differences in:

1) *Statistical methodology;* methods for deciding the numbers of factors to extract have a significant impact on the factor structure obtained.
2) *Instruments for assessing symptoms*; the use of different rating scales is the most critical issue since different measures vary in the number and type of symptoms which directly determine the number and composition of dimensions.
3) *Levels of analyses;* number and types of dimensions depend on whether individual items or global ratings of scales are entered.
4) *Characteristics of the illness;* chronicity, medication status, and stage of the illness are likely to influence the factor structure of symptoms.

The current models of symptomatology in schizophrenia spectrum disorders can also be criticized from the point of view that the major syndromes subsume symptoms which are unlikely to share a common etiology and which are themselves heterogeneous. Thought disorder, a core symptom of the cognitive and disorganisation factor, is a multdimensional construct. The Thought Disorder Index (TDI) (Johnston & Holzman,

[4] In the following, the term 'schizophrenia spectrum disorders' will be used to refer to evidence or theories relating to both schizophrenia and related disorders, such as schizoaffective disorder, schizotypy or schizotypal personality disorder, for example, which are considered part of the schizophrenic spectrum.

1979), for example, a standard instrument for the assessment of thought disorder, categorizes thought disorder into 4 separate dimensions. The PANSS item 'conceptual disorganisation', on the contrary, scales the multidimensional construct of thought disorder into a single item. A rating of three on this item includes evidence of circumstantial or tangential thinking whereas the upper end of the scale defines negative thought disorder (mutism).

There is also evidence to suggest that negative symptoms in schizophrenia do not represent a homogenous construct. Carpenter (Carpenter, Heinrichs, & Alphs, 1988), for example, has proposed an influential model of negative symptoms which distinguishes between two main types of negative symptoms, 'primary' and 'secondary' symptoms. In this model, primary negative symptoms are the direct result of the pathophysiology of schizophrenia whereas secondary negative symptoms result from other causes. Carr and Wale (1987) have proposed that negative symptoms are related to positive symptoms. In their model, negative symptoms are a coping strategy to reduce the overstimulation associated with delusions and hallucinations. Negative symptoms have been related to other factors as well. Side effects of neuroleptic drug treatment can induce a range of symptoms which resemble negative symptoms, such as motor retardation resulting from extrapyramidal side effects. Social understimulation as a result of hospitalization is a commonly underemphasized cause of negative symptoms (Wing & Brown, 1970). Negative symptoms can also be the result of depression in the prodromal phase (Conrad, 1958), after psychotic episodes (post psychotic depression) or neuroses, personality disorders, and mild organic brain syndromes (Angst, Stassen & Woogon, 1989).

Similarly, hallucinations and delusions in schizophrenia are likely to be characterized by distinct neural correlates, yet they are subsumed in the positive factor in the majority of studies.

The models discussed which are based on factor analytic procedures should therefore not be taken as evidence that the symptom structures identified represent homogenous syndromes each of which is the manifestation of a singular etiological process. Andreasen et al. (1995, p. 346) concluded: "Factor analysis is essentially a data reduction method. It demonstrates which items in a group are highly correlated with on another, indicating that they co-occur. Demonstrating that they co-occur does not necessarily prove a conceptual or an etiological relationship, however." Therefore, the clinical syndromes identified in schizophrenia are lacking validity if they are not linked to data which provide evidence regarding their underlying cognitive and neural mechanisms, etiology, and prognosis. Research into underlying cognitive mechanisms may be particularly useful for this purpose. The identification of cognitive impairments allows inferences regarding the underlying neural substrates of syndromes, and previous studies (Liddle, 1987b; O'Leary et al., 2000) have identified distinct cognitive profiles corresponding to the different clinical syndromes of schizophrenia. Yet, this research has largely focused on cognitive processes, such as memory, language and attention, and less often on basic sensory or perceptual processes. Indeed, the most eminent psychiatrists in this field, Emil Kraepelin and Eugen Bleuler, did not consider disturbances in visual perception relevant to the understanding of schizophrenia. Kraepelin (1919/1971, p. 5), for example, suggested that "Perception of external impressions in dementia praecox is

not usually lessened to any great extent as far as a superficial examination goes." This position was echoed by Bleuler (1911/1950, p. 76), who argued that "Sensory responses to external stimuli are quite normal. To be sure, the patients will complain that everything appears to be different... However, this strangeness is usually attributable to a deficit in customary associations and particularly to an alteration of emotional emphasis."

Fifty years later, a group of researchers provided some striking evidence to challenge these basic assumptions regarding the nature of sensory processes in schizophrenia. The first pieces of evidence of disturbances in visual perception were essentially phenomenological in nature, that is, detailed examinations of the subjective experiences of patients (see Table 1.2). The pioneering studies by Conrad (1958) and Matussek (1952a, 1952b, 1987) provided striking evidence for profound changes in visual perception in the prodromal and acute stages of schizophrenia. Both researchers also implicated disturbances in visual perception in the development of delusions. Later studies by McGhie and Chapman (1961), Chapman (1966), Cutting and Done (1986), and Phillipson and Harris (1985) have supported and extended these findings.

Studies in experimental psychopathology have confirmed that patients with schizophrenia are impaired in the processing of visual information. Yet, there exists a multitude of theories which account for such deficits. In the following sections, research will be discussed which has examined a specific aspect of visual perception in schizophrenia, Gestalt perception. First, the results of studies will be reviewed which have investigated Gestalt perception in schizophrenia spectrum disorders. This is followed by a review of theories of cognitive dysfunction in schizophrenia spectrum disorders. Finally, critical issues for research and theories are raised.

Table 1.2

Patient Reports of Changes in Visual Perception in Schizophrenia

"She remembered that she could not look at the whole door. She could only see the knob or some corner of the door. The wall was fragmented into parts" (Arieti, 1962, p. 85).
"I may look at the garden, but I don't see it as I normally do. I can only concentrate on detail. For instance, I can lose myself in looking at a bird on a branch, but then I don't see anything else" (Matussek, 1987, p. 92).
"Everything I see is split up. It's like a photograph that's torn in bits and put together again. If somebody moves or speaks, everything I see disappears quickly and I have to put it together" (Chapman, 1966, p. 29).

1.3. Gestalt Perception in Schizophrenia Spectrum Disorders

1.3.1 Gestalt Perception: Cognition and Neurophysiology

Gestalt can be translated as 'whole', 'form', 'shape' or 'configuration'. The term is closely associated with the Gestalt school of psychology which argued for the existence of properties of psychological and biological processes which cannot be reduced to their constituent parts. Wertheimer (1924/1938, p. 7) summarized this position as follows: "There are entities where the behaviour of the whole cannot be derived from

its individual elements nor from the way these elements fit together; rather the opposite is true: the properties of any parts are determined by the intrinsic structural law of the whole". In 1922, Wertheimer was successful in discovering principles involved in the formation of perceptual groups or 'Gestalten' in the visual field. An overview of the principles underlying the formation of Gestalts in the visual field can be seen in Figures 1.1-1.6.

The properties of Gestalten were not confined to sensory experiences. Köhler (1938) pointed out that experienced time has certain properties in common with experienced space and concluded that learning, thinking and emotions may share attributes of Gestalt processes. Gurwitsch (1964) extended the application of Gestalt theory to propose that consciousness per se, and therefore all modes of thought, share the characteristics of Gestalt processes. In his view, Gestalt coherence and context-dependency are inherent characteristics of consciousness. The phenomenal characteristics of the field of consciousness reveal, for example, that novel phenomenal organisations unfold continuously to produce the 'stream of consciousness' (James, 1890) in which the continuity of context links each act of consciousness with the preceding act and with those to follow.

The central tenet of Gestalt psychology, that perception is not a product of independent local stimulation but is characterized by emergent, holistic properties, has been confirmed in numerous experiments. New paradigms involving computational and traditional psychophysical approaches have been developed which allow a rigorous study of perceptual organisation and its underlying processes (see Watt & Phillips, 2001, for a review). In the language of modern cognitive psychology, Gestalt perception is an early

Overview of Gestalt Principles in Visual Perception

Figure 1.1

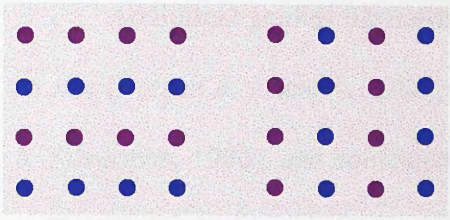
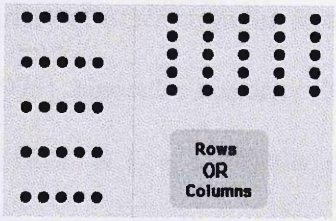


Figure 1.2.



Similarity (Figure 1.1) Objects tend to be grouped by their similarity. *Proximity* (Figure 1.2) The closer two figures are to each other, the more likely that they will be grouped together.

Figure 1.3

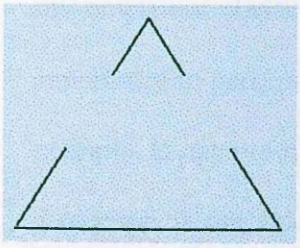


Figure 1.4

Closure (Figure 1.3) Missing parts of a figure are 'filled in' to complete the figure. *Figure/Ground* (Figure 1.4) An object or a 'figure' depend on for their characteristics upon the ground on which they appear.

Figure 1.5

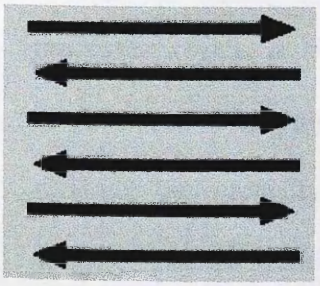
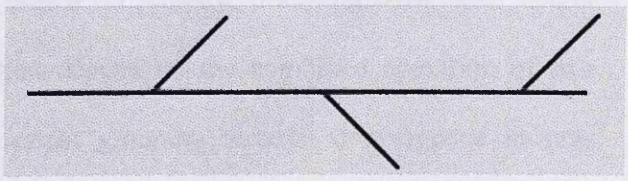


Figure 1.6



Common Fate (Figure 1.5) Objects that are moving in the same direction tend to be grouped together. *Good Continuation or Prägnanz* (Figure 1.6) When stimuli are ambiguous, the perception will be as 'good' meaning simple or regular, as the prevailing conditions 'allow'.

form of feature binding that identifies and represents relationships among stimulus features (Gray, 1999).

Additional studies have established that a variety of other stimulus features such as size (Bergen & Adelson, 1988), texture (Julesz, 1975), binocular disparity (Nakayama & Silverman, 1986), and coincidence in time (Alais, Blake & Lee, 1998) also contribute to Gestalt perception.

A number of findings, however, suggest that Gestalt perception must be approached differently than originally proposed by Gestalt theorists. For example, the anti-empiricist stance of Gestalt psychology led to the view that learning is of minor importance in perception. However, research has shown that grouping by proximity, for example, is open to modifications by experience (Polat & Sagi, 2001). Similarly, Gestalt perception is not solely a dynamic process but is, in part, determined by prespecified receptive field arrangements. As a result, Gestalt perception, as described by the Gestalt psychologists, may be best applied to processes where, in computational terms, novel input produces novel output as the result of the interaction between organisational processes (Watt & Phillips, 2001). Stated differently, the cognitive and neural mechanisms underlying Gestalt perception depend on the combined operation of two different but mutually supportive processes: grouping through convergence in pre-specified feature hierarchies and grouping through dynamic Gestalt organisation which involves processes that create novel groupings that can be specified only after the input is known.

Other questions remain unresolved in this field of research. Wertheimer (1923) discussed Gestalt perception as occurring at a very early stage in the processing of visual

information. Although there is agreement that grouping of visual elements based on Gestalt principles is crucial for pre-attentive processing (Treisman, 1988), recent research suggests that central state factors, such as attention, exert their influence through top-down factors on lower processing stages and could be involved in perceptual grouping (Gilbert et al., 2000). The influence of higher level processes during perceptual grouping, however, would support another claim of Gestalt psychology, namely the interaction between various parts of a system in a dynamic fashion.

Finally, much debate in cognitive neuroscience revolves around the neural correlates of perceptual grouping. Köhler (1920/1938) originally proposed that Gestalten in the visual field corresponded to 'Physical Gestalten' of brain activity. Such entities corresponded to physico-chemical fields of the cortex which permits the free distribution of ionic concentrations along functional boundaries (Scheerer, 1994). The refutation of Köhler's concept of physical Gestalten through studies of Lashley, Sperry, and associates (Lashley, Chow, & Semmes, 1951; Sperry & Miner, 1955) and the demonstration of its implausible physiological assumptions caused the demise of the theory.

Certain advances in the brain sciences in recent years suggest that the assumptions of Gestalt theory regarding the nature of brain processes and their relation to cognition may not be as implausible as widely assumed (Scheerer, 1994). Recent research indicates that on the neurophysiological level, Gestalt perception may be mediated by synchronized spike activity in the gamma band range (30-50hz) (Singer & Gray, 1995). In a series of studies Singer and associates (reviewed in Singer, 1999) reported that synchronization of neural responses revealed that the strength of response synchronization reflected elementary criteria for Gestalt perception such as continuity,

proximity, similarity in the orientation domain, collinearity, and common fate. However, there are also theoretical arguments suggesting that there may be no need for synchronization (Shadlen & Movshon, 1999), and some experiments have failed to detect synchronization of neural responses (Tovee & Rolls, 1992).

1.3.2 Findings of Experimental Psychopathology in Schizophrenia

An overview of the studies of Gestalt perception in schizophrenia discussed below is shown in Table 1.3 (pp. 38-40). Evidence from at least 22 studies suggests that patients with schizophrenia are characterized by impairments in Gestalt perception. There is also evidence to suggest that Gestalt perception is intact in schizophrenia. The studies by Carr, Dewis, and Lewin (1998), Chey and Holzman (1997), Knight, Manoach, Elliott, and Hershenson (2000), Mori et al., (1996), Rief (1991), and Silverstein, Osborn, West, and Knight (1998) could not confirm the hypothesis that schizophrenia patients are characterized by dysfunctional Gestalt perception.

The studies by Carter, Robertson, Nordhal, Chaderjain, and Oshora-Celaya (1996) and Granholm, Perry, Filoteo, and Braff (1999) reported results which differed in other aspects from the findings discussed thus far. Both studies employed a version of the Global/Local task (Navon, 1977) which uses large letters made up of small letters. The task typically requires participants to identify the letter which is made up of small letters (global level) or to identify the individual letters (local level). The consistent finding for normal subjects is that the targets at the global level are identified faster than targets at the local level. On the basis of initial results, Navon (1977) proposed that global attributes of a stimulus are analyzed first, with subsequent local analysis. Reduced

responsiveness to Gestalt properties of stimuli in schizophrenia would predict that patients are impaired in the detection of targets at the global level but display faster detection of targets at the local level. Precisely the opposite finding was by Carter et al. (1996) and Granholm et al. (1999). In both studies, patients with schizophrenia showed a reversed pattern. Schizophrenic patients showed faster response times for the global level and slower response times for the local level. On the other hand, a pattern consistent with the hypothesis of reduced responsiveness to Gestalt properties of stimuli in schizophrenia was reported by Ferman, Primeau, Delis, and Jampala (1999) with the same task. In this study, schizophrenia patients responded significantly faster to local relative to global targets.

Differential pattern of performance in experimental tasks were also reported in the remaining studies which found dysfunctional Gestalt perception in schizophrenia patients. The pattern of performance for patients with schizophrenia differed significantly across these studies. Thus, in 7 of the 22 studies, deficits in Gestalt perception led to performance advantages of patients. Schizophrenia patients were faster in detecting targets than control groups, for example. Conversely, 15 studies found evidence for dysfunctional Gestalt perception in tasks in which schizophrenia patients' task performance was characterized by a task deficit. The relevance of performance deficits in experimental tasks for the understanding of cognitive deficits in schizophrenia will be discussed in detail in section 1.5.1 (pp. 57).

Ten studies assessed the symptomatology in schizophrenia in relation to performance on measures of Gestalt perception. Overall, the studies reported differential clinical correlates of cognitive dysfunction. The study by Carter et al. (1996) reported

that dysfunctional Gestalt perception was correlated with an increase in auditory hallucinations. This association was not replicated by Granholm et al. (1999). In the studies by Silverstein, Baksi, Chapman, and Nowlis (1998a), Silverstein, Kovács, Corry, and Valone (2000), and Izawa and Yamamoto (2002), dysfunctional Gestalt perception was correlated with the PANSS factors 'cognitive' and 'disorganisation'. The relationship between thought disorder and Gestalt perception was examined by Silverstein and Knight (1998) with the Thought Disorder Index (TDI) (Johstone & Holman, 1979). Supporting the link between dysfunctional Gestalt perception and disorganised symptoms, data from 21 acutely psychotic and chronic schizophrenia patients showed that Gestalt perception was correlated with the TDI factors 'disorganised' and 'associative'.

Contrary to these findings, Doninger, Silipo, Rabinowicz, Snodgrass, and Javitt (2001) found that elevated negative symptoms were related to a perceptual closure deficit in schizophrenia. Positive symptoms emerged as the main clinical correlate of dysfunctional Gestalt perception in the study by Peters, Nunn, Pickering, and Hemsley (2002). No significant correlations between psychotic syndromes and dysfunctional Gestalt perception were reported by Carr, Dewis, and Lewin (1998) and by Lieb, Merklin, Rieth, Schüttler, and Hess (1994).

Dysfunctional Gestalt perception does not constitute an epiphenomenon of medication treatment. The study by Frith et al. (1983) included patients with schizophrenia who were not on neuroleptic medication and found significant cognitive dysfunctions. Rabinowicz, Owen, and Gorman (1994) examined systematically the impact of medication on Gestalt perception. In this study, medication status was

manipulated and schizophrenic and non-schizophrenic psychotic (predominantly schizoaffective) patients were tested both off and on neuroleptics. Medication status had no impact on cognitive performance. Knight (1992) reported that there is also no relationship between level of depot medication and performance on perceptual organisation tasks.

There are several explanations which can account for the divergent findings on Gestalt perception in schizophrenia. First, the stimuli in the studies differed significantly in complexity and structure. For example, the study by Frith et al. (1983) examined Gestalt perception with schematic drawings of faces whereas Silverstein et al. (2000) employed a contour integration task. The stimulus elements in this task consisted of Gabor patches which model the receptive properties of neurons in the primary visual cortex (V1). As discussed, experimental and theoretical evidence (Phillips & Singer, 1997, Watt & Phillips, 2001) suggests that Gestalt perception may involve different cognitive and neural mechanisms: grouping through convergence in pre-specified feature hierarchies and grouping through dynamic Gestalt organisation. The former might be involved where Gestalt perception occurs with stimuli which have strong configural properties, such as symmetry. In contrast, for stimuli relations in which fewer configural properties are evident, Gestalt perception has to rely on past experience and current context. The processing of stimuli with prepotent structures in schizophrenia was specifically examined in studies by Knight, Manoach, Elliott, and Hersherson (2000) and Silverstein, Osborn, West, and Knight (1998a). Both studies confirmed the hypothesis that schizophrenia patients have intact Gestalt perception for stimuli with prepotent configural properties. Phillips & Silverstein (in press) interpret this finding as support for

the hypothesis that "...schizophrenia thus involves a reduced ability to organise activity into coherent groups, but this only impairs performance when cues to grouping are weak in some way" (p. 13).

The studies by Rabinowicz, Opler, Owen, and Knight (1996) and Silverstein, Knight, Schwarzkopf, West, Osborn, and Kamin (1996) examined the location of the cognitive deficits in Gestalt perception in schizophrenia. In a study notable for the conceptual sophistication of the experimental design, Rabinowicz et al. (1996) evaluated whether impairments in Gestalt perception in schizophrenia are due to deficits in a primary sensory store vs. an impairment in short term visual working memory (STVM). The results indicated that schizophrenic patients were capable of basic structural information processing in the sensory store but deficient in the allocation of cognitive and conceptual processing resources to incoming data in STVM. Silverstein et al. (1996) included a task manipulation to examine specifically the contributions of top-down processing strategies to impairments in Gestalt perception. Strengthening of contextual top-down feedback normalized performance of poor premorbid patients, suggesting that impairments in top-down processing might be a critical deficit in Gestalt perception in schizophrenia.

There is evidence to suggest that dysfunctional Gestalt may not be present in all schizophrenia patients. Four studies have examined whether impairments in Gestalt perception are pronounced in subtypes of schizophrenia. Studies by Place and Gilmore (1980), Cox and Leventhal (1978), and Wells and Leventhal (1984) compared whether patients with paranoid and non-paranoid forms of schizophrenia differ in Gestalt perception. Only Cox and Leventhal (1978) reported significantly more impairment in

Gestalt perception for non-paranoid schizophrenics. Silverstein et al. (1996) differentiated between poor premorbid and good premorbid patients with schizophrenia. Poor premorbid patients exhibited pronounced impairments in Gestalt perception whereas good premorbid patients did not show this impairment. The findings of a study by Parnas, Vianin, Saebye, Volmer-Larsen, and Bovet (2001) suggest that potential differences also exist between patient groups at various stages of the disorder. Parnas et al. (2001) compared three groups of patients (chronic schizophrenia, first-episode patients and a high-risk group with prodromal symptoms) on three task of perceptual organisation. Chronic patients exhibited reduced Gestalt perception but patients with prodromal symptoms were characterized by enhanced responsiveness to Gestalt properties on cognitive tasks.

Differential clinical correlates of dysfunctional Gestalt perception might, in part, be explained by the different symptom models employed. Studies by Silverstein et al. (1998b, 2000) have used both a four and five factor solution of the PANSS whereas Doninger et al. (2001) used a three factor model. Contrary, Peters et al (2002) grouped symptoms into a positive and a negative factor. Furthermore, particular syndromes of schizophrenia, such as disorganisation, may be more prevalent in chronic schizophrenia than in acute patients (Salonkangas, 1997). Cognitive impairments may therefore correlate differently in chronic and acute samples of schizophrenia patients.

Table 1.3

Studies of Gestalt Perception in Schizophrenia

Study	Patients	N	Task	Symptom Rating	Summary of Findings
Carr et al. (1998)	OP-ScZ	30	Visual Search Task	SAPS, SANS	Intact perceptual grouping in patients with schizophrenia
Carter et al. (1996)	OP-ScZ	23	Navon Global/Task	BPRS	Impaired performance for global elements for patients with schizophrenia. Impaired Performance was correlated with auditory hallucinations
Chen et al. (2001)	ScZ	22	Motion Perception Task		Schizophrenia patients were only impaired in the processing of coherent motion but local motion processing was intact
Chey et al. (1997)	Ch-ScZ Ch-ScZA	8 6	Embedded Figures Task, Similarity Task		Intact perceptual grouping in schizophrenia patients
Cox et al. (1978)	PD-ScZ NPD-ScZ	15 15	Embedded Figures Test, Visual Suffix Task, Figure Recognition Task		Differential, pre-attentive, perceptual grouping deficit for non-paranoid schizophrenia patients
Doniger et al. (2001)	Ch-ScZ	26	Visual Closure Task	PANSS	Patients with schizophrenia showed impaired perceptual closure. Impaired performance was correlated with negative symptoms
Ferman et al. (1999)	A-ScZ A-ScZA	15	Navon Global/Local Task	SAPS, SANS	Patients with schizophrenia responded faster to local targets. No significant correlations between performance and symptom ratings
Frith et al. (1983)	A-ScZ	21	Schematic Face Sorting Task		Schizophrenia patients were significantly impaired in integrating Gestalt aspects of stimuli
Granhom et al. (1999)	OP-ScZ Ch-ScZ	10 12	Navon/Global Task	BPRS	Impaired performance for global elements for patients with schizophrenia. No significant correlations between performance and BPRS ratings
John & Hemsley (1992)	Ch-ScZ	15	Picture Matching Task	BPRS	Schizophrenia patients were deficient in the use of top-down processing strategies to organise visual input

Table 1.3 (cont.)

Study	Patients	N	Task	Symptom Rating	Summary of Findings
Izawa & Yamamoto (2002)	Ch-ScZ	24	Searchlight Task	SANS, SAPS	Patients with schizophrenia were significantly impaired in the recall and recognition of complex figures. Impaired performance was significantly correlated with disorganised symptoms
Knight et al. (2000)	Ch-PPM ScZ Ch-GPM ScZ	10 10	Letter Configuration Task		Patients with schizophrenia revealed intact processing of stimuli with strong symmetrical properties
Lieb et al. (1994)	Ch-ScZ	24	Pre-attentive Texton Task	BPRS	Impairments in pre-attentive stimulus processing. No significant correlations between performance and BPRS ratings
Mori et al. (1996)	OP-ScZ	15	Visual Search Task		Intact pre-attentive processing in patients with schizophrenia but a deficit in focal attentional processes
Orlowski et al. (1985)	A-ScZ	22	Line Numerosity Task		This study replicated the findings by Place & Gilmore (1980). Patients with schizophrenia had significantly faster response latencies for complex stimuli arrays
Parnas et al. (2002)	Ch-ScZ A-ScZ Prodrom	10 10 10	Navon Global/Local Task Contour Detection Task Motion Coherence Task		Patients with prodromal symptoms showed enhanced perceptual grouping compared to chronic schizophrenics, who were characterized by significant impairments in Gestalt perception
Place & Gilmore (1980)	10 Ch-ScZ	10	Line Numerosity Task		Schizophrenia patients were significantly more accurate in the counting of line elements n
Peters et al. (2002)	A-ScZ	11	Degraded Version of the Stroop Test	Manch. Scale	Impaired perceptual grouping resulted in less interference for psychotic subjects with elevated positive symptoms
Rabinowicz et al. (1996)	A-ScZ Ch-ScZ	8 16	Perceptual Grouping Task		Schizophrenia patients were impaired in perceptual grouping. Impairments were associated with dysfunctional short-term memory

Table 1.3 (cont.)

Study	Patients	N	Task	Symptom Rating	Summary of Findings
Rabinowicz et al. (1996)	A-ScZ Ch-ScZ	8 16	Perceptual Grouping Task		Schizophrenia patients were significantly impaired in Gestalt perception. Deficits were associated with dysfunctional short-term memory
Reich & Cutting (1982)	Ch-ScZ	20	Complex Picture Task		Patients with schizophrenia were characterized by a 'piecemeal' approach in the description of complex images
Rief (1991)	Ch-ScZ	24	Pre-attentive Perceptual Grouping Task		Schizophrenia patients were characterized by intact perceptual grouping
Silverstein et al. 1996	PPM-A-ScZ GPM-A-ScZ Non-ScZ-Psy GPM-OP-ScZ	11 14 14 10	Pre-attentive Perceptual Grouping Task		PPM schizophrenia patients were impaired in perceptual grouping
Silverstein et al. (1998b	A-ScZ Ch-ScZ Psychosis	12 17 21	Visual Suffix Task		Patients with schizophrenia showed intact performance for pattern with strong figural properties
Silverstein et al. (1998a)	Ch-ScZ	18	Visual Recognition Task	PANSS	Schizophrenia patients with elevated disorganised symptoms were impaired in the ability to perceptually group unstructured patterns.
Silverstein & Knight (1998)	Ch-ScZ A-ScZ NoN-ScZ-Psy	21 22	Visual Suffix Task	TDI	Impaired perceptual grouping was associated with the scores on TDI categories 'associative' and 'disorganised' in schizophrenia
Silverstein et al. 2000	Ch-ScZ NoN-ScZ-Psy	23 20	Contour Integration Task	PANSS	Deficits in perceptual grouping for schizophrenia patients correlated with elevated levels of disorganized symptoms
Wells & Leventhal (1984)	PD-ScZ NPD-ScZ	10 10	Preattentive Grouping Task		The study replicated the findings by Place & Gilmore (1980).

Note: Abbreviations for patient groups: ScZ=Schizophrenia; Ch-ScZ=Chronic Schizophrenia; Ch-ScZA=Chronic Schizoaffective Disorder; A-ScZ=Acute Schizophrenia; A-ScZA= Acute Schizoaffective Disorder; OP-ScZ=Outpatients with Schizophrenia; PD-ScZ=Paranoid-Schizophrenia; NPD-ScZ=Non-Paranoid Schizophrenia; PPM-ScZ=Poor Premorbid Schizophrenia; GMP-ScZ= Good Premorbid Schizophrenia; Non-ScZ PsY=Non-Schizophrenia Psychotic Disorders; Non-PsY=Non-Psychotic Psychiatric Disorders; CT=Control Subjects without Psychiatric Disorders

Abbreviations for Symptom Rating Scales: PANSS=Positive and Negative Syndrome Scale; BPRS=Brief Psychiatric Rating Scale; SANS= Scale for the Assessment of Negative Symptoms; SAPS=Scale for the Assessment of Positive Symptoms; TDI=Thought Disorder Index

1.3.3 Findings of Experimental Psychopathology in Schizophrenia Spectrum Disorders

Five studies were identified in the literature which examined Gestalt perception in schizophrenia spectrum disorders. Table 1.4 (pp. 43) shows an overview of these studies and the main experimental findings. Similar to the studies in schizophrenia, studies have found both abnormal and intact Gestalt perception in schizophrenia spectrum disorders. The studies by Goordarzi, Wykes, and Hemsley (2000), Granholm, Cadenhead, Shafer, and Siloteol (2002), Lieb, Denz, Hess, Schüttler, Kornhuber, and Schreiber (1996), and Rawlings and Claridge (1984) suggest that there is evidence for dysfunctional Gestalt perception in schizophrenia spectrum disorders. Silverstein, Raulin, Pristach, and Pomerantz (1992) could not confirm this finding.

The nature of dysfunctional Gestalt perception in studies which employed the Global/Local Task (Navon, 1977) differed significantly. Granholm et al. (2002) reported that patients with schizotypal personality disorder were more responsive to stimuli at the Global level. Goodarzi et al. (2002) and Rawlings and Claridge (1984) found that students with elevated levels of schizotypal symptoms showed a local processing advantage. These studies also differed in their conclusions as to whether a left or right hemisphere dysfunction underlies dysfunctional Gestalt perception in schizophrenia spectrum disorder. For participants with elevated levels of schizotypy in the studies by Goodarzi et al. (2002) and Rawlings and Claridge (1984), a local processing bias was associated with a right hemisphere dysfunction. However, Granholm et al. (2002) concluded that a left hemisphere dysfunction was responsible for reduced responsiveness to stimuli organisation in the global condition in schizotypal personality disorder. The

relationship between right hemisphere dysfunction and deficits in Gestalt perception was supported by a study of Lieb et al. (1996). Adolescents with a genetic risk for schizophrenia did not show a processing advantage in the right hemisphere for texton elements.

Two studies examined symptom correlates of impairments in Gestalt perception. Goodarzi et al. (2000) found that impaired Gestalt perception was significantly correlated with positive symptomatology in schizotypic participants. Granholm et al. (2002) obtained a significant correlation between interpersonal deficits and enhanced processing of stimulus organisation.

The conflicting evidence on Gestalt perception in schizophrenia spectrum may be related to the diverse subject populations in the studies reviewed. Thus, participants shared few clinical and demographic characteristics. Goodarzi et al. (2000) and Rawlings and Claridge (1984) recruited small samples of university students and subdivided subjects into high and low schizotypal subjects. Silverstein et al. (1992) recruited university students who scored two or more standard deviations on the Perceptual Abberation or Physical Anhedonia Scales (Chapman, Chapman, & Raulin, 1976) and obtained a sample of 57 and 68 participants respectively. Granholm et al. (2001) specifically examined participants with schizotypal personality disorder (SPD). Although schizophrenic spectrum disorders are a dimensional construct which supposedly share a common behavioural and neural disposition for the development of schizophrenia (Meehl, 1962), it has been proposed that schizotypal relatives of patients with schizophrenia may be different from clinically selected schizotypal participants (Kendler, 1985). There is evidence to suggest, for example, that schizotypal relatives of

schizophrenia patients are primarily characterized by negative or deficit-like symptoms (Dworkin & Lenzenweger, 1984).

Table 1.4.

Studies of Gestalt Perception in Schizophrenia Spectrum Disorders

Study	Participants	N	Task	Scale	Summary of Findings
Granholm et al. (2000)	SPD	21	Navon Global/Local Task	SPQ	Impaired performance for global elements in patients with SPD. Impaired performance was correlated with greater interpersonal deficits
Goodarzi et al. (2000)	Student Population	32	Navon Global/Task	Q-LIFE	Subjects with elevated levels of schizotypy showed superior local processing. Local bias was associated with right-hemisphere activation and increased positive symptoms
Lieb et al. (1996)	Adolescents with genetic risk for ScZ	17	Pre-attentive Texton Detection Task		Offspring of parents with schizophrenia were significantly impaired in the detection of texton elements which was associated with dysfunctional processing in the right hemisphere
Rawlings et al. (1996)	Student Population	32	Navon Global/Local Task	EPQ, STQ	Schizotypic subjects showed superior local processing for stimuli in the left visual field
Silverstein et al. (1992)	Student Population	57	Pre-attentive Grouping Task, Visual Suffix Task, Configural Superiority Task	PercAb, PhyAnhed	Students with elevated levels of physical anhedonia displayed intact Gestalt perception.

Note: Abbreviations of Subjects: SPD=Schizotypal Personality Disorder
Abbreviations for Scales: SPQ=Schizotypal Personality Questionnaire, O-Life=Oxford-Liverpool Inventory of Feelings and Experiences, EPQ=Eysenck Personality Questionnaire, STQ=Schizotypy Questionnaire, PercAb=Perceptual Abberation Scale, PhyAnhed=Physical Anhedonia Scale

1.4 Theories of Cognitive Dysfunctions in Schizophrenia Spectrum Disorders

Several hypotheses have been proposed to account for cognitive dysfunctions in schizophrenia spectrum disorders. In the following, theories will be reviewed that have been related to impairments in Gestalt perception in schizophrenia spectrum disorders. As a result, the review is necessarily selective and will not consider the model by Frith (1992), for example. A broad range of theoretical approaches will be examined to derive differential hypotheses of cognitive dysfunction in schizophrenia spectrum disorders. Those approaches will be emphasized which have attempted to link a variety of cognitive deficits in schizophrenia spectrum disorders to the concept of 'context'. An overview of the predictions and assumptions of theories of cognitive dysfunctions in schizophrenia spectrum disorders is shown in Table 1.5 (pp. 56).

1.4.1 Models of Attentional Dysfunctions in Schizophrenia Spectrum Disorders

From its very beginnings, attentional dysfunctions were implicated in the explanations of cognitive deficits in schizophrenia. Both Bleuler and Kraepelin considered impairments in attention as central to the disorder. Kraepelin (1919/1971) suggested that patients "loose both inclination and ability on their own initiative to keep attention fixed for any length of time" (p. 5-6). In a different context, Kraepelin suggested that this form of attentional impairment is complemented by "an irresistible

attraction of attention to casual external impression" (p. 6-7). He proposed that the former was only present during the acute and terminal stages of the illness.

Bleuler (1911/1950) described prominent alterations in attentional processes by differentiating between a deficit in passive and active attention. Active attention, in his view, refers to the ability to initiate and control mental processes which are impaired in schizophrenia, often in parallel with disturbances in affect (p. 68). Passive attention, on the contrary, characterises the selectivity and inhibitory functions of attention and is also reduced in schizophrenia: "The selectivity which normal attention ordinarily exercises among the sensory expressions can be reduced to zero so that almost everything is recorded that reaches the senses" (p. 68).

Impairments in the selectivity of information processing have been emphasized by McGhie and Chapman (1961). In their view, the primary disorder underlying the symptoms in schizophrenia is "... a decrease in the selective and inhibitory functions of attention" (p. 114). As a consequence of this deficit, disturbances in the control of action appear due to information which is normally outside the range of conscious awareness. Positive symptoms, according to this model, are compensatory mechanisms which represent the patient's attempt to make sense of his changed reality.

A similar proposal was made by Frith (1979). In his view, the basic cognitive defect in schizophrenia "...is an awareness of automatic processes which are normally carried out below the level of consciousness" (p. 233). Frith's formulation of the underlying mechanism of cognitive dysfunctions in schizophrenia was strongly influenced by Broadbent (1958). Broadbent postulated a filter which is necessary to prevent the overloading of a limited-capacity information channel. According to Frith

(1979), the major symptoms of the disorder (hallucinations, delusions, and thought disorder) can be accounted for by positing a breakdown in the filtering mechanism so that preconscious material enters awareness.

Nuechterlein and Dawson (1984) argued that a wide range of cognitive deficits in schizophrenia could be viewed as a reduced availability of attentional processing resources. Dysfunctions in attention are thought to underlie the negative symptoms in schizophrenia. Impairments in effortful processing might serve as an enduring vulnerability factor which is present before clinical symptoms develop. Differential hypotheses regarding the underlying neural substrates of attentional dysfunction in schizophrenia have been proposed by this research group (Nuechertlein, Buchsbaum, & Dawson, 1994). Buchsbaum et al. (1990) examined metabolic activity with positron emission tomography (PET) during performance in the degraded-stimulis version of the Continuous Performance Test (CPT) in schizophrenia patients. The results suggested that reduced performance in the CPT in schizophrenia patients was associated with lowered prefrontal activation as well as disrupted cortical circuits in the right hemisphere. Further evidence for a relationship between prefrontal dysfunction and attentional deficits in schizophrenia was reported in a study by Cohen et al. (1987). This study employed an auditory analogue of the CPT. Compared to normal controls, schizophrenic patients showed less metabolic activity in the middle prefrontal cortex (bilaterally) and the left anterior temporal cortex.

1.4.2 Models of Context-Processing in Schizophrenia Spectrum Disorders

1.4.2.1 'Weakening of the Influence of Stored Memories or Regularities of Previous Input on Current Perception' (Hemsely & Gray)

Hemsley and Gray developed a theory in which dysfunctional cognition in schizophrenia is related to impaired activation of contextually appropriate schemata (Gray, Feldon, Rawlins, Hemsley, & Smith, 1991a; Gray, Hemsley, Feldon, Gray, & Rawlins, 1991b; Hemsley, 1987, Hemsley, 1994). In this theory, contextual information, both spatial and temporal, is associated with the activation of relevant stored material in long-term memory which leads to 'expectancies' or 'response biases' (Hemsley, 1994). The fundamental impairment in schizophrenia lies in the utilization of such stored 'expectancies'. Hemsley (1987, p. 182) therefore defines the basic disturbance in schizophrenia as a "...weakening of the influence of stored memories or regularities of previous input on current perception". In a later formulation of the model (Hemsley, 1994), Hemsley hypothesized that 'memories of past regularities' are stored but that the rapid and automatic access to such information, which is relevant for the evaluation of aspects of sensory input, is impaired (p. 101). The intrusion of sensory experiences of aspects of the environment not normally perceived or ambiguous sensory input and unexpected material from long-term memory cause the development of delusions and hallucinations. Garety and Hemsley (1994) also proposed that, in addition to abnormal perceptual experiences, delusions are the result of abnormal reasoning styles. Hemsley and Garety (1986) demonstrated that delusional patients require less information before reaching a decision and jump to conclusions. Negative symptoms, according to Hemsley,

are potentially also secondary to impairments in cognition (1977, 1994). Cognitive impairments lead to an 'information overload' to which patients respond through reductions in behavioural activity which lead to the characteristic symptoms, such as poverty of speech, social withdrawal, and motor retardation.

Deficits in context processing have been linked to biological and neuropsychological models. Hemsley and Gray related the 'weakening of the influence of stored memories or regularities of previous input on current perception' to behavioural models of latent inhibition (Baruch, Hemsley, & Gray, 1988) and Kamin's blocking effect (Jones, Gray, & Hemley, 1992). Interestingly, latent inhibition can be abolished if animals in he pre-exposure phase receive amphetamine (Crider, Solomon, & McMahon, 1982). The effect is reversed, however, with the administration of neuroleptics, suggesting a role of abnormal dopaminergic neurotransmission for dysfunctional cognition. Baruch, Hemsley, and Gray (1988) provided further evidence for this link. Patients with acute schizophrenia learned the association in the pre-exposure condition of the latent inhibition paradigm faster than controls. After 6 to 7 weeks of treatment with antipsychotic medication, performance of patients normalized.

Dysfunctional cognition in schizophrenia has been linked by Gray et al. (1991a,b) to abnormal brain circuitry in the hippocampus and related subcortical brain structures. This proposal was based on a model by Gray (1982) which attributes the function of a 'comparator' of actual and expected stimuli to the hippocampus. Gray et al. (1991a,b) argued that a failure in this function is related to dopaminergic hyperactivity. It was proposed that damage to the circuitry which regulates normal interaction between input from the hippocampus (via subiculum) to the nucleus accumbens and the mesolimbic

system underlies the cognitive and biological abnormalities in schizophrenia (Gray et al., 1991a, 1991b).

1.4.2.2 'Dysfunction in the Representation and Maintenance of Context' (Cohen & Servan-Schreiber)

In the model of Cohen and Servan-Schreiber and colleagues (Cohen & Servan-Schreiber, 1992; Braver, Barch, & Cohen, 1999), various cognitive impairments in schizophrenia have been related to a dysfunction in the representation and maintenance of context. In this model, context is relevant but does not necessarily form part of the content of a (behavioural) response and has been defined as "...information supplied by preceding events and stored in working memory" (Cohen & Servan-Schreiber, 1992, p. 46). Examples of context in this model include a specific prior stimulus, task instructions or an intended action (Braver, Barch & Cohen, 1999). The representation of context is distinguished from contents stored in short-term memory and is associated with mechanisms located within the prefrontal cortex. Impairments in context processing are related to two cognitive dysfunctions in schizophrenia: working memory and behavioural inhibition. Deficits in these cognitive functions are hypothesized to underlie a number of cognitive and behavioural dysfunctions in schizophrenia, such as perserveration, switching problems, distractibility and susceptibility to interference and working memory failure. Initial support for this model was reported in a study in which a neural network simulated successfully performance of patients with schizophrenia on the CPT, a lexical disambiguation task, and the Stroop Test as arising from reduced context processing (Cohen & Servan-Schreiber, 1992). Further studies (Cohen, Barch, Carter, & Servan-

Schreiber, 1999, Servan-Schreiber, Cohen, & Steingard, 1996), which have provided behavioural data of patients with schizophrenia, have confirmed these results.

In the initial formulation of the model (Cohen & Servan-Schreiber, 1992), deficits in the processing of context were hypothesized to correlate with the negative symptoms of schizophrenia. This was not confirmed by later studies which reported both positive (Servan-Schreiber, Cohen, & Steingard, 1996) and disorganised symptoms (Cohen, Barch, Carter, & Servan-Schreiber, 1999) as the clinical correlates of deficits in context - processing in schizophrenia.

Impairments in context-processing have been related to structural abnormalities of the prefrontal cortex (PFC) and dopaminergic neurotransmission. Dysfunctional dopamine-mediated modulation of the PFC is hypothesized to contribute to deficits in both the maintenance and updating of internally represented context information. In an earlier version of the theory, impairments in context processing were modeled as arising from reduced gain of units in a component of the model interpreted as being in the PFC (Cohen & Servan-Schreiber, 1992). In a later version, it was proposed that increased noise levels in mesocortical dopamine, which lead to tonically reduced dopamine activity in the PFC, are the cause of dysfunctional context-processing (Braver, Barch, et al. 1999). In a recent study, Perlstein, Carter, Noll, and Cohen (2001) examined specifically the hypothesis of a relationship between impairments in context processing and underactivation of prefrontal cortical units in schizophrenia. Patterns of brain activation in 16 medicated patients with schizophrenia were examined with functional magnetic resonance imaging (fMRI) in response to performance in a sequential-letter memory task. The task varied systematically working memory load but kept stimulus encoding and

response demands constant across conditions; only the requirements to maintain and update increasingly greater amounts of information at higher loads differed. Patients with schizophrenia showed a deficit in physiological activation of the right dorsolateral prefrontal cortex with normal task-dependent activity in other regions, but only under the condition that distinguished them from comparison subjects on task performance. Patients with greater dorsolateral pre-frontal cortex dysfunction performed more poorly and reduced performance in these patients was selectively associated with disorganised symptoms.

1.4.2.3 'Dysfunctional Cognitive Coordination' (Phillips & Silverstein)

Phillips and Silverstein (in press) proposed a model of cognition in schizophrenia which relates dysfunctional cognitive and neural processes to impairments in 'cognitive coordination'. Cognitive coordination is defined as the "...interactions that affect the salience or dynamic grouping of neuronal signals without changing what they mean" (p. 3). According to Phillips and Silverstein, deficits in context processing in schizophrenia are one manifestation of a wider impairment in cognitive coordination. The definition of context in this model differs significantly from the theories of Hemsley and Gray (Gray et al., 1991a; Hemsley, 1987) and Cohen and Servan-Schreiber (1992). Phillips and Silverstein distinguish the 'primary input', which determines the possible interpretations of a particular stimulus, and contextual processes which modulate the salience of the various interpretations of the stimulus. Context, therefore, includes both effects of concurrent context as well as information stored in working memory. The

authors suggest that both of these types of context are relevant for an understanding of dysfunctional cognition in schizophrenia.

Coordinating interactions are ubiquitous throughout the nervous system and therefore implicated in all types and levels of cognitive activity (Phillips and Singer, 1997). They are thought to involve contextual interactions and dynamic grouping in cognition. Widespread impairments in these processes in schizophrenia have led the authors to conclude that dysfunctional cognitive coordination might be central to schizophrenia and other psychiatric disorders. Phillips and Silverstein assume that dysfunctional cognitive coordination is related to impairments in perception, pre-attentive sensory gating, selective attention, working and long-term memory. At the level of signs and symptoms, dysfunctional cognitive coordination is predicted to correlate with the disorganisation syndrome in schizophrenia which is interpreted as reflecting a broader deficit in the coordination of contextually related stimuli. The association between disorganisation and dysfunctional coordination has been confirmed in a series of studies by Silverstein et al. (1998a, 1998b, 2000) in which deficits in perceptual grouping were found consistently to correlate with either the cognitive or disorganisation cluster of the PANSS.

Dysfunctional cognition in schizophrenia is seen as a consequence of underactivity of the *N*-methyl-D-aspartate (NDMA) receptor channel. The authors suggest that NMDA channels may play a crucial rule in neural transmission and coordination. For example, NMDA channels have been related to high-frequency rhythms in the gamma-band range (Phillips and Singer, 1997) and there is extensive evidence in the normal psychological literature implicating gamma oscillations in a wide

range of cognitive functions including perception, attention, and memory (Tallon-Baudry & Bertrand, 1999). Studies investigating gamma oscillations in schizophrenia have reported reductions in activity, which are mainly related to disorganised symptoms (Lee, Williams, Breakspear, & Gordon, in press). Strong support for the possible involvement of the NMDA receptor in schizophrenia comes from studies which have examined the effects of NMDA antagonists in normal volunteers (Javitt & Zuskin, 1991). Subanesthetic doses of phencyclidine (PCP) and ketamine produce a drug-induced psychosis which resembles the symptomatology of schizophrenia and associated cognitive dysfunction (Krystal et al., 1994; Malhotra et al., 1996).

1.4.3 Cognitive Dysfunction and Abnormal Lateralization in Schizophrenia Spectrum Disorders

Abnormal lateralization has long been considered relevant for the understanding of cognition in schizophrenia spectrum disorders (Flor-Henry, 1969). Cutting and Magaro have linked dysfunctional Gestalt perception in schizophrenia to disturbances in the balance of hemispheric functions.

Cutting (1985, 1990) proposed that dysfunctional cognition in schizophrenia is related to underactivation of the right hemisphere which gives rise to the characteristic psychological profile of the disorder. In his view, the cerebral hemispheres subsume cognitive functions which are distinct. In a recent formulation of his approach, Cutting (1990) based his psychological model of cerebral hemisphere functioning on a proposal by Kosslyn (1987). Kosslyn outlined a distinction between the left and right hemispheres in terms of the information they operate upon. According to Kosslyn, the left hemisphere

deals mainly with information along categorical lines and the right hemisphere with information according to spatial-coordinates. Each hemisphere comprises a controller which monitors the cognitive activity. Defined broadly, the left hemisphere is predisposed to process language, object perception and imagery, the right hemisphere is involved in the location of objects in space. The essential component underlying the imbalance of lateralization in schizophrenia is an underactivity in the right hemisphere whereas the left hemisphere shows an increase in activity relative to the right.

Cutting (1994) suggested that schizophrenic symptoms, such as auditory hallucinations, disordered self-body boundaries, flattened affect, delusional misidentification, and formal thought disorder represent examples of phenomena which are exhibited by right-hemisphere-damaged patients. Right hemisphere dysfunction has also been related to elementary cognitive processes by Cutting (1985, 1989). In an earlier formulation, Cutting summarized the cognitive deficit in schizophrenia patients as a tendency to 'concentrate on the detail, at the expense of the theme' (1985, p. 300).

Magaro (1980, 1981, 1984) outlined a similar model which is based on the early insights of cognitive psychology to characterize cognition in schizophrenia. Specifically, Magaro attributed to paranoid and non-paranoid patients with schizophrenia a differential hemispheric pattern of activation. He proposed that non-paranoid forms of schizophrenia are characterized by an overactivation of the right hemisphere whereas paranoid forms of schizophrenia display a left-hemisphere preference. Such patterns of cerebral dysfunction lead to distinct cognitive styles in paranoid and non-paranoid forms of schizophrenia. According to Magaro, cognitive processing in paranoid patients with schizophrenia is dominated by schemata ('top down' processing) which lead to the interpretation of

perceptual data in terms of rigid conceptual processes and to the preference of controlled over automatic processing. Non-paranoid forms of schizophrenia are characterized by the opposite pattern. Right hemisphere overactivation causes perceptual data to be processed without adequate categorization and classification from conceptual processes. As a result, patients with non-paranoid forms of schizophrenia are mainly deficient in the controlled processing of information and, therefore, rely more frequently on automatic processing of information.

Table 1.5

Theories of Cognitive Dysfunctions in Schizophrenia Spectrum Disorders: Assumptions and Predictions

Model	Definition of Cognitive Deficit	Location of Cognitive Deficit	Clinical Correlates	Pathophysiology
Attentional Dysfunction				
Chapman & McGhee (1961), Frith (1979)	'Selective and Inhibitory Functions of Attention'	Deficit in the Early Stages of Stimulus Identification and Processing	Positive Symptoms	
Nuechterlein & Dawson (1984)	'Availability and Allocation of Processing Resources'		Negative Symptoms	Right Hemisphere Underactivation, Dysfunction of Prefrontal Cortex
Context Processing				
Hemsley & Gray (Gray et al., 1991a, Hemsley, 1987, 1994)	'Weakening of the Influence of Stored Memories or Regularities of Previous Input'	Primarily Mediated Through Long-Term Memory	Positive & Negative Symptoms	Dopaminergic Hyperacitivity, Hippocampus and Nucleus Accumbens
Cohen & Servan-Schreiber (1992)	'Representation and Maintenance of Context'	Information From Preceding Events in Working Memory	Negative, Positive & Disorganised Symptoms	Dysfunctional Dopaminergic Modulation of Prefrontal Cortex
Phillips & Silverstein (in press)	'Impaired Cognitive Coordination'	Current and Preceding Context	Disorganisation	Distributed Impairment, NMDA-Hypofunction
Abnormal Lateralization				
Cutting (1985)	'Concentration on the Detail, at the Expense of the Theme'			Right Hemisphere Underactivity
Magaro (1980)	'Deficient Conceptual Disorganisation and Integration'	Dysfunction in Controlled vs. Automatic Processing Mode		Differential Hemispheric Dysfunction in Paranoia and Schizophrenia

1.5 Critical Issues in Research on Gestalt Perception and Theories of Cognitive Dysfunction in Schizophrenia Spectrum Disorders

As discussed, studies of Gestalt perception in schizophrenia spectrum disorders have produced conflicting evidence regarding the nature of the deficit and related clinical symptoms. Associated theories of cognitive dysfunction have postulated several hypotheses which differ significantly in the definition of the deficit and pathophysiological correlates. Such disagreement is not specific to this particular aspect of schizophrenia research but reflects the state of the field as a whole in which a multitude of theories and empirical findings exist which provide competing and, at times, mutually exclusive evidence. The inherent problems in research into the psychology of schizophrenia led Karl Jaspers (1959), for example, to conclude that any attempt to solve the enigma of schizophrenia was doomed to failure.

Before the hypotheses underlying the present research are formulated, a brief critical review will be given to discuss some of the main conceptual problems of research on Gestalt perception and of theories of cognitive dysfunction.

1.5.1 General Performance Deficiencies in Schizophrenia Spectrum Disorders

Among the most challenging problems for research in schizophrenia are the general difficulties of patients in cognitive tasks which make the interpretation of performance deficits far from straightforward (Chapman & Chapman, 1978; Knight, 1984, Knight & Silverstein, 2001). Performance deficiencies of schizophrenia patients are related to multiple confounds that are the result of secondary effects of the disorder

(e.g., varying drug regimes, poor motivation etc.) and the pervasive cognitive deficits which are present in the large majority of patients (Heinrichs, 1993). Therefore, demonstration of a deficit on a given cognitive task may not be very informative for the identification of impairments in specific cognitive processes in schizophrenia (Chapman & Chapman, 1978). A number of strategies have been proposed to remedy the problem associated with the *general deficit model* (see Knight & Silverstein, 2001, for a review). Typically, predictions for the general deficit model in schizophrenia assume that patients are significantly deficient on all task conditions, or if differential significance emerged, such differences would vary with the difficulty level of the condition. Knight (1984) outlined a process-orientated approach which has attempted to address the methodological difficulties discussed. This strategy advocates the use of well-established models from cognitive psychology to predict theory driven patterns of performance within and across tasks that should be found when specific stages of processing function either adequately or inadequately. Knight (1984) delineated four ways in which predictions of the general deficit model can be refuted:

1) *Disconfirmation strategy;* this strategy is implemented by providing convincing evidence of patients' competence in a specific cognitive process.
2) *Superiority strategy;* this strategy involves the demonstration that a specific cognitive impairment can lead to an advantage in an experimental task.
3) *Relative superiority strategy;* the distinguishing characteristic of the relative superiority strategy is that it hypothesizes a specific reversal, compared with normal controls, in the relative performance level of at least two tasks or conditions in the experiment.

4) *Multiparadigm strategy*; in this strategy, cognitive theory is used to predict and test a pattern of performance indicating a specific deficit that is not confounded with the obvious predictions of a general deficit model.

The research design of a sizeable number of studies reviewed can be criticized on these grounds. The study by Izawa and Yamamoto (2002), for example, employed a searchlight task in which participants viewed a geometric figure on a computer screen. The test figure was covered with a black mask and the subject was able to see part of the figure through a hole 3cm in diameter. The first task was to trace the image on the computer screen with a mouse. In the second part of the experiment, participants were asked to draw the figure on paper from memory and to select a correct figure from 6 displays. Accuracy of the copy and recognition rates were the main dependent variables. The results showed that patients with schizophrenia had significantly higher error rates on both copying and recall tasks. The authors interpret this result as evidence that schizophrenic patients are characterized by a reduced "...ability to integrate spatially and temporally fragmented visual stimuli" (p. 72). However, it is difficult to conceive how such a specific deficit in a cognitive processes can be identified in this study. Patients with schizophrenia are characterized by impairments in visual working memory (Silverstein, Osborn, & Palumbo, 1998) and recall memory (Levin, Yurgelin-Todd, & Craft, 1989) for example. Both memory processes are critically involved in both the copying and recall tasks and, therefore, acted as confounds in task performance for schizophrenia patients in this task.

1.5.2 Heterogeneity in Schizophrenia Spectrum Disorders

Schizophrenia spectrum disorders may represent a group of diseases which share a common outcome (psychosis) but differ in the etiological mechanisms which bring about this end state (Tsuang & Faraone, 1995; Tsuang et al., 2000). The study of patients who are identified on the basis of non-specific symptoms with possibly different underlying cognitive and neurobiological abnormalities may, therefore, constitute a mayor stumbling block in the search for the causes of the disorder. The heterogeneity of schizophrenia spectrum disorders is most evident on the level of symptoms and outcome, but includes cognitive dysfunctions (Heinrichs, 1993) and neuropathology (Selemon, 2001) as well. Despite this mantra which is endorsed by the great majority of schizophrenia researchers, the large number of studies reviewed here and the design of research studies in general, continue to view the disorder as a single entity. Strategies to reduce the heterogeneity of the disorder could include the comparison of within group differences where the independent variable is related to an aspect of the disorder which allows a reliable differentiation of patients, i.e. course of the disorder, specific symptoms etc.

The same criticism can be leveled at theories of cognitive dysfunction in schizophrenia spectrum disorders. Only the models of Phillips and Silverstein (in press) and Magaro (1980) make specific predictions regarding the relationship between subtypes of schizophrenia spectrum disorders and cognitive dysfunctions.

1.5.3 Construct Validity of Experimental Tasks

Construct validity refers to the degree to which inferences can legitimately be draw from operationalisations to the theoretical constructs on which those operationalisations are based (Everitt, 1997). Few studies of Gestalt perception in schizophrenia spectrum disorders have employed experimental tasks whose conceptual relationship to the construct of Gestalt perception is clear and which have a substantial history of replicability and reliability in the normal psychological literature. Secondly, no data are available in the literature which have examined the relationship between measures of Gestalt perception; this makes comparisons between studies difficult and raises the question of the conceptual relationship between the various measures employed. These issues are critical since only those tasks will be useful whose underlying cognitive processes are clearly defined and which can both guide biological exploration and relationships to macrobehavioural symptomatology (Knight & Silverstein, 1998).

Issues of construct validity also apply to tasks which have been seen as paradigmatic examples of Gestalt perception. Kimchi (1992), for example, argued that the Global/Local Task may not measure the precedence of holistic processing (and therefore the intactness of perceptual grouping), but more appropriately the precedence of higher level units before lower level units in stimulus processing. Evidence in the normal psychological literature suggests that the advantage of the global level of stimuli structure in this task is also critically influenced by a number of variables, such as visual angles, exposure duration, stimulus size etc. (see Kimchi, 1992, for a an extensive review). Kinchla and Wolfe (1979) used stimuli of a similar nature to those of Navon (1977), but of variable size. The results suggested that the precedence of global processing was

related to the size of the letters. When the letter was very large, processing of the small letters preceded processing of large letter. The authors concluded from the results that global processing occurs prior to more detailed processing only when the global structure of a pattern or object can be ascertained by a single eye fixation.

Studies which employed the Global/Local paradigm differed significantly in these variables. For example, the studies by Granholm et al. (1999), Ferman et al. (1999) and Carter et al (1996) employed display times of 3000ms, 100ms, and 4000ms, respectively. The study by Ferman et al. (1999) showed particular differences in the experimental design. This study failed to replicate the normal effect of faster reaction times for the global display (!) for normal subjects and used stimuli which consisted of numbers as opposed to the letter display in the standard paradigm.

2. METHOD

2.1 Overview of Studies

The thesis comprises four studies: 1) Gestalt perception in schizotypy (pp. 95-111); 2) Gestalt perception in acute schizophrenia (pp.111-146); 3) Gestalt perception in chronic schizophrenia (pp.146-169); and 4) Gestalt perception and ToM in schizophrenia (pp.169-202).

2.2 Ethical Considerations

All studies were approved by the local ethics committee.

2.3 Participants

For the studies reported in this thesis, four groups of participants were recruited: 1) a group of psychology students who took part in the research for course credits (n=423); 2) a group of patients with chronic and acute schizophrenia (n=71). Although both patient groups had a similar duration of illness and symptoms (see demographic and clinical variables for both patient groups in Studies 3 & 4), the main variable which differentiated the two schizophrenia groups was the episodic course of illness in the 'acute' schizophrenia group. Thus, patients in this group were discharged after treatment and attended outpatient clinics prior to the admission. In contrast, the 'chronic' schizophrenia patients were treatment refractory, long-term institutionalized patients.

3) a group of patients with non-schizophrenia psychotic disorders (n=37); and 4) a psychiatric control group consisting of patients with non-psychotic psychiatric disorders (n=26). Demographic and clinical characteristics of participants will be given in the chapters which discuss the individual studies of the thesis.

For the psychiatric patient groups, the following criteria were fulfilled:

- Potential participants with histories of vision disorders, closed head injury, mental retardation, or neurological syndromes (e.g., epilepsy, cerebral palsy) were excluded.
- Participants were at least 18 years of age but not older than 65.
- Participants had normal to corrected vision.
- For patients in the non-psychotic psychiatric group, patients who had a history of psychotic episodes or symptoms were excluded. The psychiatric control group was screened with the B module of the Structured Clinical Interview for DSM-IV Diagnosis-Patient Edition (SCID) (SCID-I/P, Version 2.0; First, Spitzer, Gibbon, & Williams, 1995) for a history of psychotic disorders. One patient was dropped from this group and assigned to the non-schizophrenia psychotic disorders group after it emerged from consultations with the attending psychiatrist that this patient had a history of substance-induced psychotic symptoms. Patients with schizophrenia were recruited from inpatient units for psychotic disorders at New York Presbyterian Hospital, Weill Medical College of Cornell University (n=61), Stratheden Hospital, Fife NHS Trust, U.K. (n=5), and Bellesdyke Hospital, Forth Valley NHS Trust, U.K. (n=5).

The non-schizophrenia psychotic disorders group was also recruited from inpatient units for psychotic disorders at New York Presbyterian Hospital, Weill Medical College of Cornell University. In addition, 2 patients participated in the research who attended an outpatient clinic for psychotic disorders at the same hospital. The non-schizophrenia psychotic disorders group consisted of individuals with different diagnoses, such as schizoaffective disorder (n=16), mood disorders with psychotic features (n=15), substance-induced psychosis (n=3), and psychotic disorders not otherwise specified (n=3).

Patients in the non-psychotic psychiatric disorders group were diagnosed with mood disorders (n=6), personality disorders (n=10), and substance abuse (n=10), according to DSM-IV criteria. Participants were recruited from in- and outpatient programs for patients with substance abuse and personality disorders at New York Presbyterian Hospital, Weill Medical College of Cornell University.

DSM-IV diagnosis was established for patients with acutely psychotic schizophrenia (n=37) and non-schizophrenia psychotic disorders (n=30) with the SCID where patient cooperation allowed. For 12 patients, a diagnosis was made with a consensus decision and thorough review of chart notes alone and in consultation with the attending psychiatrist. SCID interviews were conducted by Peter Uhlhaas. In the case of one patient, no reliable diagnosis could be established which differentiated between schizoaffective disorder and schizophrenia. This case was initially excluded from analyses which compared patients with schizophrenia with patients with non-schizophrenia psychotic disorders and non-psychotic psychiatric disorders.

For individuals with chronic schizophrenia (n=35) and chronic non-schizophrenia psychotic disorders (n=5), diagnosis was established by thorough chart review and in consultation with the attending psychiatrist and clinical psychologist. All patients with schizophrenia fulfilled DSM-IV criteria for schizophrenia at the time of testing.

Patient's medication status was monitored. All patients with schizophrenia and 97% other psychotic disorders were on medication at the time of testing. Sixty-eight of the 71 patients with schizophrenia were on atypical medication at the time of testing. In the group with other psychotic disorders, 32 out of 34 patients were receiving atypical medication.

2.4 Assessment of Psychopathology

Prior to the assessment of psychopathology, informed consent was obtained from all participants. A brief interview was conducted to collect information about the education, history of psychiatric problems, and other demographic data of participants. Participants were administered a standard visual acuity examination (Snellen Chart), which involved examining acuity monocularly in each eye, and then binocularly. Testing sessions took place in a quiet, well-lit room.

All participants in the research were informed about the purpose of the research before signing the consent forms and approached by Peter Uhlhaas. Patients were only approached after consultation with the responsible psychiatrist/psychologist. Students who took part in the Study 1 'Gestalt perception in schizotypy', however, were not given an explanation which involved the concepts 'schizotypy' or 'schizophrenia'. Instead,

participants were informed that the research examined personality dimensions in relation to a cognitive style in the general population. Patients with a diagnosis of schizophrenia were informed that the research examined cognitive functions in schizophrenia. For the non-schizophrenia psychotic group and the non-psychotic psychiatric controls, instructions emphasized that the participants were recruited as a comparison groups in a study which examined cognition in schizophrenia. Information sheets and consents forms for the different psychiatric and non-psychiatric populations can be found in the Appendix.

In all studies, assessment of psychopathology was carried out before the experimental tasks were administered to participants.

2.4.1 Psychotic Disorders

Psychopathology in patients with psychotic disorders was assessed with the PANSS (Kay et al., 1986). The PANSS consists of a 30 to 40 minute formalized interview from which each of 30 symptoms are rated along a 7-point scale. The scale yields separate scores along nine clinical dimensions, including scales for a positive syndrome, a negative syndrome, depression, composite index, and general psychopathology. Several studies have found the instrument to be highly reliable (e.g., Kay, Opler, & Lindenmayer, 1994). The interviews were conducted by Peter Uhlhaas who had an inter-rater reliability on the PANSS interview of .90.

2.4.2 Schizotypy

Psychopathology in the student population was assessed with the Schizotyal Personality Questionnaire (SPQ) (Raine, 1991). The SPQ is a 72-item self report questionnaire that incorporates DSM-III-R criteria for the diagnosis of schizotypal personality disorder. The questionnaire consists of nine subscales, each of which corresponds to one of the nine symptoms of schizotypal personality disorder. The subscales are: ideas of reference, excessive social anxiety, odd belief or magical thinking, unusual perceptual experiences, odd or eccentric behaviour, lack of close friends, odd speech, constricted affect, and suspiciousness. In the original study by Raine (1991), 55% of subjects scoring in the top decile on the SPQ qualified for a clinical diagnosis of DSM-III-R schizotypal personality disorder.

In addition to the SPQ, thought disorder was assessed with a short form of the Thought Disorder Index (TDI) (Johnston & Holzman, 1979). The TDI was developed as a rating instrument to categorize disordered speech into four categories (associative, disorganized, idiosyncratic, and combinatory disturbance) and four levels of severity. The short form of the TDI derives estimates of thought disorder with four Rorschach cards which are comparable to the full 10-card version (Coleman et al., 1993). Response and inquiry stage were done in succession so that responses to each card were completed prior to the next card.

2.5 Measures

2.5.1 Verbal Intelligence

For the patient populations in this research, the vocabulary subtest of the Shipley Institute of Living Scale (Shipley, 1940) was administered to assess verbal intelligence. This subtest consists of 40 multiple-choice questions in which the respondent is asked to choose which of four words is closest in meaning to a target word. The respondent is required to complete each of the sequences. Administration time for the subtest is 10 minutes. A vocabulary score is computed from the total number of correct responses out of 40. As this test involves multiple-choice responses, the respondent may have attained some correct responses by guessing. The number of items that are not completed is divided by four and added to the raw score total. This is performed as a correction factor for guessing under the assumption that had the respondent guessing on these omitted item, they would get, on average, 1 in 4 correct.

The National Adult Reading Test (NART) (Nelson, 1991) was used for the non-clinical student population. The NART comprises a list of 50 words with regular and irregular pronounciation. The subject is required to read the list of words and the number of errors made is recorded. WAIS verbal, performance, and full-scale IQs can be predicted from reading error scores.

2.5.2 Gestalt Perception

2.5.2.1 Contour Integration Test

The research used two versions of a contour integration test. The contour integration test employs stimuli which consists of Gabor elements. Gabor patches are gaussian-modulated sinusoid luminance distributions which model the known receptive-field properties of neurons in the primary visual cortex (V1). The embedded contour cannot be detected by purely local filters, or by the known types of orientation tuned neurons with large receptive fields (Kovács, 2000). These long-range orientation correlations along the path of the contour can only be found by the integration of local orientation measurements. These relatively low-level interactions are sensitive to factors of perceptual organisation, such as differentiation between figure and ground and visual closure. Kovács and Julesz (1993), for example, found superiority of closed paths over open paths in terms of maximal separation between adjacent elements, and enhanced local contrast sensitivity within closed contours (Kovásc & Julesz, 1994). Visual spatial integration in this task also improves with age (Kovásc, Kozma, Fehér, & Benedek, 1999), suggesting that neural circuits integrating local features into coherent groups mature later than circuits that process local features (Kovács, 2000). Versions of the card sets used in this research have detected perceptual grouping impairments in amblyopia (Kovács, Polat, & Norcia, 1996), a disorder involving suspected deficits in longe-range spatial interaction in cortical areas subserving one eye.

The first stimulus set consisted of 20 cards. Examples of stimuli cards can be seen in Figure 2.1. Each card contained a closed path of Gabor elements embedded in a

random array of the same spatial frequency and contrast. A graded series of cards was generated by an algorithm that allowed precise control over relevant parameters.

The closed path of Gabor elements was manipulated by varying the orientation jitter between adjacent elements which involves the random orientation of elements relative to the path segment thereby increasing the difficulty to locate a contour. The orientation jitter between adjacent Gabor elements on the contour was restricted to 10 degrees for the first stimulus, increasing in steps of 2 degrees per card to 40 degrees for the last stimulus card. Detection rates approach chance levels when the orientation of elements relative to the path-segment is randomized by +-30 degrees (Field, Hayes, & Hess, 1993).

The stimulus cards were presented binocularly at a distance of 1 meter on a flat table. Participants were allowed to scan the card for 30 sec after which they had to give a response where the contour was located on the card. The contour was always located in one of the corners of the card. The participants' task was to locate the contour by pointing to one of the corners and tracing the outline of the contour with their index finger. Maximum score was 40 degrees and minimum score was10 degrees.

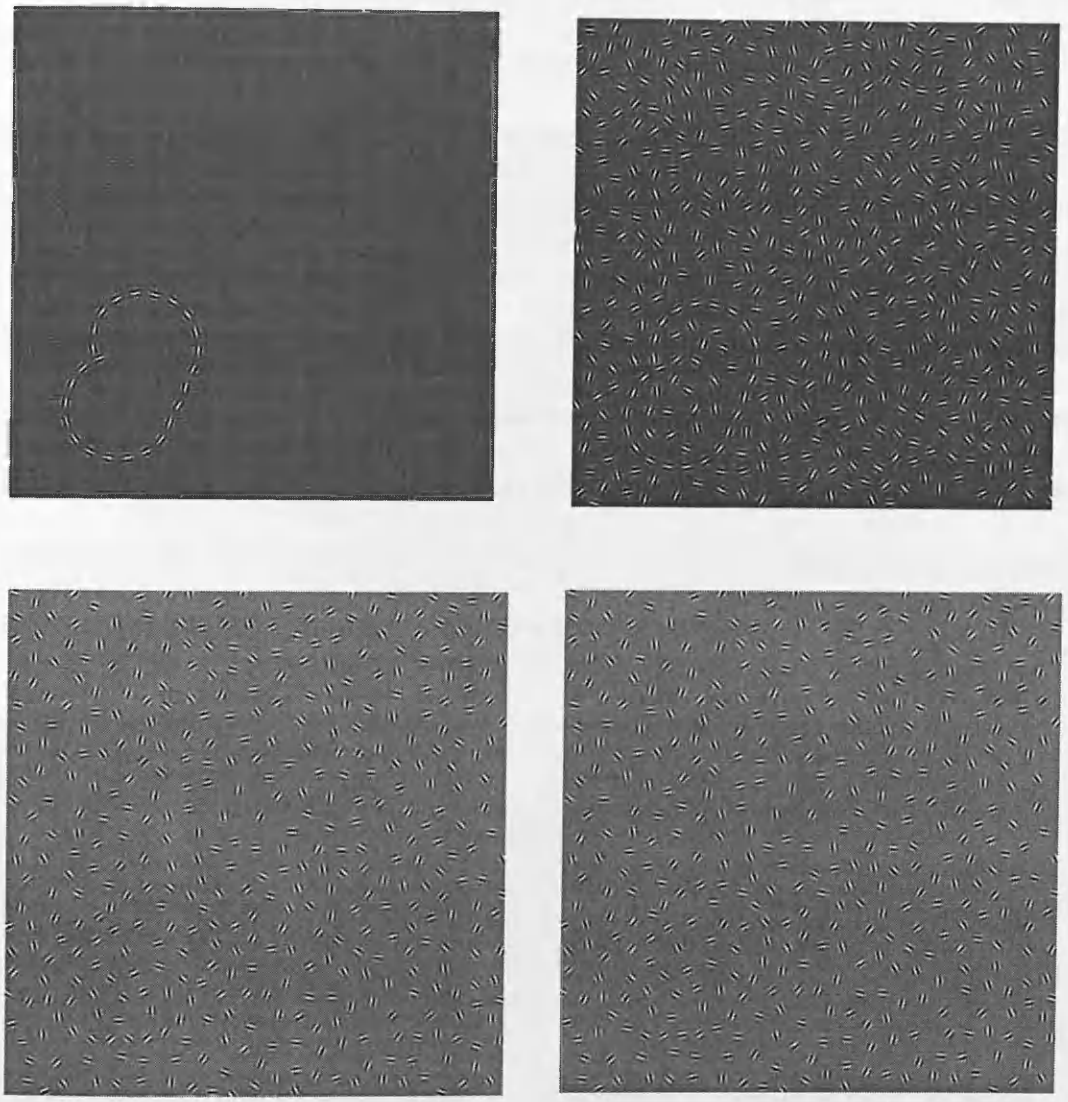


Figure 2.1 Examples of stimulus cards with random variation of path segments. In the top panels, a closed path of Gabor elements can be seen alone and embedded in a random array of Gabor elements. The bottom panels show a closed path of Gabor elements with an orientation jitter between elements of 20 degrees (left) and a closed path of Gabor elements with an orientation jitter of 30 degrees (right). In the examples, the contour is always located in the left bottom corner of the card.

The second stimulus set consisted of 15 cards. In contrast to the first set, the noise ration between path segments was held constant and the average spacing between the background elements and spacing between elements of the closed contour was manipulated. The ratio of the mean background spacing and spacing between neighboring contour elements (or delta, *D*) defines the contour signal to noise ratio, which ranged from 1.2 to .50 in .05 increments. At $D > 1$, the cards contain a first-order density cue, and therefore the contour can be identified by detecting the group of elements with the closet spacing. At $D < 1$, however, there is no density cue, and only second-order orientation cues are available for the location of the contour, which must be detected solely on the basis of long-range correlations between elements.

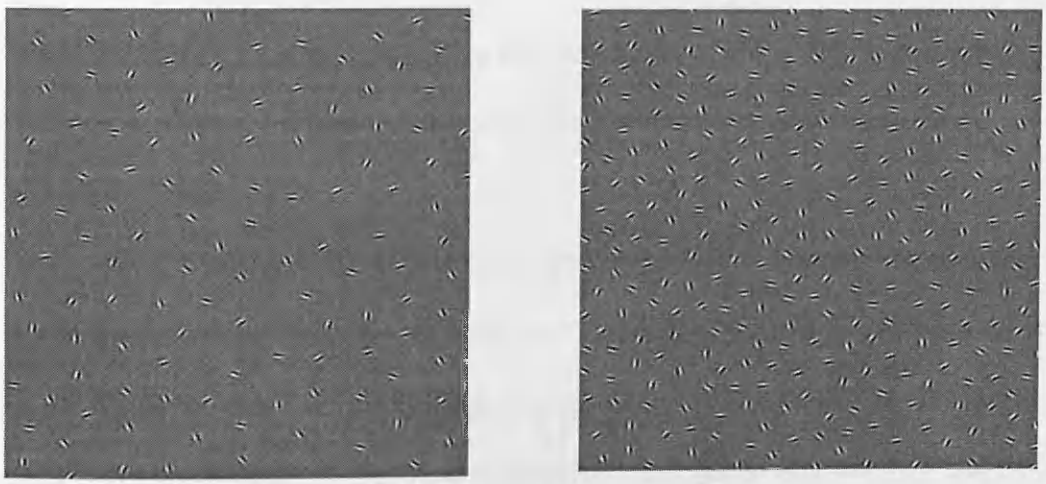


Figure 2.2 Examples of stimulus cards with manipulation of the spacing of background elements and path segments (left: $D = 1.20$, right $D = .75$).

The administration was the same as for the first set, except for the fact that if a participant did not locate a contour, administration was continued and performance on subsequent cards was used to estimate delta (*D*). Maximum *D* value was .05 and

minimum score was 1.20. Time to complete the task was approximately 10 minutes for both card sets.

2.5.2.3 Visual Size Perception Task

The illusory effect in this task is the result of the influence of the context circles upon the perception of the inner disk. A critical variable is the distance between context circles and the inner disk which emphasizes the modulatory role of context and the perceptual grouping principle of proximity as the underlying mechanisms of the illusory effect. The context circles produce either a decrease in apparent size when the context circles are bigger than the inner disk, or an increase if the context circles are smaller. There is evidence to suggest that children show less context sensitivity in this task (Kovács & Kaldy, in press), suggesting that maturation of long-range spatial interactions underlies contextual influences in both the contour integration and visual size perception task (Kovács et al., 1999).

Two versions of this task were developed during the course of the research. For the first (manual version), six different cards were produced plus two practice cards which displayed either the comparison stimuli alone (no surrounds) or surrounded by context circles (Figure 2.3). In the condition 'reducing' (large surrounds), a black circle of 14mm diameter was presented on a white laminated card of 13x17cm surrounded by 8 context circles of 22 mm. On the first card (near surrounds), the distance between the context circles and inner disc was 5mm. On the second card (far surrounds), the distance between context circles and inner disc was increased to 10mm. In the condition 'enlarging' (small surrounds), a circle of 16 mm was surrounded by 8 context circles of 6

mm with a distance of 3mm (near surrounds). On the second card (far surrounds), the distance between context and inner disc was increased to 6mm.

To indicate the apparent size of the inner disc, participants selected a comparison stimulus from a wheel that presented single circles (with no surrounding circles) ranging in diameter from 10mm to 22mm in steps of 0.5mm. The circles appeared one at a time in a 27mm aperture in the apparatus. Each subject performed 4 trials for each card in a randomized order. The stimulus cards and wheel were mounted on a board adjacent to each other so that the inner disc was horizontal to the comparison stimuli. The cards were presented at a distance of 1 meter.

The trials were averaged to produce scores for the two conditions where the comparison stimuli was presented alone (no surrounds) and two scores each for the conditions 'large surrounds' and 'small surrounds'. A score was computed which provided an estimate of the context effect. The scores for the context conditions were calculated as the differences between the estimate in the 'no surrounds' condition and the conditions in which the circle of the same size was surrounded by context circles. Since no differences between 'near surrounds' and 'far surrounds' stimuli were observed across the studies, the scores of 'near surrounds' and 'far surrounds' cards were combined and averaged. Thus, the summed score of the two cards in each context condition produced a score for the overall context effect in the 'enlarging' and 'reducing' condition.

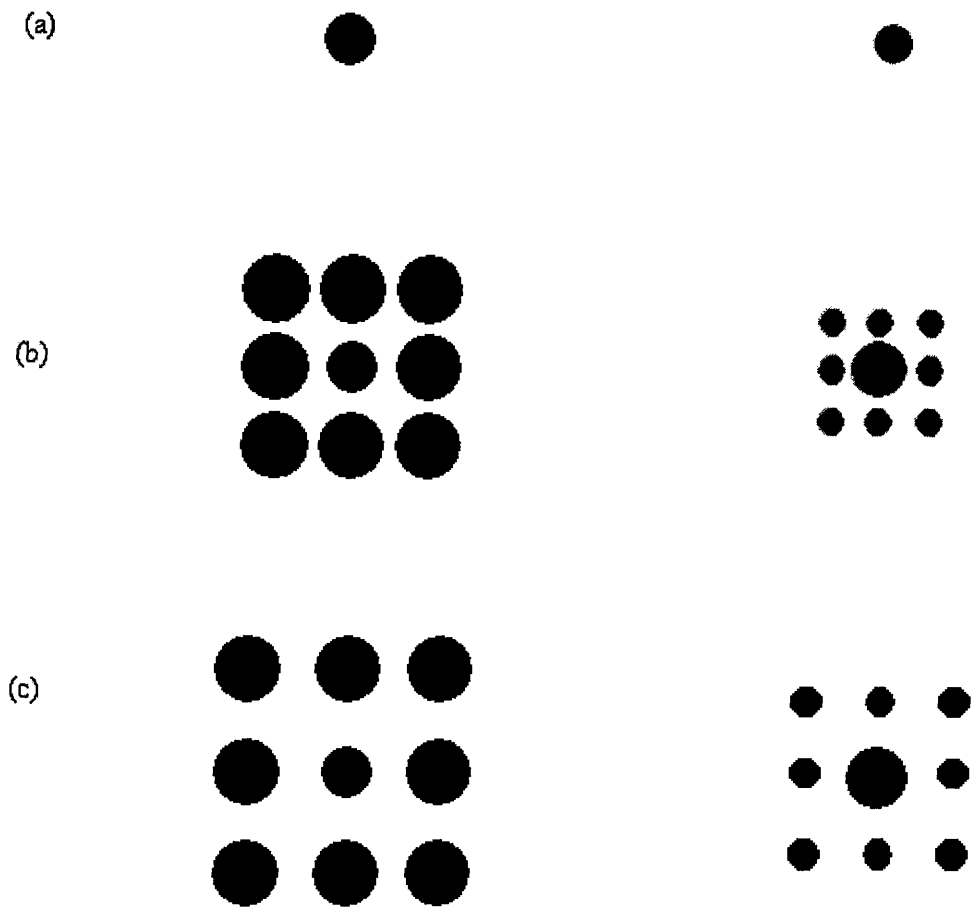


Figure 2.3 Examples of the stimuli used in the visual size perception task. (a) 'no surrounds', and (b) card 'near surrounds' and (c) 'far surrounds'. Examples on the right display the condition 'enlarging' and left 'reducing'.

The second version of the visual size perception task (computerized version) was a two-alternative forced choice task. The computer program which ran the task was developed by Berry (2001). The program was run on a Dell INSPIRON 2650 laptop

computer with a 14 inch screen. The display size of the monitor was set to 800 × 600 pixels, with the program window taking up the entire screen.

In the control condition a series of two target circles (a "standard" and a "variable" target) were presented to the participant (see Figure 2.4). Each presentation of two target circles was termed a "trial". There were 32 serially presented trials, with each trial lasting 4 seconds before the display briefly reverted to a blank gray screen in preparation for the next trial. The standard target circle was 100 pixels in diameter throughout the trials. The diameter of the variable target circle randomly varied from 94, 98, 102 or 106 pixels on different trials. The program also pseudo-randomly determined whether the variable target appeared to the left or right of the standard target on any given trial.

In the context condition the two target circles were each surrounded by context circles on each trial. One of the targets was surrounded by 8 context circles that were each 125 pixels in diameter (the reducing context circles), while the other target was surrounded by 8 context circles that were each 50 pixels in diameter (the exaggerating context circles). There were 96 trials in this condition, each lasting for 4 seconds. The standard target was 100 pixels in diameter on every trial. On 80 of the trials, the larger target circle was always surrounded by the reducing context circles, with the smaller target circle surrounded by the exaggerating context circles; the diameter of the variable target circle could be 82, 86, 90, 94, 98, 102, 106, 110, or 114 pixels. The larger target circle was surrounded by the exaggerating context circles on 16 trials, when the variable target was 98 or 102 pixels in diameter.

Prior to commencing the experiment, participants viewed three stimuli examples. The experimenter explained that the size comparison involved the two center circles in each display. Viewing distance was held constant at approximately 1m. Administration of the context and control conditions was randomized across participants. Participants were instructed to decide which of the target circles ('left' or 'right') was larger which was recorded by the experimenter by pressing one of two adjacent arrow keys on the keyboard. Responses were recorded by the computer program, which automatically provided a summary of the participants' responses, indicating how often the larger target circle was correctly identified at each level of the variable target's size. The time to complete the task was approximately 25 minutes for the manual version and 20 minutes for the computerized version.

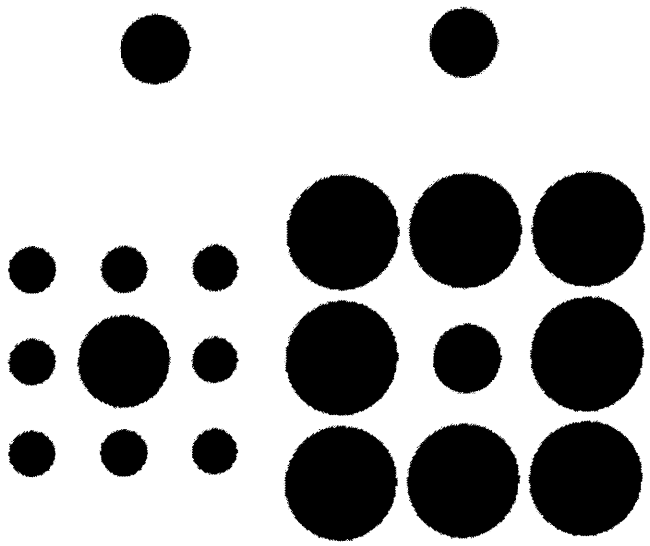


Figure 2.4 Examples of stimuli in the visual size perception task (computerized version) with context circles (bottom panel) and without context circles (top panel).

2.5.2.3 Visual Closure Task

Mooney and Ferguson (1951) developed a visual closure task consisting of degraded pictures (Figure 2.5) where all shades of gray are removed, thereby leaving the shadows rendered in black and the highlights in white. The test contains 51 degraded black and white images of men, women, and children of various ages. Perception of Mooney faces involves the grouping of the fragmentary parts into coherent images based on the Gestalt principle of closure. In a later study, Mooney (1957) demonstrated that visual closure ability is positively associated with age in children.

Experiments in neuropsychology and neuroscience have examined the neural correlates of visual closure processes in this task. Landsell (1970) found that removal of the right temporal lobe is associated with impairments in visual closure. In contrast, left temporal removals did not produce impairments of visual closure. In a recent study by Rodriguez et al. (1999), upright perception of a Mooney face was correlated with a significant increase in synchronized gamma activity in the area between parietal-occipital and frontotemporal regions. Both right hemisphere activity and gamma oscillations have been related to Gestalt perception (Bradshaw, Gates, & Patterson, 1976; Singer, 1999)

The basic task for participants was to identify a face and to assign one of six categories to each picture: boy, girl, grown-up man grown-up woman, old man and old woman. The correct sorting of a picture was interpreted by Mooney (1951) as evidence that visual closure had been achieved. Although Mooney suggested correct answers for all 51 pictures, Landsell (1968) found through an item analysis that four of the 51 images were statistically unreliable. Landsell further modified the test by using three of the remaining 47 pictures as practice items. In the present study, these three practice images

were combined with versions of the same pictures which showed the full face. Furthermore, three of the four discarded images were added to the practice block. The three images were presented upside down along with the three degraded practice items. Thus, only 44 of the original 51 pictures are scored: 28 pictures allowed either of two answers as correct while the remaining 16 had only one correct answer. In addition, the same 44 images were presented upside down bringing the number of images to a total of 88 which were viewed during the task.

Each image was displayed on a computer screen of standard size. The participant was seated 1m away from the screen. At the beginning of the task, the participant was instructed 'that he/she is going to see a series of images in which some of the images show a drawing of a human face in which some parts are missing'. It was also pointed out that in some of the images, no face could be seen. Participants were also instructed to select one of the 6 categories from a list which was placed in front of the subject during the task. The task was started with the presentation of the first 3 practice images. Each image was shown together with complete version of the same image. In the second set of the practice images, the three upside down images were presented together with the upright images of the first set. Participants proceeded to the experiment only after identifying 2 out 3 images in the first set correctly. A response was scored as correct if the participants identified an upright face together with the appropriate category. In the experiment, the images were presented for 15 seconds. Upright and upside down faces were randomized. Time to complete the task was approximately 30 minutes.

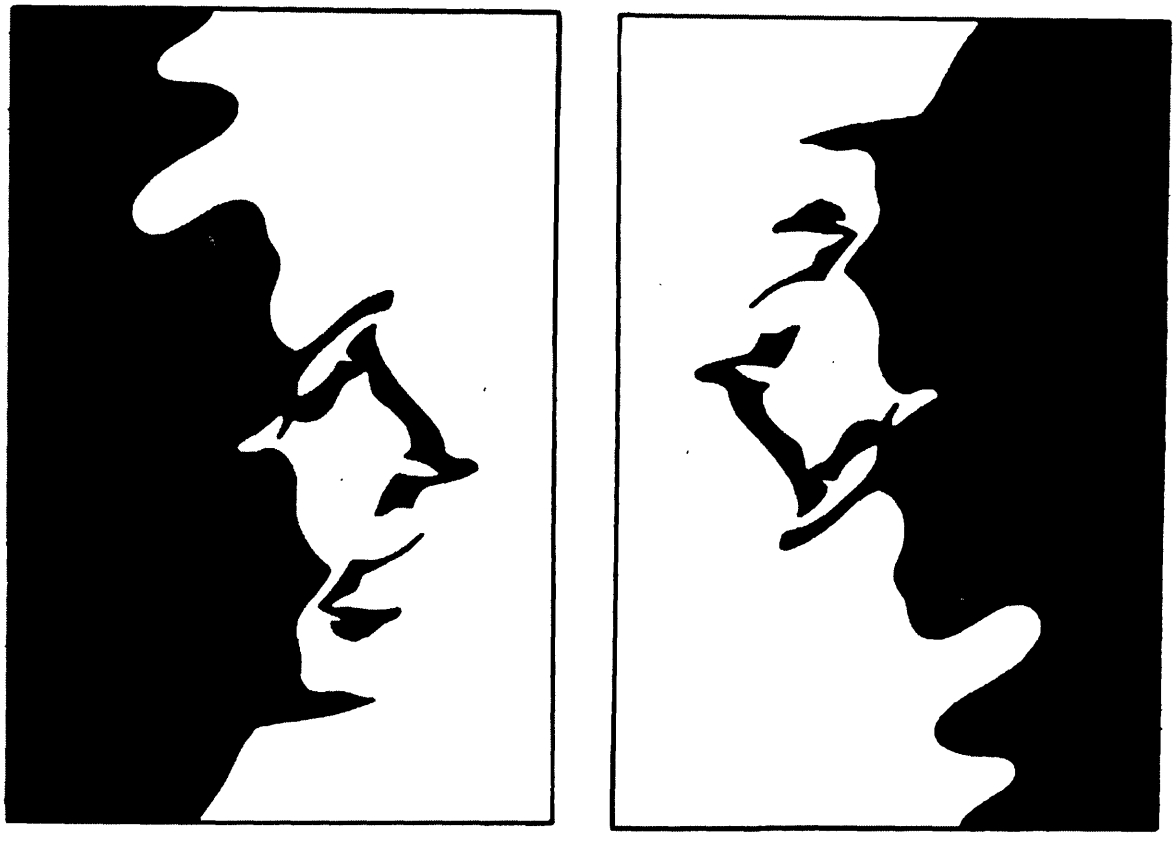


Figure 2.5 A Mooney face depicting the upright face of a grown woman (left) and an inverted version of this same image (right).

2.5.3 ToM

Three measures were employed to examine ToM. ToM refers to the ability to attribute independent mental states to self and others in order to explain and predict behaviour. In a recent paper, Tager-Flushberg and Sullivan (2000) proposed a componential view of ToM. In this model, the authors distinguish between a social-cognitive component and social- perceptual component of ToM. The social-perceptual component encompasses capacities which allow the distinction between people and objects, and to make online rapid judgements about people's mental state using facial and

bodily cues, for example. The social-cognitive component entails the conceptual understanding of mind as a representational system. The tasks were selected to differentially assess the social-perceptual and cognitive components of ToM. Participants took approximately 30 minutes to complete all tasks.

2.5.3.1 First-Order ToM

First-order ToM was explored with the Sally-Anne task (Table 2.1) (after Wimmer & Perner, 1983; Baron-Cohen, Leslie, & Frith, 1985). The task was performed using illustrative dolls and props. First-order ToM describes the ability to recognize that a story character has a false belief about the location of an object. Dennet (1978) suggested that attribution of a false belief to another person constitutes a criterion for ToM. There were three questions in this task : 1) a false-belief question 2) a reality question 3) a memory question. Response to the first question is the main criteria for intact first-order ToM.

Table 2.1

First-Order ToM Task

This is Sally and this Anne. Sally has this ball and she is going to put her ball in the basket. Then Sally goes out to play, so she leaves. Anne comes along and takes Sally's ball out of the basket and puts it in the box. Then Anne leaves. Sally comes back
(false belief question) Where will Sally look for her ball?
(reality question) Where is the ball really?
(memory question) Where was the ball in the beginning?

2.5.3.2 Hinting Task

The Hinting task was developed by Corcoran, Mercer, and Frith (1995) and assesses the ability to infer the real intentions behind indirect speech utterances. The task comprises ten short passages involving an interaction between two characters. Each story ends with one of the characters dropping a very obvious hint and the participant is required to explain what the character intended to communicate (see Table 2.2). If a participant fails to give a correct answer, a more obvious hint is read out by the experimenter. An appropriate response to the first hint is scored with two points. If a correct response is given at the second stage, the participant is given a score of one. If the participant fails to give a correct answer to any of the two hints, a score of zero is given to the item. The maximum total score is 20 points.

Each story was read out aloud by the experimenter to the participant. If a patient requested to hear a story again, the experimenter repeated the story to compensate for working memory impairments in patients.

Table 2.2

Example of the Hinting Task

George arrives in Angela's office after a long and hot journey down the motorway.
Angela immediately begins to talk about some business ideas. George interrupts Angela:
Hint 1: "My, my! It was a long, hot journey down the motorway!"
Question 1: What does George really mean when he says this?
Hint 2: George goes on to say: "I'm thirsty!"
Question 2: What does George want Angela to do?

2.5.3.3 Eyes Test

Baron-Cohen, Wheelwright, Hill, Raste, and Plumb (2001) developed a test to judge the mental state of another person from 36 photographs of the eye-region of faces. The task requires the participant to select a word out of a list of four which best describes what the person in the picture is thinking or feeling. A face with the corresponding 4 mental state terms can be seen in Figure 2.6. In an analysis of the test, Baron-Cohen et al. (2001) proposed that the Eyes Test involves the rapid mapping of mental state terms to the fragments of facial expressions. In contrast to the first-order ToM task and Hinting Task, the Eyes Test involves only the attribution of a mental state but not an inference about the content of that mental state. Hence, the Eyes Test can be considered to measure a 'primitive' form of ToM which may be considered an integral part of the social-perceptual component of ToM.

The participants were asked to select a mental state term as quickly as possible and to indicate any word meanings they were unsure of. A glossary with explanations of all mental state terms could be read by the participant at any time during testing. Data from the initial study by Baron-Cohen et al. (2001) showed that performance on the Eyes Test was not correlated with IQ in the general population nor in a sample of high functioning adults with Autism and Asperger Syndromes.

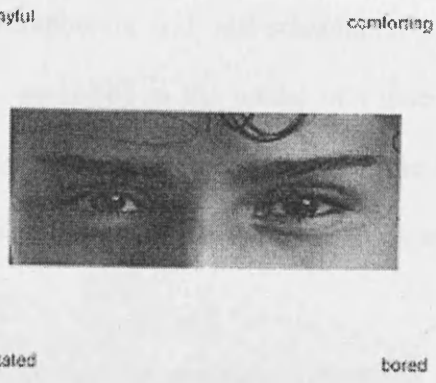


Figure 2.6 Example of a stimuli from the Eyes Test (Baron-Cohen et al. 2001) with four mental state terms.

2.6 Research Design and Statistical Analysis

2.6.1 Examination of Schizophrenia Spectrum Symptomatology

The analysis of symptoms in schizophrenia spectrum disorders was guided by a model of Peralta and Cuesta (2001) who argued for a hierarchical approach towards clinical dimensions in schizophrenia. In this model, clinical dimensions are organised into various levels of complexity, ranging from higher-order levels (corresponding to the simple or big dimensions, i.e., positive, negative, and disorganised syndromes) to lower order levels (corresponding to the more complex or fine grained dimensions, i.e., thought

disorders, paranoid delusions). This approach has the advantage that the power of detecting cognitive dysfunctions is significantly increased.

Symptoms in schizophrenia and non-schizophrenia psychotic disorders were grouped into five factors according to the model of Lindenmayer et al. (1994). The individual factors and item composition can be seen in Table 2.3. Patients were also rated on the item 'inappropriate affect' (Cuesta & Perualta, 1995) which allowed for a score on the factor 'disorganisation'.

In addition to the analysis of the main syndromes of schizophrenia spectrum disorders ('positive', 'negative', 'cognitive', and 'disorganisation'), individual items of the PANSS were selected, 'conceptual disorganisation' and 'suspiciousness', in order to examine the hypothesis that specific symptoms of schizophrenia spectrum disorders are related to differential cognitive dysfunctions. A broader definition of schizophrenia was used for these comparisons which consisted of patients with both schizophrenia and schizoffective disorder. Patients with non-schizophrenia psychotic disorders were not included in this group since there is evidence to suggest that thought disorder in bipolar disorder, for example, is qualitatively different from thought disorder in both schizoaffective disorder and schizophrenia (Shenton, Solovay, & Holzman, 1987).

Table 2.3

Five Factor Model of Schizophrenic Symptoms According to Lindemayer et al. (1993) and Cuesta and Peralta (1995)

Factor	***Symptom***					
Negative	Emotional Withdrawal	Passive/ Apathetic Withdrawal	Lack of Spontaneity	Poor Rapport	Active Social Avoi-dance	Blunted Affect
Excitement	Excitement	Poor Impulse Control	Hostility	Tension		
Cognitive	Conceptual Disorganisation	Disorientation	Mannerisms and Posturing	Poor Attention	Difficulty in Abstract Thinking	
Positive	Suspiciousness/ Persecution	Delusions	Grandiosity	Unusual Thought Content		
Depression	Preoccupation	Guilt Feelings	Depression	Somatic Concern	Anxiety	
Disorganisation	Conceptual Disorganisation	Inappropriate Affect	Poor Attention			
Other PANSS Items	Uncooperative-ness	Motor Retardation	Stereotyped Thinking	Lack of Judge-ment and Insight	Distur-bances of Volition	Halluci-nations

In order to examine the relationship between dysfunctional Gestalt perception and the disorganisation syndrome in schizophrenia spectrum disorders, a three factor solution proposed by Raine et al. (1994) was adopted for the analysis in schizotypal participants (see Table 2.4). Thought disorder was measured with the TDI (Johnson & Holzman, 1979).

Table 2.4

Three Factor Model of Symptoms in Schizotypal Personality Disorder According to Raine et al. (1994)

	Symptoms			
Factor				
Cognitive-Perceptual	Ideas of Reference	Magical Thinking	Unusual Perceptual Experiences	Paranoid Ideation
Interpersonal	Social Anxiety	No Close Friends	Constricted Affect	Paranoid Ideation
Disorganisation	Odd Behaviour	Odd Speech		

2.6.2 Significance Levels and Post Hoc Tests

All hypotheses were examined with two-tailed tests. The significance level for rejecting the null hypothesis was .05. The research will also report results which reached the statistical trend level. Post hoc were comparisons were computed with the Scheffé test.

2.6.3 Assumptions for Statistical Analysis

Given the number of proposed statistical comparisons in the research, it is likely that for some procedures the assumptions of normality for the distribution of scores and homogeneity of variances will not be met. Although several procedures are robust against departures from both the normality and homogeneity of variance (Everitt, 1996), there is no consensus in the literature of how such violations should be dealt with. Thus, it was

decided that for comparisons in which violations were observed, appropriate non-parametric procedures were employed. The Kruskal-Wallis test was used for testing differences between group means. For the analysis of variance in a repeated measures design in which the sphericity assumption was not met, the significance of the F ratiowas evaluated with the Greenhouse-Geisser procedure. However, the results of non-parametric tests will only be reported if the results differ significantly from findings obtained with parametric procedures.

2.6.4 Statistical Analysis and Interpretation of Covariates

Patient populations were not matched in demographic variables, such as education, intelligence, and length of illness. The rationale and strategies for controlling for differences in such 'nuisance' variables have been discussed controversially (Meehl, 1971). For example, Brüne (2003) has suggested that deficits in ToM in schizophrenia are largely the result of lower IQ in schizophrenia patients and deficits in working memory, for example, rather than a genuine impairment in the ability to mentalize. A number of studies examining ToM in schizophrenia have therefore carried out additional analysis with subsamples of patients matched on current IQ. However, statistical control of IQ in this example has its own set of problems. There is evidence, for example, to suggest that schizophrenia patients with poor premorbid social adjustment have lower IQ (Jones, Guth, Lewis & Murray, 1992). Since the present research hypotheses that schizophrenia patients with poor premorbid functioning are particularly impaired in ToM, controlling for IQ may lead to a non-representative sample which will generate misleading results.

The following strategies were therefore adopted to deal with possible confounds through differences in IQ, for example, and other variables: 1) correlations were obtained for the different experimental groups to identify possible covariates. The correlations were computed separately for the groups. Only those variables which were correlated in at least two experimental groups at the .10 significance level with cognitive measures will be considered as potential covariates. This strategy was adopted to control for the number of comparisons; 2) following Meehl (1971), analyses will be carried out which report results of analyses which are both corrected and uncorrected for the influence of covariates; and 3) within group comparisons of schizophrenia patients, for example, will be taken into account to determine the influence of covariates since schizophrenia patients will be more closely matched on education and intelligence than analyses which contrast schizophrenia patients with a group of patients with non-psychotic disorders, for example.

3. HYPOTHESES

The first goal of the research was to determine whether impairments in Gestalt perception are associated with schizophrenia spectrum disorders. Hypotheses concerning the nature of the cognitive dysfunction are as follows:

Hypothesis 1

Schizophrenia spectrum disorders are characterized by a reduced responsiveness to Gestalt properties of stimuli. Specifically, impairments in Gestalt perception are the result of deficits in the organisation of visual stimuli based on context.

In addition, the aim of this research is to clarify the contribution of impairments in context processing to deficits in Gestalt perception in schizophrenia spectrum.

Hypothesis 1a

Impaired Gestalt perception in schizophrenia spectrum disorders is related to deficits in the processing of both current as well as preceding context.

To address the methodological issues raised, the research was guided by a process-oriented approach (Knight, 1984, Knight & Silverstein, 2001) in order to test competing hypothesis of cognitive dysfunction in schizophrenia and to disconfirm the predictions of the general deficit model.

Hypothesis1b

Dysfunctional Gestalt perception in schizophrenia spectrum disorders can result in superior performance on some cognitive tasks.

Three tasks were selected for the research to examine Gestalt perception in schizophrenia spectrum disorders. Tasks were selected which are compatible with Gestalt perception as studied in the normal psychological literature and for which there is extensive evidence regarding their underlying cognitive mechanisms.

Hypothesis 2

Measures of Gestalt perception assess a common construct. Accordingly, measures of Gestalt perception will be significantly correlated.

Third, the research was concerned with identifying the clinical correlates of impaired Gestalt perception in schizophrenia spectrum disorders at higher-order levels (corresponding to the simple or big dimensions, i.e. positive, negative and disorganized syndromes) and lower order levels (corresponding to the more complex or fine grained dimensions, i.e. thought disorders, paranoid delusions) (Peralta & Cuesta, 2001). As argued above, simple dimensions are heterogeneous subsuming individual symptoms whose cognitive and biological substrates are likely to be different. At the level of simple dimensions, the clinical correlate of Gestalt perception was characterized as follows:

Hypothesis 3

Dysfunctional Gestalt perception in schizophrenia spectrum disorders is related to the 'disorganisation syndrome.'

In addition, two individual symptoms were examined, thought disorder and paranoia. Thought disorder is a core symptom of the disorganisation syndrome (Cuesta & Peralta, 1995). Bleuler (1911) hypothesized that the 'loosening of associations', a central component of formal thought disorder, constitutes a fundamental or primary disturbance.

Hypothesis 3a

Thought disorder is related to dysfunctional Gestalt perception in schizophrenia spectrum disorder.

Based on the model of Magaro (1980), the distinction between paranoid and non-paranoid patients was examined. It was hypothesized that schizophrenia patients with pronounced paranoid symptomatology are characterized by a distinct cognitive 'style'.

Hypothesis 3b

Paranoid Schizophrenia is characterized by enhanced Gestalt perception.

The research was concerned with characterizing the extent and changes in dysfunctional Gestalt perception in patients at different stages of the disorder and the relationship to

changes in clinical state. According to Neuchterlein and Dawson (1984), characteristic patterns of cognitive dysfunction can be assigned into three categories:

1) *Stable Vulnerability Indicator;* stable vulnerability markers are stable, trait-like individual characteristics of schizophrenia patients that are consistently different from normal participants even during remission and do not become abnormal even during psychotic episodes.
2) *Mediating Vulnerability Factor;* mediating vulnerability factors are variables that show abnormalities during clinical remission as well as during psychotic episodes, but that also become more severely deviant during and possibly somewhat before psychotic exacerbations.
3) *Episode Indicator;* episode indicators are abnormalities occurring during psychotic periods that return to normal levels during clinical remission.

The pattern of impaired Gestalt perception in schizophrenia spectrum disorders was hypothesized as follows:

Hypothesis 4

Impairments in Gestalt perception constitute a mediating vulnerability marker.

Fifth, the link between impairments in Gestalt perception and aspects of social cognition in schizophrenia was examined. Previous research by Silverstein et al. (1996) has indicated that dysfunctional Gestalt perception is related to poor premorbid status in schizophrenia. Poor premorbidity is strongly related to social functioning possibly implicating deficits in social cognition in this subtype of schizophrenia. Therefore, the

relationship between a specific aspect of social cognition, Theory of Mind (ToM), and impairments in Gestalt perception was explored. ToM can be described as the ability to infer the mental states of other people, such as beliefs and intentions (Tager-Flushberg & Sullivan, 2000). Frith (1992) has linked impairments in ToM to a number of symptoms in schizophrenia. However, the cognitive correlates of deficits in ToM in schizophrenia are largely unknown. Recent evidence (Baldwin, Baird, Saylor, & Clark, 2001) suggests that context processing is relevant for the development of precursors of ToM in infancy and impairments in both domains are correlated in the general population and in autism (Jarrold, Butler, Cottington, & Jiminez, 2001).

Hypothesis 5

Dysfunctional Gestalt perception in schizophrenia spectrum disorders is related to impaired Theory of Mind (ToM).

4. GESTALT PERCEPTION IN SCHIZOTYPY

4.1 Aims of the study

The aim of the study was to establish whether dysfunctional Gestalt perception is associated with schizophrenia spectrum disorders and to determine which symptoms correlate with such impairments. The study of cognitive dysfunctions in schizophrenia spectrum disorders is useful for the identification of potential markers for schizotaxia, the underlying neural integrative deficit in schizophrenia spectrum disorders (Meehl, 1962).

4.2 Method

4.2.1 Participants

The participants were 423 undergraduate psychology students who took part in this study for course credits. Of the 423 potential participants, 337 returned the SPQ questionnaire, a return rate of 77.7%. Seven questionnaires were filled out incompletely and 24 participants were excluded due to previous psychiatric illnesses.

Participants who fell within the top or bottom 20% of overall scores on the SPQ were contacted and recalled for the second part of the experiment. Of the contacted students, 32 participants with high scores and 37 with low SPQ scores took part in the experiment.

4.2.2 Measures

The following measures were employed in this study: 1) the NART (Nelson, 1991) for the assessment of intelligence; 2) the SPQ (Raine et al., 1991) and the TDI (Johnston & Holzman, 1979) for the examination of psychopathology; and 3) two measures of Gestalt perception, the visual size perception task (manual version) and the version of the contour integration task in which the orientation jitter between adjacent elements of the contour was manipulated.

4.3 Results

4.3.1 Demographic and Clinical Variables

Table 4.1

Means, Standard Deviations, and Mean Differences for Demographic and Clinical Variables of Participants

	Schizotypal		Non-Schizotypal		Signific. Level
	(n=32		(n=37)		
Variable	M	SD	M	SD	
Age (in years)	22.7	8.0	21.5	5.5	$t(67)$=.18 p>.83 (HV)
Sex (Male/Female)	10/22		29/8		$\chi 2(1)$=.83 p>.36
Education (in years)	14.4	1.9	14.3	1.4	$t(67)$=.21 p>.84 (HV)
Verbal IQ (NART)	108.4	5.0	108.5	5.3	$t(67)$=.23 p>.82 (HV)

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance.

Demographic Data Demographic data are presented in Table 4.1. The three groups did not differ in age, sex distribution, verbal IQ, and education. Statistical relationships between demographic variables and neurocognitive measures were explored which could indicate possible confounds for the analysis of performance on cognitive measures. An unexpected correlation was obtained between age and performance on the contour integration task. The ability to detect contours was negatively correlated with age in this task. Previous research by Kovásc et al. (1999) suggested that perceptual grouping improves with age. The finding in this research may be explained by the positive association between age and elevated scores on the factor disorganisation. Since it is hypothesized that disorganisation in schizophrenia spectrum disorders may be related to dysfunctional Gestalt perception, it possible that the relationship between these two variables may also account for the correlation between performance on the contour integration task and age.

SPQ Data Schizotypal and non-schizotypal participants were compared on the overall score and the three factors of the SPQ (Table 4.3). As expected because of the selection criteria, schizotypal participants had significantly higher scores on all factors than non-schizotypal participants.

Table 4.2

Correlations between Demographic, Clinical, and Neurocognitive Measures Groups Combined (Row 1), Schizotypal (Row 2), and Non-Schizotypal Participants (Row3)

	Age	Education	Verbal IQ
Contour Integration Task			
	-.32**	-.11	**.24***
	-.34*	-.14	.23
	-.29+	-.07	.25
Visual Size Perception Task			
Reducing	-.06	-.02	-.00
	-.06	-.05	.03
	-.08	-.01	-.02
	-.01	.00	-.15
Enlarging	.05	-.03	-.35+
	-.10	.04	.03
Total SPQ Score			
	.16	**.24***	-.09
	.51*	**.71***	-.20
	-.22	-.10	.02
SPQ Cognitive-Perceptual Factor	.04	.08	-.10
	.11	.21	-.13
	-.04	.07	-.27
SPQ Disorganisation Factor	.22+	**.31****	-.07
	.49**	**.66*****	-.19
	-.19	-.14	.22
SPQ Interpersonal Factor	-.02	-.09	.01
	-.09	-.22	.16
	-.03	-.24	-.15

Note. +=p<.1; *=p<.05; **=p<.01;***=p<.005; ****=p<.0001

Table 4.3

Means, Standard Deviations, and Mean Differences for SPQ Data for Schizotypal and Non-Schizotypal Participants

	Schizotypal		Non-Schizotypal		Signific. Level
	(*n*=32)		(*n*=37)		
Factor	M	SD	M	SD	
Total Score	39.0	10.2	8.4	3.0	*t*(69)= 17.49 p<. 00001 (IV)
Cognitive-Perceptual	18.2	3.6	4.1	2.2	*t*(69)=19.87 p<.0001 (IV)
Interpersonal	15.9	5.4	3.1	1.9	*t*(69)=13.37 p<.0001 (HV)
Disorganisation	10.4	4.9	2.1	1.5	*t*(69)=9.82 p<.0001 (IV)

Note. (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance.

Thought disorder assessment 18 out of 28 schizotypal participants produced at least one thought disordered response. Level of thought disorder and categories are shown in Table 4.4. The level and nature of thought disorder was similar to previous research in schizotypy (e.g., Coleman, Levy, Lenzenweger, & Holzman, 1996) with responses falling mainly into the category of idiosyncratic verbalizations.

Table 4.4

Total TDI Score and Categories of Thought Disorder in Schizotypal Participants

TDI Category	*n*	M	SD
Total TDI Score	18	8.6	7.1
Idiosyncratic Verbalizations	14	5.9	7.1
Combinatory TD	4	2.7	5.7
Disorganised TD	1	3.5	1.5

Intercorrelations Between Measures of Gestalt Perception Correlations between the contour integration and visual size perception tasks were performed. The only significant correlation between the two tasks was found for schizotypal participants in the condition 'reducing'. This suggests that schizotypal participants who were more impaired in the contour integration task were more accurate in the estimation of the inner disk. The association between the two tasks was not present in non-schizotypal participants. In addition, the individual conditions of the visual size perception task, 'reducing' and 'enlarging', showed no statistical relationship.

Table 4.5

Intercorrelations Between Measures of Gestalt Perception

Groups Combined (Row 1,) Schizotypal Participants (Row2), and Non-Schizotypal Participants (Row 3)

	Contour Integration Task	Visual Size Perception Task	
		Reducing	Enlarging
Visual Size Perception Task			
Reducing	.02 **.40*** -.15		
Enlarging	-.10 -.07 -.14	-.04 .15 -.15	

Note. +=p<.1; *=p<.05; **=p<.01;***=p<.005; ****=p<.0001

4.3.2 Neurocognitive Correlates of the Three Factor Model of the SPQ

Correlations between measures of Gestalt perception and factors of the SPQ were examined for both groups combined and separately (Table 4.6). No significant correlations emerged between the neurocognitive measures and the factors disorganisation, cognitive-perceptual, and interpersonal of the SPQ.

Table 4.6

Correlations Between Measures of Gestalt Perception and Factors of the SPQ Groups combined (Row1), Schizotypal Participants (Row2), Non-Schizotypal Participants (Row 3)

	Contour Integration Task	Visual Size Perception Task	
		Reducing	Enlarging
Factor			
Total SPQ			
	-.07	-.11	-.01
	.06	.10	-.12
	.13	-.10	-.13
Cognitive-Perceptual	-.10	-.16	.04
	.01	.07	.01
	-.01	-.26	.23
Interpersonal			
	-.15	-.11	-.09
	.01	-.17	-.19
	-.18	.15	-.24
Disorganisation			
	-.07	-.06	-.05
	.06	.08	-.12
	.13	-.10	-.04

Note. +=p<.1; *=p<.05; **=p<.01;***=p<.005; ****=p<.0001

4.3.3 Gestalt Perception in Schizotypal and Non-Schizotypal Participants

Table 4.7

Means, Standard Deviations, and Results of Analysis of Variance on Measures of Gestalt Perception

Test		Schizotypal (n=32) M	SD	Non-Schizotypal (n=37) M	SD	Signific. Level	Post hoc
Contour Integration Task		28.6	4.8	29.6	4.4	$\chi 2(1)=.80$ p>.37 (HV)	
Visual Size Perception Task	Reducing	.08	.07	.08	.09	$\chi 2(1)=.04$ p>.94 (HV)	
	Enlarging	.22	.12	.22	.11	$\chi 2(1)=.03$ p>.99 (HV)	
	Control Circle 14mm	1.33	.06	1.34	.06	$\chi 2(1)=.15$ p>.72 (HV)	
	Control Circle 16mm	1.48	.06	1.48	.05	$\chi 2(1)=.01$ p>.93 (IH)	

Note. Analyses were carried out with BMDP 5V (Dixon, 1992). Analyses testing a priori hypothesis regarding between group contrasts were conducted using single degree of freedom contrasts (Rosenthal & Rosnow, 1985). (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance.

Contour Integration Task Schizotypal and non-schizotypal participants did not differ in their performance threshold for detecting contours. Performance levels of both groups were similar to data reported by Field, Hayes, and Hess (1993) for non-patient adults.

Visual Size Perception Task Both groups were compared on their size estimates in the 'no surrounds' and two context conditions. The groups showed no differences in size estimation in the 'no surrounds' conditions of 14mm and 16mm. There were also no significant differences in the two context conditions.

4.4 Discussion

The results from two tasks which examined Gestalt perception in schizotypal and non-schizotypal participants suggest that dysfunctional Gestalt perception is not a general feature of schizophrenia spectrum disorders. Schizotypal and non-schizotypal participants did not differ in the contour integration and visual size perception tasks. Therefore, hypothesis 1 could not be confirmed. Furthermore, no significant correlations were obtained between dysfunctional Gestalt perception and the factor disorganisation of the SPQ. This also disconfirmed the hypothesis that disorganisation is related to dysfunctional Gestalt perception in schizophrenia spectrum disorders (hypothesis 3). The results support findings from a study by Silverstein et al. (1992) which reported that dysfunctional Gestalt perception is not associated with schizotypy in a sample of university students. However, the results of this research are at variance with a number of previous studies (e.g., Goodarzi et al. 2000) in this field which have reported an association between schizotypy and dysfunctional Gestalt perception.

4.5 Comparison of Thought Disordered Schizotypal vs. Non-Thought Disordered Schizotypal vs. Non-Schizotypal Participants

4.5.1 Aims of the Study

In order to further examine hypothesis 3 'dysfunctional Gestalt perception in schizophrenia spectrum disorders is related to the 'disorganisation syndrome'', analyses of variance were carried out after subdividing the sample into thought disordered schizotypal, non-thought disordered schizotypal, and non-schizotypal participants. Thought disordered schizotypal participants were defined as high SPQ scorers who gave at least one TDI scorable response.

4.5.2 Results

4.5.2.1 Demographic and Clinical Variables

Demographic and Clinical Variables Table 4.8 displays the main demographic variables. The four groups did not differ significantly on the variables education, sex distribution, verbal IQ, and age.

Table 4.8

Means, Standard Deviations, and Mean Differences for Demographic and Clinical Variables of Participants

Variable	Thought Disordered Schizotypal (n=18) M	SD	Non-Thought Disordered Schizotypal (n=10) M	SD	Non-Schizotypal (n=37) M	SD	Signific. Level	Post hoc
Age (in years)	20.4	3.2	20.2	3.7	21.5	5.5	$F(2,62)$=.54 p.>.59 (HV)	
Sex (Male/Female)	4/14		4/6		8/29		$\chi 2(2)$=1.51 p>.47	
Education (in years)	14.1	1.2	14.4	.97	14.3	1.4	$F(2,62)$=.33 p>.72 (HV)	
Verbal IQ (NART)	108.4	4.7	108.0	4.6	108.5	5.3	$F(2,62)$=.05 p>.96 (HV)	

Note. (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance.

SPQ Data Differences in symptomatology were explored between thought disordered schizotypal, non-thought disordered schizotypal, and non-schizotypal participants (Table 4.9). Of particular interest were potential differences between the two schizotypal groups. As expected, significant main effects of group were obtained for all comparisons. Post hoc Scheffé tests indicated that the only intergroup comparison which reached statistically significant levels between the schizotypal groups was on the cognitive-perceptual factor of SPQ. Non-thought disordered schizotypal participants had significantly higher score on this factor than thought disordered schizotypal participants.

Table 4.9

Means, Standard Deviations, and Mean Differences for SPQ Data for Thought Disordered Schizotypal, Non-Thought Disordered Schizotypal, and Non-Schizotypal Participants

	Thought Disordered Schizotypal		Non-Thought Disordered Schizotypal		Non-Schizotypal		Signific. Level	Post Hoc
	(*n*=18)		(*n*=10)		(*n*=37)			
Factor	M	SD	M	SD	M	SD		
Total Score	37.1	6.7	39.5	5.5	8.4	3.0	*F*(2,62)= 318.8 p<. 00001 (HV)	TD<NS NTD<NS
Cognitive-Perceptual	17.4	2.9	19.9	4.3	4.1	2.2	*F*(2,62)=202.2 p<.0001 (IV)	DT<NS NTD<NS NTD<TD
Interpersonal	15.7	6.2	17.4	3.2	3.1	1.9	*F*(2,62)=97.2 p<.0001 (IV)	NTD<NS TD<NS
Disorganisation	9.8	3.1	9.8	3.2	2.1	1.5	*F*(2,62)=86.0 p<.0001 (IV)	TD<NS NTD<NS

Note. (IV): inhomogeneous variance (Levine statistic: criteria: p<.05); (HV): homogeneous variances. TD=Thought Disordered Schizotypal; NTD=Non-Thought Disordered Schizotypal; NS=Non-Schizotypal

4.5.3 Gestalt Perception in Thought Disordered Schizotypal vs. Non-Thought Disordered Schizotypal vs. Non-Schizotypal Participants

Contour Integration Task The groups differed significantly in the threshold for detecting contours. Post hoc Scheffé tests indicated that the thought disordered schizotypal participants scored significantly lower than the non-thought disordered schizotypal participants.

Visual size perception task There was a main effect of group for the condition 'reducing'. Post-hoc Scheffé tests indicated that the thought disordered schizotypal participants scored significantly more accurately than non-thought disordered schizotypal participants. There was no significant main effect for the condition 'enlarging'. There were no group differences in size estimates in the condition 'no surrounds', 14mm and 16mm.

Table 4.10

Means, Standard Deviations, and Results of Analysis of Variance on Measures of Gestalt Perception

	Thought Disordered Schizotypal		Non-Thought Disordered Schizotypal		Non-Schizotypal		Signific. Level	Post Hoc
	(*n*=18)		(*n*=10)		(*n*=37)			
Factor	M	SD	M	SD	M	SD		
Contour Integration Task	27.4	3.6	31.4	4.9	29.6	4.4	$\chi 2(2)=6.34$ p<.04 (HV)	TD<NTD
Visual Size Reducing Perception Task	.05	.06	.12	.07	.08	.09	$\chi 2(2)=6.49$ p<.03 (HV)	TD<NTD
Enlarging	.20	.13	.22	.10	.22	.11	$\chi 2(2)=.01$ p>.99 (HV)	
Control Circle 14mm	1.33	.05	1.33	.05	1.34	.06	$\chi 2(2)=.31$ p>.85 (HV)	
Control Circle 16mm	1.47	.06	1.47	.05	1.48	.05	$\chi 2(2)=.07$ p>.86 (HV)	

Note. Analyses were carried out with BMDP 5V (Dixon, 1992). Analyses testing a priori hypothesis regarding between group contrasts were conducted using single degree of freedom contrasts (Rosenthal & Rosnow, 1985). (IH) inhomogeneous variance according to the Levine statistic (criteria: p<.05) (HV): homogeneous variance.
TD=Thought Disordered Schizotypal; NTD=Non-Thought Disordered Schizotypal; NS=Non-Schizotypal

4.5.4 Discussion

The second goal of the study was to examine whether a specific subset of schizotypal participants, those with thought disorder, are impaired in Gestalt perception. Thought disordered schizotypal participants demonstrated an impairment in their ability to detect grouping among noncontiguous elements comprising a closed (i.e., circular) contour. This finding is consistent with previous data with this task investigating Gestalt perception in schizophrenic patients (Silverstein et al., 2000). In the present study, deficits in Gestalt perception also resulted in a task superiority on the visual size perception task in thought disordered schizotypal participants. Schizotypal participants with thought disorder displayed more accurate judgements in the condition 'reducing', suggesting impairments in the processing of visual context in the form of reduced sensitivity to surrounding visual elements. Interestingly, the difference in context sensitivity was not present in the condition 'enlarging'. The dissociation between the conditions 'reducing' and 'enlarging' in thought disordered schizotypes is consistent with data from developmental studies demonstrating that sensitivity to visual context in these two conditions of the visual size perception task occurs at different developmental periods (Káldy & Kovács, in press). The significant correlation between performance in the visual size perception task, condition 'reducing', and in the contour integration task in schizotypal participants furthermore indicates that dysfunctional Gestalt perception in thought disordered schizotypes is the result of a single impairment in Gestalt perception in both tasks.

Two aspects of the results merit further discussion. First, it is unclear as to whether impairments in Gestalt perception are related to thought disorder per se or

whether thought disorder in association with elevated levels of schizotypy were responsible for dysfunctional Gestalt perception. The latter hypothesis could not be explored as the TDI was not administered to non-schizotypal participants, which would have allowed a comparison of thought disordered schizotypal participants vs. thought disordered non-schizotypal participants. Although a previous study by Coleman et al. (1996) showed that schizotypal participants were characterized by significantly elevated levels of thought disorder compared to non-schizotypal participants, mild forms of disordered thinking were also found in non-schizotypal participants. Gambini, Campana, Macciardi, and Scarone (1997) estimate the occurrence of thought disorder in the normal population at 6-12%.

A second question concerns the nature of thought disorder in schizotypy and its relationship to impairments in Gestalt perception. Thought disorder is a core sympton of the disorganisation syndrome (Cuesta & Peralta, 1995) and the association between thought disorder and dysfunctional Gestalt perception in schizotypal participants supports the hypothesis that dysfunctional Gestalt perception is related to the disorganisation syndrome (hypothesis 3). A detailed analysis and comparison between thought disorder in schizotypy and schizophrenia and dysfunctional Gestalt perception suggests that this relationship may be slightly different in schizotypy, however. Linguistic context operates both at the level of individual words and in the way in which these meanings are combined with syntactic structure and knowledge of the world to process sentences (Tannenhaus & Luca, 1987). Both forms of linguistic context are deficient in schizophrenia (Barch & Berenbaum, 1997; de Silva & Hemsley, 1974) yet phenomenologically, schizophrenic patients have problems mainly with higher level

context which leads to the characteristic incoherence and fragmentation of thought processes. This type of thought disorder is mainly related to the TDI 'disorganised' and 'associative' factors, which in previous research (Knight & Silverstein, 1998) have been associated with impairments in Gestalt perception in schizophrenia. Thought disorder in schizotypy in this study and previous research (Coleman et al., 1996), however, was mainly associated with the TDI 'idiosyncratic verbalization' factor which describes stilted and odd language and use of words. The relative absence of disorganised and associative thought disordered responses in schizotypal participants raises the question whether thought disorder in schizotypy can be related to clinical disorganisation. From a theoretical point of view, mild forms of thought disorder, such as peculiar verbalizations, can be considered continuous with the more severe responses found in schizophrenia (Johnson & Holzman, 1979). Thought disorder in schizotypy may, therefore, represent more subtle failures of context processing which result in odd and inappropriate expressions at the level of individual words, but not failures to coordinate meaning at the syntactic and pragmatic levels of language production.

5. GESTALT PERCEPTION IN ACUTE SCHIZOPHRENIA

5.1 Aims of the study

The aims of the study were to confirm and extend the findings of Study 1 which indicated that dysfunctional Gestalt perception is related to a subtype of schizophrenia spectrum disorders with elevated levels thought disorder and to compare the type of cognitive dysfunctions in both populations. In contrast to Study 1, the second version of the contour integration task was employed which involved the manipulation of the average spacing between the background elements and spacing between elements of the closed contour. Initial testing with patients showed that the recording of the threshold for detecting contours in the first version was more likely to be confounded by a generalized deficit and that the second version might be more sensitive to dysfunctions in Gestalt perception in schizophrenia patients. Secondly, a third measure of Gestalt perception was added to the test battery, the visual closure task, to examine Gestalt perception of complex images in schizophrenia.

5.2 Method

5.2.1 Participants

Three groups of patients participated in the study: 1) a group of 37 patients with schizophrenia from an acute inpatient program for psychotic disorders at New York

Presbyterian Hospital, Weill Medical College of Cornell University; 2) patients with other non-schizophrenia psychotic disorders, who were recruited from the same unit (*n=30)*; and 3) a non-psychotic psychiatric control group consisting of in- and outpatients with non-psychotic psychiatric disorders (*n*=26).

Composition of the non-schizophrenia psychotic and non-psychotic psychiatric groups in terms of DSM-IV diagnosis can be seen in Table 5.1.

Table 5.1

DSM-IV Diagnosis of Patients with Non-Schizophrenia Psychotic Disorders and Non-Psychotic Psychiatric Disorders

	Psychotic Non-Schizophrenia	Non-Psychotic Disorders
Diagnosis	(*n*=30)	(*n*=26)
Schizoaffective Disorder	13	
Psychosis NOS	3	
" substance induced	2	
Mood Disorder w. Psychotic Features	12	
without " "		6
Personality Disorders		10
Substance Abuse		10

5.2.2 Measures

The following measures were employed in this study: 1) the Shipley Institute of Living Scale (Shipley, 1940) for the assessment of verbal intelligence; 2) the SCID (First et al., 1995) and PANSS (Kay et al., 1986) for the examination of psychopathology; and

3) the visual size perception task (manual version), the contour integration task which involved the manipulation of the average spacing between the background elements and spacing between elements of the closed contour, and the visual closure task to examine Gestalt perception.

5.3 Results

5.3.1 Demographic and Clinical Variables

Table 5.2

Means, Standard Deviations, and Mean Differences for Demographic and Clinical Variables of Participants

	Schizophrenia	Non-Schizophrenia Psychotic	Non-Psychotic Disorders	Signif. Level	Post hoc
Variable	(*n*=37) M SD	(*n*=30) M SD	(*n*=26) M SD		
Age (in years)	36.5 9.7	34.7 9.4	36.9 8.7	*F*(2,90)=.52 p>.60 (HV)	
Sex (male/female)	30/7	20/10	16/10	$\chi 2(2)=3.23$ p>.20	
Education (in years)	11.6 2.9	12.7 2.4	12.9 1.5	*F*(2,90)=3.65 p<.049 (IH)	
Age of onset[1] (in years)	23.7 6.7	21.4 6.8		*t*(65)=1.27 p>.21 (HV)	
Shipley Vocabulary Score	22.6 6.5	25.5 7.6	28.7 5.3	*F*(2,90)=6.70 p<.002 (HV)	S<CT

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; S=Schizophrenia; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

[1] 'Age of onset' refers to the age at the first hospitalization/treatment of psychiatric symptoms

Demographic Data Demographic data are presented in Table 5.2. The three groups did not differ in age, sex distribution, and age of onset of psychiatric symptoms. Significant main effects of group were observed for the level of education and verbal IQ. Post hoc comparisons indicated that patients with schizophrenia had significantly lower scores on the Shipley Vocabulary test than non-psychotic psychiatric controls. There was also a statistical trend for schizophrenia patients to have less years of education.

Table 5.3.

Correlations between Demographic, Clinical, and Neurocognitive Measures

Groups Combined (Row 1), Schizophrenia Group (Row2), Non-Schizophrenia Psychotic Group (Row3,) and Non-Psychotic Psychiatric Group (Row 4)

	Age	Age of Onset	Education	Verbal IQ
Visual Closure Task	-.19	-.02	-.18	**.23***
	-.10	.09	.15	.15
	-39*	-.21	.03	.15
	-.14		.14	.24
Contour Integration Task	-.09	-.18	**.22***	**.23***
	-.06	.30	.25	**.35***
	-.12	-.04	.30	.04
	-.06		.07	-.04
Visual Size Perception Task				
Reducing	-.08	-.15	.05	-.02
	-.17	-.18	.07	-.06
	-.37+	-.25	-.09	-.23
	-.10		.05	.01
Enlarging	-.02	.05	-.02	-.15
	.02	.04	.06	.13
	-.04	.04	.03	-.32
	-.10		-.03	-.40

Note. +=p<.1; *=p<.05; **=p<.01;***=p<.005; ****=p<.0001

Table 5.3 shows the correlations between demographic and clinical variables and neurocognitive measures. Of particular interest were the statistical relationships between demographic variables and neurocognitive measures that could indicate possible confounds for the analysis of performance on the cognitive tasks. Performance in the contour integration task was positively associated with level of education and verbal IQ when all groups were combined and in the schizophrenia group.

Table 5.4

Means, Standard Deviations, and Mean Differences for PANSS Scores for Schizophrenia and Non-Schizophrenia Psychotic Disorders

	Schizophrenia		Non-Schizophrenia Psychotic		Signific. Level
	(*n*=37)		(*n*=29)		
Factor/Item	M	SD	M	SD	
Total Score	79.2	15.0	70.8	15.1	*t*(66)= 2.27 p<. 03 (HV)
Positive	12.4	4.3	9.9	3.9	*t*(66)=2.55 p<.01 (HV)
Negative	15.6	4.9	13.1	5.6	*t*(66)=1.91 p<.06 (HV)
Excitement	8.9	4.6	9.8	4.1	*t*(66)= -.943 p>.35 (HV)
Depression	10.5	3.8	13.5	4.0	*t*(66)=3.16 p<.002 (HV)
Disorganisation	7.7	3.5	5.6	3.2	*t*(66)=2.56 p<.01 (HV)
Cognitive	14.3	4.8	11.2	3.9	*t*(66)=2.84, p<.0006 (HV)
Conceptual Disorganisation	3.1	1.8	2.0	1.4	*t*(66)= 2.67 p<.01 (HV)

Note: (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance.

PANSS Data Schizophrenia and non-schizophrenia psychotic patients were compared on the level of general psychopathology and individual factors/items of the PANSS (see Table 5.4). Schizophrenia patients had significantly higher overall ratings of general psychopathology and significantly elevated scores on the PANSS factors 'disorganised', 'positive', 'cognitive', and on the item 'conceptual disorganisation' than the psychotic non-schizophrenia group. There was a statistical trend for patients with schizophrenia to display more negative symptoms. Patients with non-schizophrenia psychotic disorders had significantly more depressed symptoms.

Intercorrelations Between Measures of Gestalt Perception Table 5.5 shows the correlations between the three measures of Gestalt perception. Data from all three groups were entered. Such analyses would be informative in determining whether measures of Gestalt perception are assessing a single construct. As shown in Table 5.5, only few significant correlations emerged which were modest in size (the pearson correlation coefficient (r) ranged from .25 to .32). As in Study 1, both context conditions of the visual size perception task were not overall correlated with performance on the contour integration task. Performance in the contour integration and the visual closure tasks was significantly correlated.

Inspection of the correlations for the individual groups shows that the size of the correlations differed between groups. Specifically, there were trends for statistically significant associations between the visual closure, contour integration, and visual size perception tasks in the schizophrenia group which were not found for the non-psychotic psychiatric controls.

Table 5.5

Intercorrelations Between Measures of Gestalt Perception

Groups Combined (Row 1), Schizophrenia Group (Row2), Non-Schizophrenia Psychotic Group (Row3), and Non-Psychotic Psychiatric Group (Row 4)

	Visual Closure Task	Contour Integration Task	Visual Size Perception Task	
			Enlarging	Reducing
Visual Closure Task				
Contour Integration Task	**.32***			
	.30+			
	.37+			
	-.15			
Visual Size Perception Task				
Enlarging	.17	.08		
	.42+	.14		
	.17	.06		
	.08	.15		
Reducing				
	.05	-.06	**.26***	
	-.13	.20	**.39***	
	.25	-.21	.23	
	.21	.07	-.08	

Note. +=p<.1; *=p<.05; **=p<.01;***=p<.005; ****=p<.0001

5.3.2 Neurocognitive Correlates of the Five Factor Model of the PANSS

Correlations between measures of Gestalt perception and factors/scales of the PANSS were examined for both psychotic disorders group combined and separately (Table 5.6). Of principal interest were the correlations between the main psychotic syndromes (cognitive, positive, and negative), the factor 'disorganisation', and

neurocognitive performance. The visual closure task, contour integration task, and the context condition 'enlarging' of the visual size perception task were significantly correlated with the factor 'disorganisation' in patients with schizophrenia. Correlations between this factor and cognitive measures suggest a differential pattern of performance for schizophrenia patients. Whereas increased levels of disorganisation led to a performance impairment in the visual closure and contour integration tasks, elevated scores on this factor resulted in a more accurate estimation of the inner disk in the context condition of the visual size perception task. In addition, performance in the visual closure and contour integration tasks was significantly correlated with the factor 'cognitive' of the PANSS in the schizophrenic group. A significant correlation was also found for increased scores on the factor 'positive' and enhanced size estimation for patients with schizophrenia in the context condition 'enlarging' of the visual size perception task.

There were no significant correlations between performance on the neurocognitive measures and the factors 'cognitive' and 'disorganisation' in the non-schizophrenia psychotic group. When the combined symptom scores of the psychotic groups were examined, only performance in the contour integration task was significantly correlated with the factor 'cognitive' and 'disorganisation'. Overall levels of psychopathology were only correlated with the performance in the visual closure task in patients with schizophrenia.

Table 5.6

Correlations Between Measures of Gestalt Perception and Factors of the PANSS Schizophrenia and Non-Schizophrenia Psychotic Groups Combined (Row1), Schizophrenia Group (Row2), and Non-Schizophrenia Psychotic Group (Row 3)

	Visual Closure Task	Contour Integration Task	Visual Size Perception Task	
Scale/Item			Enlarging	Reducing
Total PANSS	-.18	-.22	-.15	-.10
	-.48*	-.20	-.33+	-.08
	.14	-.12	-.22	-.22
Cognitive	-.21+	**-.44***	-.14	.00
	-.37*	**-.57***	-.33+	-.10
	-.03	-.04	.14	-.01
Depression	-.01	.02	-.08	**-.29***
	-.01	-.11	-.07	-.06
	-.01	.17	-.11	**-.40***
Disorganisation	-.24+	**-.31***	-.21	-.01
	-.39*	**-.40***	**.45***	-.20
	-.09	.03	.10	.10
Excitement	-.23	-.17	-.02	-.01
	-.23	-.17	-.17	.04
	-.20	-.11	-.09	.03
Positive	-.02	.02	-.22	-.05
	-.09	.06	**-.45***	.04
	.05	-.10	.10	.36
Negative	.11	-.01	-.04	-.16
	-.28	-.06	-.19	-.20
	.46*	.06	.05	-.29

Note. +=p<.1; *=p<.05; **;=p<.01;***=p<.005; ****=p<.0001

5.3.3 Gestalt Perception in Schizophrenia, Psychotic Non-Schizophrenia, and Non-Psychotic Psychiatric Disorders

Table 5.7

Means, Standard Deviations, and Results of Analysis of Variance for Measures of Gestalt Perception

Test	Schizophrenia (n=37) M SD	Non-Schizophrenia Psychotic (n=30) M SD	Non-Psychotic Disorders (n=26) M SD	Signific. Level	Post hoc
Visual Closure Task	22.7 7.9 n=30	22.3 8.2 n=28	27.5 7.1 n=24	$F(2,79)=3.84$ p<.03 (HV)	P<CT S<CT
Contour Integration Task	.75 .09 n=34	.74 .05 n=29	.73 .03 n=24	$F(2,84)=1.22$ p>.30 (IH)	
Visual Size Perception Task Reducing	-.02 .11 n=26	-.07 .10 n=27	-.08 .11 n= 21	$F(2,71)=2.70$ p<.08 (HV)	
Enlarging	.23 .12	.23 .11	.22 .11	$F(2,71)=.01$ p>.99 (HV)	
Control Circle 14mm	1.34 .08	1.36 .04	1.31 .06	$F(2,71)=3.57$ p<.03 (HV)	P<CT
Control Circle 16mm	1.48 .07	1.50 .05	1.45 .07	$F(2,71)=2.81$ p>.07 (IH)	

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; S=Schizophrenia; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

Missing Data As can be seen in Table 5.7, not all participants completed the test battery. Patients with psychotic disorders, in particular, were more likely than the other groups to drop out of the study prior to the completion of the assessments.

Contour Integration Task The three groups did not differ on the background-element to contour-element density ration or delta (D).

Visual Size Perception Task No statistically significant differences emerged for the two context conditions although a statistical trend was present for a main effect of group in the condition 'reducing'. A significant main effect of group was observed, however, for the estimation of the control circle of 14mm. Patients in the non-schizophrenia psychotic group were more accurate than patients in the psychiatric control group. There was a statistical trend in the same direction for the estimation of the control circle of 16mm. The effect of the context circles on the perception of the inner disks for non-schizophrenia patients was similar to the performance of non-schizotypal participants in Study 1.

Visual Closure Task A main effect of group for the number of faces was observed. Post hoc Scheffé tests indicated that non-schizophrenia psychotic patients identified significantly less images compared to the non-psychotic psychiatric control group. There was a statistical trend for the comparison between the schizophrenia and the non-psychotic psychiatric control group in the same direction.

5.4 Discussion

The results from three tasks which examined Gestalt perception in acutely psychotic patients with schizophrenia, non-schizophrenia psychotic, and non-psychotic

psychiatric disorders did not provide strong evidence for deficits in Gestalt perception in schizophrenia. The absence of significant group differences in the contour integration and visual size perception tasks supports the findings of Study 1 which demonstrated that impairments in Gestalt perception in this task are not a general feature of schizophrenia spectrum disorders.

Data from the visual size perception task did not produce any significant overall group differences for the two context conditions. However, a statistical trend for a main effect of group was observed in the condition 'reducing'. Inspection of the mean context effects shows that the patients in the schizophrenia group were more accurate in the estimation of the inner disk in this condition compared to the other groups. This finding of reduced context sensitivity for the schizophrenic patients is supportive of the results from Study 1 in which thought disordered schizotypes were more accurate in this condition of the visual size perception task than non-thought disordered schizotypal and non-schizotypal participants. An unexpected finding in this task was the difference in the estimation of the control circles between groups. Patients with non-schizophrenia psychotic disorders were more accurate in control condition of 14 mm. A statistical trend in the same direction was obtained for the circle of 16mm. Changes in size constancy have been mainly associated with schizophrenia in past research (Weckowicz, 1957) but may account for the more accurate performance of psychotic non-schizophrenia patients in this study.

Significant group differences were obtained for performance in the visual closure task. Although both the schizophrenia group and psychotic non-schizophrenia patients were comparable in the ability to use contextual information to identify degraded images

of human faces, post hoc Scheffé tests indicated that only the comparison between the non-schizophrenia psychotic group and the non-psychotic psychiatric control group reached statistically significant levels. Impaired performance of patients with non-schizophrenia psychotic disorders in this task suggests that impairments in Gestalt perception may not represent a specific feature of schizophrenia. Impairments in Gestalt perception in non-schizophrenia psychotic patients may reflect deficits other than dysfunctional Gestalt perception, however. Impaired performance in the detection of degraded faces in this group was not accompanied by enhanced size estimation in the context conditions of the visual size perception task. The absence of a performance advantage for patients with non-schizophrenia psychotic disorders suggests that the deficit in this task may reflect factors associated with generalised performance deficiencies.

In order to examine whether specific aspects of psychotic symptomatology are related to impairments in Gestalt perception, correlations were performed between overall levels of psychopathology and individual factors of PANSS for both psychotic groups combined and individually. The most consistent finding which emerged from these results was that the factor 'disorganisation' correlated significantly with dysfunctional Gestalt perception in the schizophrenia group. The results, therefore, confirm the hypothesis that dysfunctional Gestalt perception in schizophrenia spectrum disorders is related to the disorganisation syndrome (hypothesis 3). This relationship does not hold for patients with non-schizophrenia psychotic disorders in the present study since none of the cognitive tasks were associated with disorganised symptoms in this group. Related to the finding of increased levels of disorganisation and cognitive

impairment in schizophrenia, significant correlations were obtained for the PANSS factor 'cognitive' for performance in the contour integration and the visual closure tasks. This correlation was predicted on the basis of the significant overlap in the composition of both factors. In addition, a significant correlation was obtained for the factor 'positive' and enhanced size estimation in the condition 'enlarging' in the visual size estimation task for patients with schizophrenia, indicating that impairments in Gestalt perception were related to increased levels of positive symptoms.

5.5 Comparison Between Disorganised Schizophrenia/ Schizoaffective Disorder vs. Non-Disorganised Schizophrenia/ Schizoaffective Disorder vs. Non-Schizophrenia Psychotic Disorders vs. Non-Psychotic Psychiatric Disorders

5.5.1 Aims of the Study

The study aimed to further explore the relationship between disorganisation and dysfunctional Gestalt perception in schizophrenia spectrum disorders. The first analysis indicated that dysfunctional Gestalt perception was specifically related to the disorganisation syndrome in schizophrenia. In addition, the findings from Study 1 suggested that thought disordered schizotypal participants were impaired in Gestalt perception, suggesting that thought disorder may be related to dysfunctional Gestalt perception in schizophrenia spectrum disorders. Accordingly, patients with schizophrenia and schizoaffective disorder were assigned into a disorganised group based on their score

on the PANSS item 'conceptual disorganisation'. Patients who received a rating higher than 3 (mild) on this item were assigned to the 'disorganised' group (n=16) whereas patients who scored lower than 3 were assigned into a 'non-disorganised' group (n=33). Of the 16 patients in the disorganised group, 4 were diagnosed with schizoaffective disorder. The 33 participants in the non-disorganised group included 8 patients with schizoaffective disorder. The two groups were compared to patients who were diagnosed with a psychotic disorder other than schizophrenia or schizoaffective disorder (n=19) and to the psychiatric control group (n=26).

5.5.2 Results

5.5.2.1 Demographic and Clinical Variables

Demographic and Clinical Variables As shown in Table 5.8, the four groups differed significantly in age. Post hoc Scheffé tests indicated that patients assigned to the schizophrenia groups were significantly older than patients in the non-schizophrenia psychotic group. Differences were also observed for the Shipley Vocabulary score. Non-disorganised schizophrenia/schizoaffective patients had significantly lower scores than the non-psychotic psychiatric disorders group.

Table 5.8

Means, Standard Deviations, and Mean Differences for Demographic and Clinical Variables of Participants

Variable	Disorganised Schizophrenia/ Schizoaffective (n=16) M SD	Non-Disorganised Schizophrenia/ Schizoaffective (n=33) M SD	Psychotic Non-Schizophrenia (n=19) M SD	Non-Psychotic Disorders (n=26) M SD	Signific. Level	Post hoc
Age (in years)	39.6 11.0	37.2 8.8	30.0 6.9	36.9 9.3	$F(3,90)=4.03$ $p<.01$ (HV)	DS<P NDS<P
Sex (male/female)	11/5	26/7	13/6	16/10	$\chi2(3)=2.14$ $p>.54$	
Education (in years)	11.1 3.9	12.4 2.5	12.2 2.1	12.9 1.5	$F(3,90)=1.84$ $p>.15$ (IH)	
Age of onset (in years)	21.2 6.6	23.9 6.3	22.0 7.6		$F(2,59)=.91$ $p>.41$ (HV)	
Shipley Vocabulary Score	24.2 6.9	23.6 7.1	24.4 7.5	28.7 5.3	$F(3,90)=3.33$ $p<.02$ (HV)	NDS<CT

Note. Post-Hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: $p<.05$); (HV): homogeneous variance; DS= Disorganised Schizophrenia/Schizoaffective Disorder; NDS=Non-Disorganised Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Psychiatric Disorders; CT=Non-Psychotic Psychiatric Disorders

PANSS Data The three groups were compared on their total scores and individual factors of the PANSS (Table 5.9). One-way ANOVA revealed significant overall group differences for the level of general psychopathology and scores on the PANSS factors 'positive' and 'negative'. Significant differences were observed for all intergroup comparisons between the disorganised group and the non-schizophrenia psychotic disorders group. The disorganised group had also significantly higher levels of symptoms on the factor 'positive' and general psychopathology than the non-disorganised group. As

expected because of the selection criteria, disorganised patients had significantly higher scores on the PANSS factors 'cognitive' and 'disorganisation'.

Table 5.9

Means, Standard Deviations, and Mean Differences for PANSS Scores for Disorganised Schizophrenia/Schizoaffective, Non-Disorganised Schizophrenia/ Schizoaffective, and Non-Schizophrenia Psychotic Groups

	Disorganised Schizophrenia/ Schizoaffective		Non-Disorganised Schizophrenia/ Schizoaffective		Psychotic Non-Schizophrenia		Signific. Level	Post hoc
	(*n*=12)		(*n*=26)		(*n*=31)			
Factor/Scale	M	SD	M	SD	M	SD		
Total Score	93.6	12.9	72.5	11.9	66.7	15.9	*F*(2,65)=22.7 p<.0001 (HV)	DS<NDS DS<P
Positive	16.0	2.5	10.3	3.6	9.3	3.7	*F*(2,65)=19.6 p<.000 (HV)	DS<NDS DS<P
Negative	16.6	5.1	14.8	4.8	11.8	5.5	*F*(2,65)=3.9 p<.03 (HV)	DS<NP
Depression	11.3	4.0	11.3	4.2	10.3	3.3	*F*(2,65)=1.51 p >.23 (HV)	
Disorganisation	11.3	3.0	5.7	2.1	5.1	2.8	*F*(2,65)=33.9 p<.000 (HV)	DS<NDS DS<P
Cognitive	18.9	4.1	11.6	2.9	10.3	3.3	*F*(2,65)=33.8 p<.000 (HV)	DS<NDS DS<P
Excitement	10.6	4.0	8.7	3.8	9.8	3.6	*F*(2,65)=1.40 p<.26 (HV)	
Conceptual Disorganisation	4.9	.80	2.1	1.2	1.8	1.4	*F*(2,65)=36.4 p<.0001	DS<NDS DS<P

Note. Post-Hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; DS= Disorganised Schizophrenia/Schizoaffective Disorder; NDS=Non-Disorganised Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Psychiatric Disorders; CT=Non-Psychotic Psychiatric Disorders

5.5.2.2 Gestalt Perception in Disorganised Schizophrenia/Schizoaffective Disorder vs. Non-Disorganised Schizophrenia/Schizoaffective Disorder vs. Psychotic Non-Schizophrenia Disorders vs. Non-Psychotic Psychiatric Disorders

Contour Integration Task There was a main effect of group for the background-element to contour-element density ratio or delta (D). Post hoc Scheffé tests indicated that the disorganised schizophrenia/schizoaffective scored significantly lower than the non-disorganised schizophrenia/schizoaffective group and the psychiatric control group.

Differences between groups were also examined with the Kruskal Wallis Test after the assumption of the homogeneity of variance was not met. The overall group difference failed to reach statistical significance ($\chi 2(3)=7.23$, $p<.065$).

Visual Size Perception Task There was a main effect of group for the context condition 'enlarging'. Post hoc Scheffé tests indicated that patients in the disorganised schizophrenia/schizoaffective group were significantly more accurate in the size estimation of the inner disk than non-disorganised schizophrenia/schizoaffective patients. None of the other post hoc comparisons were significant. No statistical differences were observed for the context condition 'reducing'. There were statistical trends for main effects of group for size estimates in the condition 'no surrounds' of 14mm and 16mm.

Visual Closure Task There was a main effect of group for the number of faces identified. Post hoc Scheffé tests showed that the disorganised schizophrenia/ schizoaffective group identified significantly less images than the psychiatric controls.

Table 5.10

Means, Standard Deviations, and Results of Analysis of Variance for Measures of Gestalt Perception

Test	Disorganised Schizophrenia/ Schizoaffective (n=16) M SD	Non-Disorganised Schizophrenia/ Schizoaffective (n=33) M SD	Psychotic Non-Schizophrenia (n=19) M SD	Non-Psychotic Disorders (n=26) M SD	Signific. Level	Post hoc
Visual Closure Task	18.6 7.6 n=12	23.4 7.7 n=29	23.3 8.2 n=18	27.8 7.1 n=24	$F(3,80)=4.01$ p<.01 (HV)	DS<CT
Contour Integration Task	.79 .09 n=14	.74 .07 n=31	.73 .03 n=19	.73 .03 n=24	$F(3,85)=4.05$ p<.01 (IH)	DS<CT DS<NDS
Visual Size Reducing Perception Task	-.05 .11 n=15	-.05 .12 n=22	.05 .08 n=17	.08 .08 n=21	$F(3,72)=.47$ p>.70 (HV)	
Enlarging	.15 .10	.28 .11	.21 .10	.22 .11	$F(3,72)=4.73$ p<.005 (HV)	DS<NDS
Control Circle 14mm	1.35 .07	1.34 .07	1.37 .04	1.31 .06	$F(3,72)=2.56$ p<.06 (HV)	
Control Circle 16mm	1.49 .08	1.48 .06	1.51 .07	1.46 .07	$F(2,71)=2.81$ p<.09 (HV)	

Note. Post-Hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; DS= Disorganised Schizophrenia/Schizoaffective Disorder; NDS=Non-Disorganised Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Psychiatric Disorders; CT=Non-Psychotic Psychiatric Disorders

5.5.3 Discussion

Differentiation between disorganised and non-disorganised patients with schizophrenia/schizoaffective disorder produced significant differences across all three tasks. Patients with disorganised schizophrenia/schizoaffective disorder were more impaired in the contour integration task. This indicates that impairments in contour

integration may be relatively specific to disorganised forms of schizophrenia and schizoaffective disorder.

Differences between groups also emerged in the visual size perception task. Impairments in Gestalt perception in the disorganised schizophrenia/schizoaffective group also led to a more accurate performance in the visual size perception task, confirming hypothesis 1b. The performance differed significantly from the previous analyses in two important aspects. Firstly, significant differences only emerged in the condition 'enlarging' whereas in Study 1 and in the first analysis of the present study, the main differences emerged in the condition 'reducing'. As hypothesized in Study 1, the dissociation between the conditions 'reducing' and 'enlarging' in schizophrenia patients and thought disordered schizotypes would be consistent with the notion that sensitivity to visual context in these two conditions of the visual size perception task occurs at different developmental periods (Káldy & Kovács, in press). Secondly, the main difference in performance in this task was within the schizophrenia/schizoaffective group. Post hoc tests indicated that only the comparison between the two schizophrenia/schizoaffective groups reached statistical significance. This pattern resembles the findings from Study 1 where the main difference emerged between thought disordered and non-thought disordered schizotypal participants in the visual size perception task.

The disorganised schizophrenia/schizoaffective group was also characterized by a significant impairment in the visual closure task which was not present in the non-disorganised group. In contrast to the first analysis, impairments in visual closure were specific to the disorganised schizophrenia/schizoaffective group and were not present in the non-disorganised patients and in the non-schizophrenia psychotic group.

5.6 Comparison between Paranoid Schizophrenia/Schizoaffective Disorder vs. Non-Paranoid Schizophrenia/Schizoaffective Disorder vs. Non-Schizophrenia Psychotic Disorder vs. Non-Psychotic Psychiatric Disorders

5.6.1 Aims of the Study

In order to test the hypothesis that paranoid schizophrenia/schizoaffective patients are characterized by enhanced Gestalt perception (hypothesis 3b), patients with schizophrenia and schizoaffective disorder were assigned into two groups based on their score on the PANSS item P6 'suspiciousness'. Patients who received a rating higher than 3 (mild) on this item were assigned to the 'paranoid group' (n=28) whereas patients who scored lower than 3 were assigned into a 'non-paranoid' group (n=21). The two groups were compared to patients who were diagnosed with a psychotic disorder other than schizophrenia or schizoaffective disorder (n=19) and to the psychiatric control group (n=26).

5.6.2 Results

5.6.2.1 Demographic and Clinical Variables

Demographic Data and Clinical Variables One-way ANOVA revealed significant group differences for age and the Shipley Vocabulary score. Post hoc Scheffé indicated that patients in the paranoid schizophrenia/schizoaffective group were significantly older than the non-schizophrenia psychotic disorders group. In addition, paranoid patients had

significantly lower Shipley Vocabulary scores than patients with non-psychotic psychiatric disorders.

Table 5.11

Means, Standard Deviations, and Mean Differences for Demographic and Clinical Variables of Participants

Variable	Paranoid Schizophrenia/ Schizoaffctive (n=28) M SD	Non-Paranoid Schizophrenia/ Schizoaffective (n=21) M SD	Psychotic Non-Schizophrenia (n=19) M SD	Non-Psychotic Disorders (n=26) M SD	Signific. Level	Post hoc
Age (in years)	39.0 9.8	36.6 9.1	30.1 6.9	36.9 9.3	$F(3,90)=4.10$ p<.01(HV)	PDS<P
Sex (male/female)	21/7	16/5	13/6	16/10	$\chi 2(3)=1.65$ p<.65	
Education (in years)	12.0 3.3	12.4 2.7	12.2 2.1	12.9 1.5	$F(3,90)=1.64$ p>.15 (IH)	
Age of onset (in years)	22.7 6.7	23.3 6.2	22.0 7.6		$F(2,59)=.155$ p>.86	
Shipley Vocabulary Score	23.6 7.3	24.0 6.8	24.4 7.5	28.8 5.3	$F(3,90)=3.30$ p<.02	PD<CT

Note. Post-Hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; PD=Paranoid Schizophrenia/Schizoaffective Disorder; NPD=Non-Paranoid Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

PANSS Data Patients were compared on their total scores and individual factors of the PANSS (Table 5.12). The paranoid schizophrenia/schizoaffective group was characterized by higher levels of general psychopathology and scores on the PANSS factors 'disorganisation', 'cognitive', 'positive', and 'negative' compared to the non-schizophrenia psychotic disorders group. The schizophrenia groups only differed on the

factor 'positive'. As expected because of the selection criteria, the paranoid schizophrenia/schizoaffective group had significantly higher scores on this factor.

Table 5.12

Means, Standard Deviations, and Mean Differences for PANSS Scores for Paranoid Schizophrenia/Schizoaffective Disorder, Non-Paranoid Schizophrenia/Schizoaffective Disorder, and Non-Schizophrenia Psychotic Disorders Groups

	Paranoid Schizophrenia/ Schizoaffective		Non-Paranoid Schizophrenia/ Schizoaffective		Psychotic Non-Schizophrenia		Signific. Level	Post hoc
	(n=16)		(n=33)		(n=18)			
Factor/Items	M	SD	M	SD	M	SD		
Total Score	83.6	14.2	74.4	16.5	66.7	15.9	$F(2,65)=7.10$ $p<.002$ (HV)	PD<NPD
Positive	13.0	4.1	10.1	3.6	9.3	3.7	$F(2,65)=8.98$ $p<.000$ (HV)	PD<NPD NPD<P
Negative	15.9	4.7	14.6	5.1	11.8	5.5	$F(2,65)=3.6$ $p<.03$ (HV)	PD<NPD
Depression	10.3	3.7	12.5	4.4	10.3	3.3	$F(2,65)=3.42$ $p<.04$ (HV)	
Disorganisation	8.3	4.0	6.5	2.8	5.1	2.8	$F(2,65)=5.41$ $p<.007$ (HV)	PD<P
Cognitive	14.9	5.3	12.8	3.8	10.3	3.3	$F(2,65)=6.04$ $p<.004$ (HV)	PD<P
Excitement	9.3	3.5	9.2	4.5	9.8	3.6	$F(2,65)=.10$ $p>.90$	

Note. Post-Hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: $p<.05$); (HV): homogeneous variance; PD=Paranoid Schizophrenia/Schizoaffective Disorder; NPD=Non-Paranoid Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

5.6.2.2 Gestalt Perception in Paranoid Schizophrenia/Schizoaffective Disorder vs. Non-Paranoid Schizophrenia/Schizoaffective Disorder vs. Non-Schizophrenia Psychotic vs. Non-Psychotic Psychiatric Disorders

Table. 5.13

Means, Standard Deviations, and Results of Analysis of Variance for Measures of Gestalt Perception

Test	Paranoid Schizophrenia/ Schizoaffective (n=28) M SD	Non-Paranoid Schizophrenia/ Schizoaffective (n=21) M SD	Psychotic Non-Schizophrenia (n=19) M SD	Non-Psychotic Disorders (*n*=26) M SD	Signific. Level	Post hoc
Visual Closure Task	21.0 8.0 *n*=23	23.2 7.8 *n*=18	23.3 8.2 *n*=18	27.8 7.1 *n*=24	*F*(3,80)=3.08 p<.03 (HV)	PD<CT
Contour Integration Task	.76 .10 *n*=25	.74 .06 *n*=20	.73 .03 *n*=19	.73 .03 *n*=24	*F*(3,85)=1.33 p>.27 (IH)	
Visual Size Reducing Perception Task	-.05 .12 *n*=23	-.48 .13 *n*=14	.05 .08 *n*=17	.08 .08 *n*=21	*F*(3,72)=.47 p>.71 (HV)	
Enlarging	.21 .14	.26 .10	.21 .10	.22 .11	*F*(3,72)=.61 p>.61 (HV)	
Control Circle 14mm	1.35 .08	1.35 .07	1.51 .05	1.46 .07	*F*(3,72)=2.58 p<.06 (IH)	
Control Circle 16mm	1.48 .07	1.49 .07	1.50 .07	1.46 .07	*F*(3,71)=2.41 p>.10 (IH)	

Note: Post-Hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; PD=Paranoid Schizophrenia/Schizoaffective Disorder; NPD=Non-Paranoid Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

Visual Closure Task The four groups differed significantly in the number of images identified in the visual closure task. Post hoc Scheffé indicated that the paranoid schizophrenia/schizoaffective group identified significantly less images than the psychiatric control group.

Contour Integration Task No main effects of group were for the background-element to contour-element density ration or delta (D).

Visual Size Perception Task There were no difference between groups in the two context conditions of the visual size perception task. Although there was a statistical trend for a main effect of group for the estimation of the control circle of 14mm, no intergroup differences were significant at the .05 level. The groups did not differ in the estimation of the control circle of 16mm.

5.6.3 Discussion

The comparison between paranoid and non-paranoid patients with schizophrenia/schizoaffective disorder did not confirm the hypothesis that paranoid schizophrenia patients are characterized by enhanced Gestalt perception (hypothesis 3b). Patients with schizophrenia/schizoaffective disorder and elevated scores on the PANSS item P6 'suspiciousness' were not characterized by enhanced responsiveness to Gestalt properties in the contour integration and visual size perception tasks. Statistical analyses of performance in both tasks did not indicate significant differences between the two groups. Inspection of the mean differences furthermore suggests that paranoid patients

exhibited *reduced* responsiveness to Gestalt properties of stimuli in both tasks. This hypothesis is supported by the data from the visual closure task. In this task, paranoid patients with schizophrenia/schizoaffective disorder were significantly impaired in the integration of complex visual images.

5.7. Changes in Gestalt Perception and Psychotic Symptomatology in Acute Schizophrenia

5.7.1 Aim of the Study

In order to examine the hypothesis that impairments in Gestalt perception constitute a mediating vulnerability marker (hypothesis 4), patients who participated in the first assessment were retested on the same cognitive and symptom measures at discharge. Comparison of data from both assessments would indicate whether dysfunctions in Gestalt perception remain stable while psychotic symptoms remit. Alternatively, it was hypothesized that dysfunctions in Gestalt perception would improve during the remission of symptoms.

5.7.2 Results

Missing Data Of the 93 patients who were examined in the first assessment, 61 participated in the second assessment. Patients who did not participate in the second

assessment primarily refused to be re-tested or were rapidly discharged so that a final assessment was not possible.

5.7.2.1 Changes in Symptomatology in Schizophrenia and Non-Schizophrenia Psychotic Disorders

PANSS Data ANOVA for repeated-measures were performed to explore changes in symptomatology between first and second testing for schizophrenia and non-schizophrenia psychotic patients. After a mean length of stay of 23 days for patients with schizophrenia and 16.2 days for patients with non-schizophrenia psychotic disorders, significant changes in symptomatology were observed. There was a significant reduction in general psychopathology ($F(1) = 20.26$, $p<.0001$) and on the factors 'positive' ($F(1) = 20.26$, $p<.0001$) , 'excitement' ($F(1) = 5.47$, $p<.02$), 'disorganisation' ($F(1) = 8.00$, $p<.01$), 'cognitive' ($F(1) = 7.09$, $p<.01$), and on the item 'conceptual disorganisation' ($F(1) = 8.56$, $p<.005$) across assessments. Only the interactions for the PANSS factor 'depression' between the factors 'assessment' and 'group' reached statistically significant levels ($F(2) = 5.52$, $p<.02$). A statistical trend for a significant interaction for the positive factor of the PANSS was observed ($F(2) = 3.24$, $p<.08$).

The schizophrenia group continued to have significantly increased levels of psychopathology compared to the non-schizophrenia psychotic disorders group at the second assessment (Table 5.14). Patients with a diagnosis of schizophrenia had significantly higher scores on the PANSS factors 'cognitive', 'negative', 'positive', and on the item 'conceptual disorganisation'.

Table 5.14

Means, Standard Deviations, and Mean Differences for PANSS Data for Schizophrenia and Non-Schizophrenia Psychotic Groups at 1st and 2nd Testing (Test)

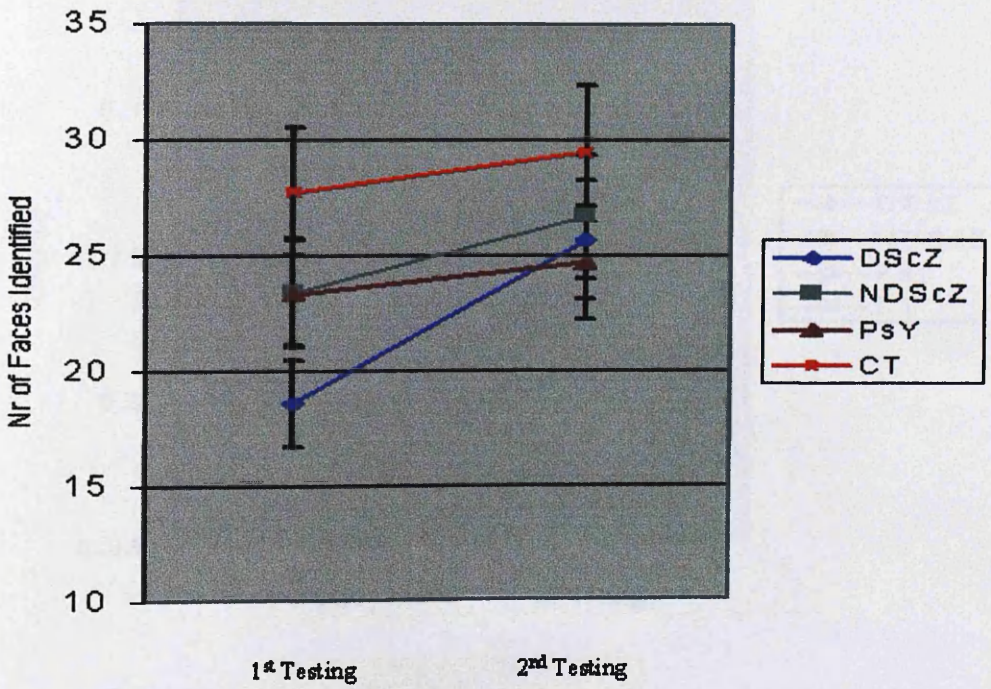
		Schizophrenia		Non-Schizophrenia Psychotic		Signific. Level
Test	Factor/Item	M	SD	M	SD	
1.	Total Score	79.2	15.0	70.8	15.1	$t(66)= 2.27$ p<. 03 (HV)
2.		70.8	22.9	60.3	8.7	$t(45)= 2.27$ p<.05 (IH)
1.	Positive	12.4	4.3	9.9	3.9	$t(66)=2.55$ p<.01 (HV)
2.		11.3	4.2	7.8	2.7	$t(45)=3.34$ p<.01 (IH)
1.	Negative	15.6	4.9	13.1	5.6	$t(66)=1.91$ p<.06 (HV)
2.		14.6	4.7	11.3	4.4	$t(45)=2.4$ p<.02 (HV)
1.	Excitement	8.9	4.6	9.8	4.1	$t(66)= -.943$ p>.35 (HV)
2.		9.0	3.6	7.9	3.2	$t(45)=1.10$ p>.29 (HV)
1.	Depression	10.5	3.8	13.5	4.0	t(66)=3.16 p<.002 (HV)
2.		11.6	4.0	11.2	3.1	$t(45)=36$ p>.72 (HV)
1.	Disorganisation	7.7	3.5	5.6	3.2	$t(66)=2.56$ p<.01 (HV)
2.		6.0	2.8	4.6	1.5	$t(45)= 2.03$ p<.04 (HV)
1.	Cognitive	14.3	4.8	11.2	3.9	$t(66)=2.84$, p<.0001 (HV)
2.		12.6	4.0	9.9	2.3	$t(45)=2.65$ p<.01 (HV)
1.	Conceptual Disorganisation	3.1	1.8	2.0	1.4	$t(66)= 2.67$ p<.01 (HV)
2.		2.3	1.2	1.4	.74	$t(45)=3.2$ p<.01 (IH)

Note: (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance.

5.7.2.2 Gestalt Perception During Remission of Psychosis

Figure 5.1

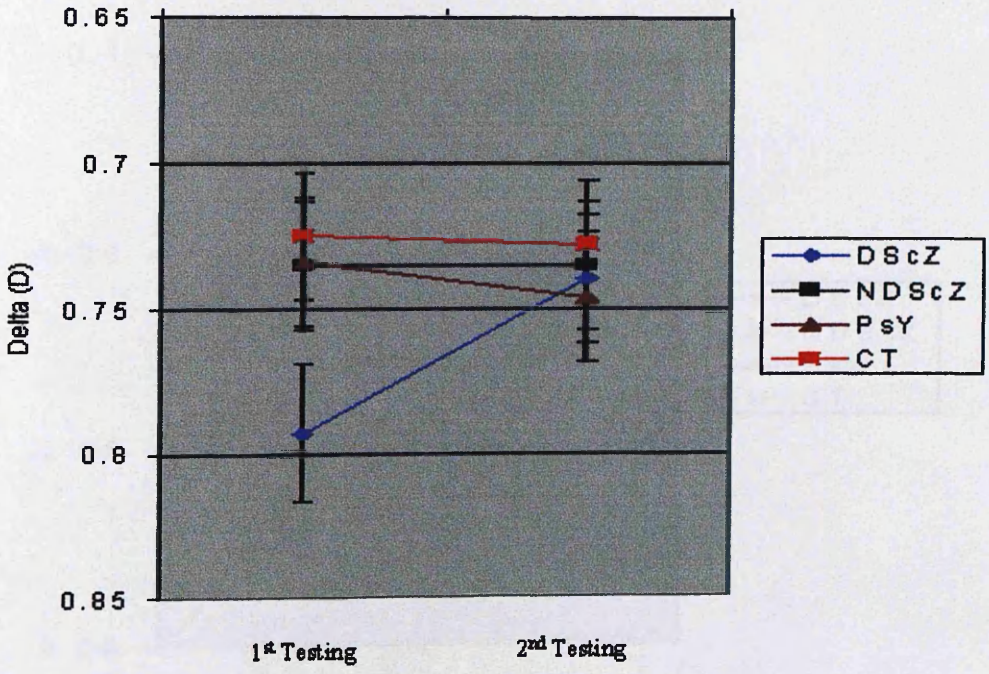
Means and Standard Deviations in the Visual Closure Task for the First and Second Testing for the Disorganised Schizophrenia/Schizoaffective Group (DScZ), Non-Disorganised Schizophrenia/Schizoaffective Group (NDScZ), Non-Schizophrenia Psychotic Disorders (PsY), and Non-Psychotic Psychiatric Controls (CT).



In an ANOVA of repeated measures, the factor 'assessment' was significant $F(2,56)=14.98$, $p<.001$. The interaction between the factor 'assessment' and 'group' was not significant $F(2)=2.00$, $p>.12$. Mean differences between groups were only significant for the first testing (1st test: p. <.01; 2nd test: p.>.40).

Figure 5.2

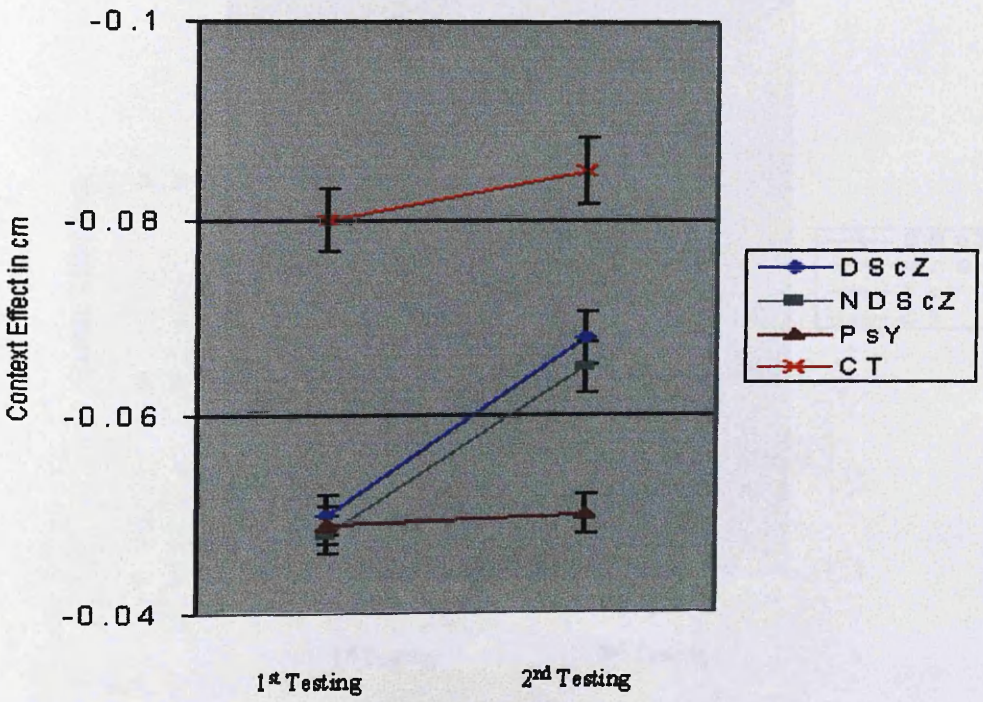
Means and Standard Deviations in the Contour Integration Task for the First and Second Testing for the Disorganised Schizophrenia/Schizoaffective Group (DScZ), Non-Disorganised Schizophrenia/Schizoaffective Group (NDScZ), Non-Schizophrenia Psychotic Disorders (PsY), and Non-Psychotic Psychiatric Controls (CT).



In an ANOVA of repeated measures, the factor 'assessment' was not significant $F(2,55)=2.85$, $p<.10$. The interaction between the factor 'assessment' and 'group' was not significant $F(2)=1.59$, $p>.20$. Mean differences between groups were only significant for the first testing (1st testing: p. <.01; 2nd testing: p.>.53).

Figure 5.3

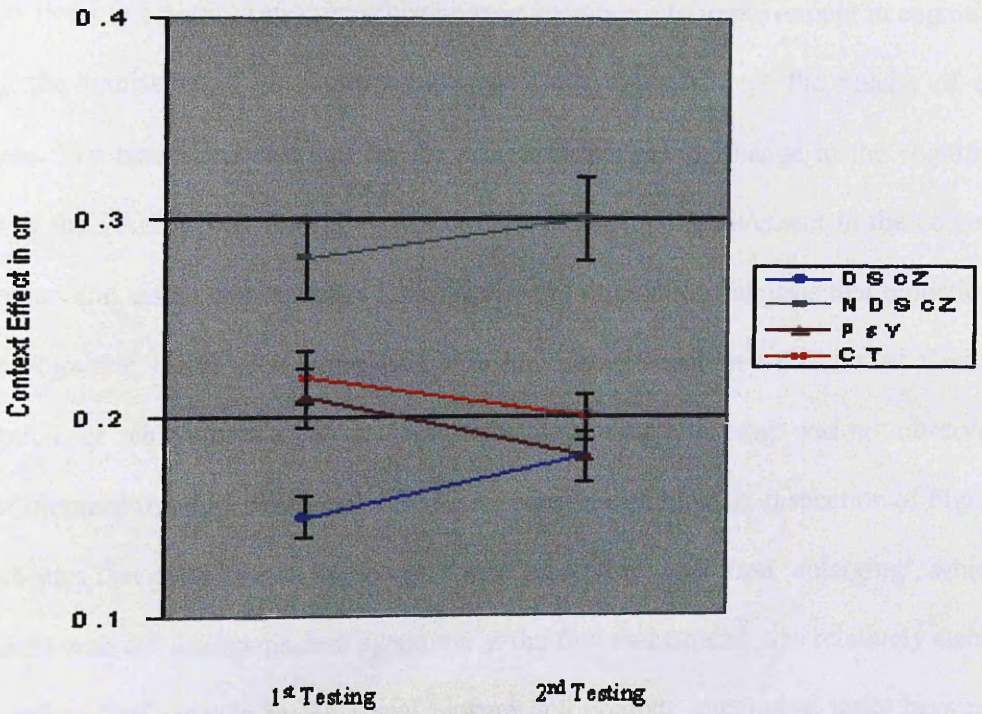
Means and Standard Deviations in the Visual Size Perception Task, Condition 'Reducing', for the First and Second Testing for the Disorganised Schizophrenia/ Schizoaffective Group(DScZ), Non-Disorganised Schizophrenia/Schizoaffective Group (NScZ), Non-Schizophrenia Psychotic Disorders (PsY), and Non-Psychotic Psychiatric Controls (CT).



In an ANOVA of repeated measures, the analysis for the factor 'assessment' and the interaction between the factors 'assessment' and 'group' did not reach statistically significant levels, $F(1,44)=.79$, $p>.380$, and $F(3,42)=.50$, $p>.68$. Mean differences between groups were not significant for both assessments (1st testing: p. >.70; 2nd testing: p.>.76).

Figure 5.4

Means and Standard Deviations in the Visual Size Perception Task, Condition 'Enlarging', for the First and Second Testing for the Disorganised Schizophrenia/ Schizoaffective Group (DScZ), Non-Disorganised Schizophrenia/Schizoaffective Group (NDScZ), Non-Schizophrenia Psychotic Disorders (PsY), and Non-Psychotic Psychiatric Controls (CT).



In an ANOVA of repeated measures, the analysis for the factor 'assessment' and the interaction between the factors 'assessment' and 'group' did not reach statistically significant levels, $F(1,44)=.78$, p.>.350, and $F(3,42)=.35$, p.>.79. Mean differences between groups were only significant for the first testing (1st testing: $p < .05$; 2nd testing: p>.21).

5.7.2.3 Hierarchical Regression Analysis of PANSS Factors and Measures of Gestalt Perception

In order to examine the relationship between changes on the PANSS factors 'cognitive', 'positive', and 'negative', and performance on measures of Gestalt perception in schizophrenia and non-schizophrenia psychotic disorders, hierarchical regression analyses were performed. Such analyses would be informative to estimate the contribution of changes in specific schizophrenic syndromes to improvement in cognition during the remission of psychotic symptoms. Table 5.15 displays the results of the analyses. The results indicate that for the schizophrenia group, change in the cognitive factor of the PANSS was the only significant predictor for improvement in the contour integration and visual closure tasks. Specifically, the association suggests that reductions in the cognitive factor were correlated with an improvement in measures of Gestalt perception for schizophrenia patients. However, the same relationship was not observed for performance in both conditions of the visual size perception task. Inspection of Figure 5.4 indicates that performance in the visual size perception, condition 'enlarging', which correlated with the disorganisation syndrome at the first assessment, was relatively stable compared to performance in the visual closure and contour integration tasks between assessments points. No significant results were obtained for the non-schizophrenia psychotic disorders group.

Table 5.15

Symptom Predictors of Changes in Gestalt Perception During Remission of Psychotic Symptoms for Schizophrenia and Non-Schizophrenia Psychotic Disorders

Test	Factor		Beta
	Schizophrenia	Non-Schizophrenia Psychotic	
Contour Integration Task	Cognitive	—	**-.31***
Visual Closure Task	Cognitive	—	**-.42***
Visual Size Perception Task			
Reducing	—	—	
Enlarging	—	—	

Note. *=p<.05; **=p<.001

5.7.3 Discussion

The results of the study do not allow strong inferences regarding the status of deficits in Gestalt perception as a mediating vulnerability marker in schizophrenia spectrum disorders (hypothesis 4). Although no significant differences were observed on the three cognitive tasks for the second testing between disorganised schizophrenia/schizoaffective patients and the other patient groups, the interpretation of the data is made difficult due to the significant number of patients who did not participate in the second assessment. Therefore, the statistical power of detecting differences on the cognitive measures at the second testing was decreased. The absence of the critical interaction in the ANOVA of repeated measures between the factors 'assessment' and

'group' in the visual closure task, for example, has also to be interpreted in the context of the small number of patients in the disorganised schizophrenia/schizoaffective group (n=9) who completed the second testing. Nevertheless, inspection of performance levels across assessments for the four patient groups in the contour integration and visual closure tasks indicates that the disorganised schizophrenia/schizoaffective group show substantial improvement in both tasks which was not associated with the other groups. Thus, performance in the contour integration and visual closure tasks for the disorganised schizophrenia/schizoaffective group reached levels at the second assessment similar to those observed in the non-disorganised schizophrenia/schizoaffective and non-schizophrenia psychotic disorders groups. In contrast, the reduction in context sensitivity in the visual size perception task, condition 'enlarging', was relatively stable in both schizophrenia/schizoaffective disorder groups.

A specific association between improvements in the contour integration and visual closure tasks and reductions in the PANSS factor 'cognitive' was found for schizophrenia patients which was not present in the non-schizophrenia psychotic disorders group. This finding furthermore supports the data from previous analyses of this research which indicated that dysfunctional Gestalt perception is linked to the disorganisation syndrome in schizophrenia spectrum disorders (hypothesis 3).

6. GESTALT PERCEPTION IN CHRONIC SCHIZOPHRENIA

6.1 Aims of the Study

The study aimed to confirm the relationship between disorganisation and dysfunctional Gestalt perception, which was demonstrated in Studies 1 and 2, in a sample of chronic patients with schizophrenia. In contrast to Study 2, the computerized version of the visual size perception task was employed which was developed during the course of the research. This version was characterized by a greater sensitivity for detecting differences in Gestalt perception (see Appendix B).

6.2 Method

6.2.1 Participants

Three groups of patients participated in the study: 1) a group of 35 patients with schizophrenia was recruited from inpatient programs for chronic psychotic disorders at New York Presbyterian Hospital, Weill Medical College of Cornell University (n=25), Stratheden Hospital, Fife NHS Trust (n=5), and Bellesdyke Hospital, Forth Valley NHS Trust (n=5); 2) thirty-five patients with other psychotic non-schizophrenia disorders. Twenty-seven patients were recruited from an inpatient program for acute psychotic disorders at New York Presbyterian Hospital, Weill Medical College of Cornell University. These patients were identical to the patients in Study 2. Five additional

patients were recruited from a chronic inpatient program for psychotic disorders at New York Presbyterian Hospital, Weill Medical College of Cornell University, and 2 patients were recruited from an outpatient program at the same hospital 3) a psychiatric control group (n=25), consisting of patients with non-psychotic psychiatric disorders. Patients in this group were identical to the participants in Study 2. Composition of the psychotic non-schizophrenia and psychiatric control groups in terms of DSM-IV diagnosis can be seen in Table 6.1.

Table 6.1

DSM-IV Diagnosis of the Non-Schizophrenia Psychotic and Non-Psychotic Psychiatric Control Groups

	Psychotic Non-Schizophrenia	Non-Psychotic Disorders
Diagnosis	(n=35)	(n=25)
Schizoaffective Disorder	16	
Psychosis NOS	2	
" substance induced	2	
Mood Disorder w. Psychotic Features	15	
without " "		5
Personality Disorder		10
Substance Abuse		10

6.2.2 Measures

The following measures were employed in this study: 1) the Shipley Institute of Living Scale (Shipley, 1940) for the assessment of verbal intelligence; 2) the SCID (First et al., 1995) and the PANSS (Kay et al., 1986) for the examination of psychopathology;

and 3) the visual size perception task (computerized version), the contour integration task which involved the manipulation of the average spacing between the background elements and spacing between elements of the closed contour, and the visual closure task to examine Gestalt perception.

6.3 Results

6.3.1 Demographic and Clinical Variables

Table 6.2

Means, Standard Deviations, and Mean Differences for Demographic and Clinical Variables of Participants

	Schizophrenia		Psychotic Non- Schizophrenia		Non-Psychotic Disorders		Signific. Level	Post hoc
Variable	(*n*=35) M	SD	(*n*=35) M	SD	(*n=25)* M	SD		
Age (in years)	37.2	6.9	36.3	9.6	37.6	8.2	*F*(2,93)=.18 p>.83 (HV)	
Sex (Male/Female)	29/6		21/14		15/10		$\chi 2(2)=4.67$ p<.09	
Education (in years)	10.9	2.7	12.9	2.5	13.0	1.5	*F*(2,93)=7.58 p<.001 (HV)	S<P S<CT
Age of onset[1] (in years)	18.7	3.9	22.9	6.8			*t*(69)=3.94 p<.01 (IH)	
Shipley Vocabulary Score	22.5	4.7	25.5	7.8	28.9	5.8	*F*(2,93)=7.71 p<.001 (IH)	S<P

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; S=Schizophrenia; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

[1] 'Age of onset' refers to the age at the first hospitalization/treatment of psychiatric symptoms

Demographic Data Demographic data are presented in Table 6.2. The three groups did not differ in age and sex distribution. Patients with schizophrenia, however, had significantly less years of education than both the non-schizophrenia psychotic and non-psychotic psychiatric control groups. Patients in the schizophrenia group had also lower scores on the Shipley Vocabulary test compared to the non-psychotic psychiatric group. In addition, the schizophrenia group was characterized by an earlier onset of psychiatric symptoms.

Statistical relationships between demographic variables and neurocognitive measures which could indicate possible confounds for the analysis of performance on the cognitive tasks were examined. Only performance on the contour integration task was associated with more years of education when scores from all groups were combined.

Table 6.3

Correlations between Demographic, Clinical, and Neurocognitive Measures Groups Combined (Row1), Schizophrenia Group (Row2), Non-Schizophrenia Psychotic Group (Row3,) and Non-Psychotic Psychiatric Group (Row 4)

	Age	Age of Onset	Education	Verbal IQ
Visual Closure Task	-.19	-.02	-.18	.14
	.08	.21	.13	.01
	-.21	-.11	.00	.02
	-.10		-.20	.05
Contour Integration Task	-.09	.15	**.23***	-.08
	-.11	**.48***	-.06	-.11
	.15	.28	.15	-.03
	.08		.20	.05
Visual Size Perception Task	-.08	-.15	.05	.12
	-.07	-.10	-.06	-.07
	.16	.18	.16	**.40***
	.06		.10	-.10

Note. +=p<.1; *=p<.05; **=p<.01;***=p<.005; ****=p<.0001

PANSS Data Schizophrenia and non-schizophrenia psychotic patients were compared on their total scores and individual factors of the PANSS (see Table 6.4). Schizophrenia patients had significantly higher overall ratings of psychopathology and significantly elevated scores on the PANSS factors 'disorganised', 'positive', 'cognitive', 'negative', and on the item 'conceptual disorganisation'. Patients with non-schizophrenia psychotic disorders had significantly more depressed symptoms.

Table 6.4

Means, Standard Deviations, and Mean Differences for PANSS Scores for Schizophrenia and Non-Schizophrenia Psychotic Groups

	Schizophrenia		Psychotic Non-Schizophrenia		Signific. Level
	(*n*=35)		(*n*=35)		
Factor/Item	M	SD	M	SD	
Total Score	77.4	16.6	69.2	17.3	*t*(69)= 2.01 p<. 04 (HV)
Positive	12.5	4.6	9.8	4.2	*t*(69)=2.61 p<.01 (HV)
Negative	17.1	5.3	13.1	5.7	*t*(69)=3.10 p<.004 (HV)
Excitement	8.5	3.1	9.4	4.1	*t*(69)= -1.03 p>.30 (HV)
Depression	11.3	3.9	13.9	3.9	*t*(69)=-2.78 p<.007 (HV)
Disorganisation	7.7	3.4	6.0	3.1	*t*(69)=2.16 p<.03 (HV)
Cognitive	13.7	4.9	11.3	3.9	*t*(69)=2.24, p<.03 (HV)
Conceptual Disorganisation	2.9	1.4	2.1	1.4	*t*(69)= 2.511 p<.02 (HV)

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance. S=Schizophrenia; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

Table 6.5

Intercorrelations Between Measures of Gestalt Perception

Groups Combined (Row 1), Schizophrenia Group (Row2), Non-Schizophrenia Psychotic Group (Row)3, and Non-Psychotic Psychiatric Group (Row 4)

	Visual Closure Task	Contour Integration Task	Visual Size Perception Task
Visual Closure Task			
Contour Integration Task	**.40****		
	.53**		
	.39*		
	-.05		
Visual Size Perception Task	**-.24***	-.20+	
	-.30	**-.36***	
	-.19	-.03	
	-.03	.04	

Note. +=p<.1; *=p<.05; **=p<.01;***=p<.005; ****=p<.0001

Intercorrelations Between Measures of Gestalt Perception Table 6.5 shows the correlations which were performed to examine the relationships between three measures of Gestalt perception. Data from patients with schizophrenia, non-schizophrenia psychotic disorders, and other non-psychotic disorders were entered. Such analyses would be informative in determining whether measures of Gestalt perception are assessing a single construct. Table 6.5 displays the correlations for the three tasks for the groups combined and separately. Combined correlations for the 3 groups show significant correlations between the visual closure task, contour integration task, and the visual size perception task. There was a trend for a statistically significant relationship between the visual size perception task and the contour integration task. Inspection of Table 6.5 shows

that these relationships were not found in the non-psychotic psychiatric control group. In contrast, significant correlations were present in the schizophrenia group between the visual closure, contour integration, and visual size perception tasks.

6.3.2 Neurocognitive Correlates of the Five Factor Model of the PANSS

Correlations between measures of Gestalt perception and factor/scales of the PANSS were examined for both psychotic disorders group combined and separately (Table 6.6). Performance on the visual closure, contour integration, and visual size perception tasks were significantly correlated with the factor 'cognitive' in patients with schizophrenia. In addition, significant correlations were obtained for the factor 'disorganisation' and performance on the visual closure and visual size perception tasks. A significant correlation was also found for increased scores on the factor 'positive' and enhanced size estimation for patients with schizophrenia. There were no significant correlations between performance on these tasks and the factors 'cognitive' and 'disorganisation' in the non-schizophrenia psychotic group. When the combined symptom scores of the psychotic groups were examined, performance on the visual closure and visual size perception tasks correlated significantly with the factor 'disorganisation'. Performance on the visual size perception and contour integration tasks was also correlated with the factor 'cognitive'. Overall levels of psychopathology were only correlated with the performance in the visual size perception task in the schizophrenia group. These results closely mirror the neurocognitive correlates of the PANSS five factor model reported in Study 2.

Table 6.6

Correlations Between Measures of Gestalt Perception and Factors of the PANSS Schizophrenia and Psychotic Non-Schizophrenia Groups Combined (Row1), Schizophrenia Group (Row2), and Non-Schizophrenia Psychotic Group (Row 3)

Scale/Item	Visual Closure Task	Contour Integration Task	Visual Size Perception Task
Total PANSS	-.17	-.17	-.22
	-.33*	-.24	**-.51****
	-.06	-.16	.22
Cognitive	**-.29***	-.21+	**.32***
	-.49**	**-.37***	**.49****
	-.11	-.12	-.07
Depression	-.14	-.14	.10
	-.12	-.07	.34+
	-.15	-.15	-.25
Disorganisation	**-.27***	-.16	**.35***
	-.45*	-.32+	**.49***
	-.12	.14	.09
Excitement	-.04	-.08	-.05
	.16	.02	.03
	-.17	-.14	-.16
Positive	.01	-.05	.10
	-.03	-.05	**.44***
	.03	-.13	-.18
Negative	.01	-.05	.10
	-.32+	-.24	-.32+
	.28	-.07	-.29

Note. +=p<.1; *=p<.05; **=p<.01;***=p<.005; ****=p<.0001

6.3.3 Gestalt Perception in Schizophrenia, Non-Schizophrenia Psychotic Disorders, and Non-Psychotic Psychiatric Disorders

Table 6.7

Means, Standard Deviations, and Results of Analysis of Variance for Measures of Gestalt Perception

Test	Schizophrenia (n=35) M SD	Psychotic Non-Schizophrenia (n=35) M SD	Non-Psychotic Disorders (n=25) M SD	Signific. Level	Post hoc
Visual Closure Task	23.6 7.7 n=32	23.1 8.6 n=32	27.5 7.1 n=24	$F(2,86)=2.70$ p<.07 (HV)	
Contour Integration Task	.73 .06 n=32	.75 .05 n=32	.72 .03 n=25	$F(2,86)=1.92$ p>.152 (IH)	
Visual Size Perception Task: Context	48.5 13.90 n=33	48.2 10.6 n=25	40.0 12.6 n=18	$F(2,74)=2.76$ p<.07 (HV)	S<CT
No Context	27.0 2.5	27.0 3.1	29.0 2.0	$F(2,74)=3.40$ p<.03 (HV)	S<CT P<CT

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance. S=Schizophrenia ; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

Missing Data Not all patients completed the neurocognitive test battery. The number of patients who completed each task can be seen in Table 6.7.

Contour Integration Task No significant differences emerged between the groups on the background-element to contour-element density ratio or delta (D).

Visual Size Perception Task A statistical trend was observed for a main effect of group for the number of circles correctly identified in the context condition. Inspection of the performance levels in this task suggests that both the schizophrenia and the non-schizophrenia psychotic group displayed similar levels of context-sensitivity in this task.

Significant differences emerged in the control condition. Post hoc Scheffé tests showed that patients with schizophrenia were less accurate in the estimation of circles which were not surrounded by context circles than the non-psychotic psychiatric control group. Similarly, a statistical trend in the same direction was observed for the comparison between the non-schizophrenia psychotic group and the non-psychotic psychiatric controls.

Visual Closure Task A statistical trend for a main effect of group for the number of faces was obtained. None of post hoc comparisons reached statistically significant levels.

6.4. Discussion

The results from three tasks which examined Gestalt perception in chronic patients with schizophrenia, non-schizophrenia psychotic, and non-psychotic psychiatric disorders confirm the results from the two previous studies. Although statistical trends were observed for the visual closure and visual size perception tasks which indicated that patients with schizophrenia were impaired in Gestalt perception, no significant differences emerged on these measures when the three groups were compared. These results are in contrast to previous studies which have reported significant impairment in Gestalt perception in chronic schizophrenia (e.g., Cox et al., 1978; Place & Gilmore,

1980; Silverstein et al., 1998c) Specifically, the study by Silverstein et al. (2000) employed a similar contour integration paradigm in patients with chronic schizophrenia who displayed significantly reduced performance in this task.

The present results also confirm the specific associations between aspects of psychotic symptomatology and impairments in Gestalt perception reported for patients with acute schizophrenia in Study 2. Similar to the previous study, elevated levels of disorganised symptomatology were significantly correlated with impairments in Gestalt perception in patients with chronic schizophrenia. There were also subtle differences, however. Whereas the factor 'disorganisation' was the main clinical correlate of cognitive dysfunctions in patients with acute schizophrenia, the factor 'cognitive' was significantly correlated with all three tasks in the present study. Nevertheless, these correlations confirm the relationship between dysfunctional Gestalt perception in schizophrenia spectrum disorders and the disorganisation syndrome (hypothesis 3) since both factors overlap significantly in their item composition. In addition, a significant correlation was obtained for the factor 'positive' and enhanced size estimation in the context condition of the visual size estimation task for patients with schizophrenia. This correlation supports the finding from Study 2.

As in Study 2, no significant correlations between the factors 'disorganisation' and 'cognitive' were observed for the non-schizophrenia psychotic disorders group. Yet, the significant overlap in the composition of this group in the present study and Study 2 does not allow any clear conclusions whether disorganisation is unrelated to impairments in Gestalt perception in chronic non-schizophrenia psychotic disorders.

6.5 Comparison Between Chronic Disorganised Schizophrenia/ Schizoaffective Disorder vs. Chronic Non-Disorganised Schizophrenia/ Schizoaffective Disorder vs. Non-Schizophrenia Psychotic Disorders vs. Non-Psychotic Psychiatric Disorders

6.5.1 Aims of the Study

On the basis of the findings from the Studies 1 and 2 which indicated that impairments in Gestalt perception are related to thought disorder in the schizophrenia spectrum, chronic patients with schizophrenia and schizoaffective disorder were assigned into a disorganised group based on their score on the PANSS item 'conceptual disorganisation' to replicate these results. Patients who received a rating higher than 3 (mild) on this item were assigned to the 'disorganised' group (n=11) whereas subjects who scored lower than 3 were assigned to a 'non-disorganised' group (n=27). Schizoaffective patients with elevated levels of conceptual disorganisation who were recruited from the program for acute psychotic disorders were not combined with the disorganised, chronic patients since these patient groups differed significantly in demographic and clinical variables. Accordingly, the two groups consisting of patients with chronic forms of schizophrenia/schizoaffective disorder were compared to patients who were diagnosed with a psychotic disorders other than schizophrenia or chronic schizoaffective disorder (n=31) and to the psychiatric control group (n=25). The disorganised group consisted of 10 patients with schizophrenia and one patient with schizoaffective disorder. The non-disorganised group had 26 patients with schizophrenia and two patients with schizoaffective disorder.

6.5.2 Results

6.5.2 Demographic and Clinical Variables

Table 6.8

Means, Standard Deviations, and Mean Differences for Demographic and Clinical Variables of Participants

Variable	Disorganised Schizophrenia/ Schizoaffective (n=11) M SD	Non-Disorganised Schizophrenia/ Schizoaffective (n=27) M SD	Psychotic Non - Schizophrenia (n=31) M SD	Non-Psychotic Disorders (n=25) M SD	Signific. Level	Post hoc
Age (in years)	38.0 9.0	37.7 5.9	35.4 9.5	36.9 9.3	$F(3,92)=.58$ p.>.11 (HV)	
Sex (Male/Female)	11/0	18/6	21/14	16/9	$\chi 2(3)=7.01$ p<.07	
Education (in years)	11.0 2.8	11.4 2.8	12.7 2.4	12.9 1.5	$F(3,92)=3.08$ p<.03 (IH)	DS<P DS<CT
Age of onset (in years)	18.8 1.8	19.6 5.3	22.7 7.4		$F(3,67)=2.24$ p>.12 (IH)	
Shipley Vocabulary Score	22.3 5.9	23.5 4.6	25.3 8.2	28.9 5.9	$F(3,92)=2.28$ p<.09 (IH)	

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance. DS= Disorganised Schizophrenia/Schizoaffective Disorder; NDS=Non-Disorganised Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Psychiatric Disorders; CT=Non-Psychotic Psychiatric Disorders

Demographic and Clinical Variables Table 6.8 displays the main demographic variables. The four groups differed significantly in the level of education. Post hoc Scheffé showed that the disorganised schizophrenia/schizoaffective group had significantly less years of education than both the non-schizophrenia psychotic disorders group and non-psychotic psychiatric control group. There were trends towards a main effect of group in the

number male/females in each group as well as verbal IQ as measured by the Shipley scale.

Table 6.10

Means, Standard Deviations, and Mean Differences for PANSS Scores for Chronic Disorganised Schizophrenia/Schizoaffective Disorder, Chronic Non-Disorganised Schizophrenia/Schizoaffective Disorder, and Non-Schizophrenia Psychotic Disorders Groups

	Disorganised Schizophrenia/ Schizoaffective		Non-Disorganised Schizophrenia/ Schizoaffective		Psychotic Non-Schizophrenia		Signific. Level	Post hoc
	(*n*=12)		(*n*=26)		(*n*=31)			
Factor/Item	M	SD	M	SD	M	SD		
Total Score	87.4	17.7	71.3	16.0	69.1	15.5	*F*(2,67)=6.2 p<.003 (HV)	DS<P DS<NDS
Positive	14.2	4.4	11.3	5.0	9.8	3.8	*F*(2,67)=4.5 p<.015 (HV)	DS<P
Negative	18.5	6.3	15.6	5.3	13.3	5.4	*F*(2,67)=4.0 p<.03 (HV)	DS<P
Depression	10.2	3.2	12.2	4.5	13.9	3.7	*F*(2,67)=4.04 p<.02 (HV)	P<NDS
Disorganisation	11.1	2.6	5.9	1.9	5.8	3.1	*F*(2,67)=20.2 p<.0001 (HV)	DS<NDS DS<P
Cognitive	18.3	3.8	11.2	2.9	11.1	3.9	*F*(2,67)=21.4 p<.001 (HV)	DS<NDS DS<P
Excitement	8.3	3.1	8.8	3.3	9.3	3.9	*F*(2,67)=.415 p>.26 (HV)	
Conceptual Disorganisation	4.6	.89	2.2	.82	2.1	1.4	*F*(2,67)=.21.3 p<.0001 (HV)	DS<NDS DS<P

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; DS= Disorganised Schizophrenia/Schizoaffective Disorder; NDS=Non-Disorganised Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Psychiatric Disorders; CT=Non-Psychotic Psychiatric Disorders

PANSS Data The disorganised schizophrenia/schizoaffective group was characterized by higher levels of general psychopathology and elevated scores on the PANSS factors 'disorganisation', 'cognitive', 'positive', 'negative', and on the item 'conceptual disorganisation' than the non-schizophrenia psychotic disorders group (Table 6.10). Similarly, the disorganised group had a higher overall PANSS score than the non-disorganised schizophrenia/schizoaffective group. As expected, the disorganised group differed also on the factors 'cognitive', 'disorganisation', and on the item 'conceptual disorganisation' from the non-disorganised schizophrenia/schizoaffective group.

6.5.2.2 Gestalt Perception in Chronic Disorganised Schizophrenia/ Schizoaffective Disorder vs. Chronic Non-Disorganised Schizophrenia/ Schizoaffective Disorder vs. Non-Schizophrenia Psychotic Disorders vs. Non-Psychotic Psychiatric Disorders

Contour Integration Task No significant differences emerged between the groups on the background-element to contour-element density ratio or delta (D).

Visual size perception task There was a main effect of group for the number of circles correctly identified in the context condition of this task. Post hoc Scheffé tests indicated that the disorganised schizophrenia/schizoaffective group was significantly more accurate in the estimation of the inner disk compared to the non-psychotic psychiatric control group. None of the other comparisons were significant.

There was also a significant main effect of group for the control condition 'no context'. The results showed a statistical trend for disorganised schizophrenia/

schizoaffectives patients to identify less circles than the non-psychotic psychiatric controls. Non-disorganised schizophrenics/schizoaffectives patients showed a statistical trend in the same direction compared to the non-psychotic psychiatric controls.

Visual Closure Task There was a main effect of group for the number of faces identified. Post hoc Scheffé tests indicated that the disorganised schizophrenia/schizoaffective group identified significantly less images than the non-psychotic psychiatric control group. There was a trend in the same direction when performance of the disorganised schizophrenia/schizoaffective group was compared with non-disorganised patients.

Table 6.13

Means, Standard Deviations, and Results of Analysis of Variance for Measures of Gestalt Perception

Test	Disorganised Schizophrenia/ Schizoaffective (n=12) M SD	Non-Disorganised Schizophrenia/ Schizoaffective (n=27) M SD	Psychotic Non-Schizophrenia (n=31) M SD	Non-Psychotic Disorders (n=25) M SD	Signific. Level	Post hoc
Visual Closure Task	18.4 7.4 n=11	25.8 7.4 n=24	23.2 8.5 n=29	27.8 7.1 n=24	$F(3,85)=4.3$ p<.007 (HV)	DS<CT, DS<NDS
Contour Integration Task	.76 .08 n=10	.73 .05 n=24	.74 .05 n=30	.72 .04 n=24	$F(3,85)=2.02$ p>.12 (HV)	
Visual Size Perception Task — Context	54.8 10.3 n=11	46.3 14.8 n=25	47.8 10.3 n=22	40.0 12.6 n=18	$F(3,73)=3.23$ p<.03 (HV)	DS<CT
No Context	26.3 2.2	27.5 2.7	26.9 3.1	29.0 2.0	$F(3,73)=3.2$ p<.02 (HV)	DS<CT NDS<CT

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance. DS= Disorganised Schizophrenia/Schizoaffective Disorder; NDS=Non-Disorganised Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Psychiatric Disorders; CT=Non-Psychotic Psychiatric Disorders

6.5.3 Discussion

Differentiation between disorganised and non-disorganised patients with chronic schizophrenia/schizoaffective disorder produced significant differences in the visual size perception and visual closure tasks. Patients with disorganised schizophrenia/ schizoaffective disorder were more accurate in visual size perception but identified significantly less images in the visual closure task. As in Study 2, both impairments were not present in the non-disorganised schizophrenia/schizoaffective group nor in the non-schizophrenia psychotic group. There were also differences in the results in the present study in comparison to Studies 1 and 2. Firstly, no significant differences were obtained in the contour integration task. Although patients in the disorganised schizophrenia/ schizoaffective patients performed more poorly in the contour integration task than the other groups, these differences did not reach statistically significant levels. This is in contrast to the previous studies which found both significant impairment in contour integration for disorganised forms of schizophrenia spectrum disorders. Secondly, the main difference in the visual size perception task was not found within the schizophrenia/schizoaffective group. In the present study, the main difference in visual size perception was obtained between disorganised schizophrenia/schizoaffective patients and the non-psychotic psychiatric control group.

Despite the failure to replicate impairments in contour integration in chronic, disorganised schizophrenia, the results support the findings from Studies 1 and 2. Specifically, the results support the hypothesis that impairments in Gestalt perception are related to disorganisation in schizophrenia spectrum disorders (hypothesis 3) and that

impairments in Gestalt perception can result in superior performance on some cognitive tasks (hypothesis 1b).

6.6 Comparison Between Chronic Paranoid Schizophrenia/ Schizoaffective Disorder vs. Chronic Non-Paranoid Schizophrenia/ Schizoaffective Disorder vs. Non-Schizophrenia Psychotic Disorders vs. Non-Psychotic Psychiatric Disorders

6.6.1 Aims of the Study

Patients with schizophrenia and schizoaffective disorder were assigned into two groups based on their score on the PANSS item P6 'suspiciousness' in order to examine the hypothesis that patients with paranoid symptomatology are characterized by enhanced Gestalt perception (hypothesis 3b). Patients who received a rating higher than 3 (mild) on this item were assigned to the 'paranoid group' group (n=19) whereas subjects who scored lower than 3 were assigned into a 'non-paranoid' group (n=20). As in the previous analyses, schizoaffective patients with elevated levels of paranoid symptomatology, who were recruited from the program for acute psychotic disorders, were not combined with patients who were recruited from units for patients with chronic psychotic disorders. The two groups were compared to patients who were diagnosed with a psychotic disorder other than schizophrenia (n=31) and to the psychiatric control group (n=25).

6.6.2 Results

6.6.2.1 Demographic and Clinical Variables

Table 6.14

Means, Standard Deviations, and Mean Differences for Demographic and Clinical Characteristics of Participants

Variable	Paranoid Schizophrenia/ Schizoaffective (n=19) M SD	Non-Paranoid Schizophrenia/ Schizoaffective (n=20) M SD	Psychotic Non-Schizophrenia (n=31) M SD	Non-Psychotic Disorders (n=25) M SD	Signific. Level	Post hoc
Age (in years)	37.6 7.5	37.9 7.1	35.4 9.6	37.5 8.2	$F(3,91)=.58$ p>.12(HV)	
Sex (male/female)	16/3	15/5	19/12	16/9	$\chi 2(3)=3.56$ p>.31	
Education (in years)	12.2 2.7	10.5 2.7	12.7 2.4	12.9 1.5	$F(3,91)=5.23$ p<.02 (HV)	NPD<CT NPD<P
Age of onset (in years)	19.6 2.9	19.1 5.3	22.6 7.3		$F(2,61)=2.19$ p>.12 (IH)	
Shipley Living Scale	24.3 4.0	23.3 6.2	25.0 8.4	28.9 5.9	$F(3,91)=2.28$ p<.09 (IH)	

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance. PD=Paranoid Schizophrenia/Schizoaffective disorder; NPD=Non-Paranoid Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

Demographic Data and Clinical Variables The only difference between the four groups was observed for the level of education. Patients in the non-paranoid schizophrenia/ schizoaffective group had significantly less years of education than the non-psychotic psychiatric and the non-schizophrenia psychotic groups.

Table 6.15

Means, Standard Deviations, and Mean Differences for PANSS Scores for the Paranoid Schizophrenia/Schizoaffective Disorder Group, Non-Paranoid Schizophrenia/ Schizoaffective Disorder Group, and Non-Schizophrenia Psychotic Group

	Paranoid Schizophrenia/ Schizoaffective		Non-Paranoid Schizophrenia/ Schizoaffective		Psychotic Non-Schizophrenia		Signific. Level	Post hoc
	(*n*=19)		(*n*=20)		(*n*=30)			
Factors/Item	M	SD	M	SD	M	SD		
Total Score	83.3	13.6	67.4	17.3	69.3	15.7	*F*(2,67)=7.02 p<.001 (HV)	PS<NPS PS<P
Positive	14.0	4.0	10.0	4.8	9.8	3.8	*F*(2,67)=7.92 p<.001 (HV)	PS<NPS PS<P
Negative	20.1	4.3	12.3	4.3	13.5	5.4	*F*(2,67)=9.5 p<.001 (HV)	PS<NPS
Depression	11.5	3.9	11.1	3.9	13.9	3.7	*F*(2,65)=3.27 p<.04 (HV)	P<NPS
Disorganisation	8.2	2.0	7.2	3.4	5.8	3.2	*F*(2,67)=3.04 p<.06 (HV)	PS<P
Cognitive	14.2	4.6	12.8	4.5	11.1	4.0	*F*(2,67)=3.11 p<.05 (HV)	PS<P
Excitement	8.4	2.9	8.5	3.5	9.3	3.9	*F*(2,67)=.34 p>.71 (HV)	PS<P
Conceptual Disorganisation	3.1	1.3	2.8	1.5	2.0	1.4	*F*(2,67)=4.01 p<.02 (HV)	PS<P

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance. PD=Paranoid Schizophrenia/Schizoaffective Disorder; NPD=Non-Paranoid Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

PANSS Data Paranoid schizophrenia/schizoaffective, non-paranoid schizophrenia/ schizoaffective, and non-schizophrenia psychotic patients were compared on their total scores and individual factors of the PANSS (Table 6.15). There were main effects of group for the general level of psychopathology and the PANSS factors 'positive',

'negative', and 'depression'. The paranoid schizophrenia/schizoaffective group was characterized by higher levels of general psychopathology and scores on the PANSS factors 'positive' and 'negative' compared to the non-paranoid schizophrenia/ schizoaffective and non-schizophrenia psychotic disorders. There were statistical trends for a main effect of group for the PANSS factors 'disorganisation' and 'cognitive'. Post hoc Scheffé indicated that the paranoid schizophrenia/schizoaffective group displayed a trend towards higher scores on both factors compared to the non-paranoid schizophrenia/ schizoaffective group.

6.6.2.2 Gestalt Perception in Chronic Paranoid Schizophrenia/Schizoaffective Disorder vs. Chronic Non-Paranoid Schizophrenia/Schizoaffective Disorder vs. Non-Schizophrenia Psychotic Disorders vs. Non-Psychotic Psychiatric Disorders

Visual Closure Task There was a main effect of group for the number of images identified. There was a trend for the paranoid schizophrenia/schizoaffective group to identify fewer images than the psychiatric control group.

Contour Integration Task A significant main effect of group was observed for the background-element to contour-element density ratio or delta (D). No intergroup differences were significant at the .05 level, however.

Visual Size Perception Task There were significant main effects of group for both the number of circles identified in the context and control conditions of the visual size

perception task. A statistical trend was observed for the paranoid schizophrenia/ schizoaffective group towards a higher accuracy in the context condition compared to the non-psychotic psychiatric group. Statistical trends towards significant intergroup differences were also found in the control condition. The non-paranoid schizophrenia/schizoaffective and non-schizophrenia psychotic groups were less accurate in size estimation than the non-psychotic psychiatric group.

Table. 6.16

Means, Standard Deviations, and Results of Analysis of Variance for Measures of Gestalt Perception

Test	Paranoid Schizophrenia Schizoaffective (n=19) M SD	Non-Paranoid Schizophrenia Schizoaffective (n=20) M SD	Psychotic Non-Schizophrenia (n=31) M SD	Non-Psychotic Disorders (n=25) M SD	Signific. Level	Post hoc
Visual Closure Task	21.8 8.8 n=17	25.7 6.6 n=18	23.8 8.2 n=29	27.5 7.1 n=24	$F(3,85)=2.77$ p<.04 (HV)	
Contour Integration Task	.76 .07 n=17	.71 .05 n=17	.74 .05 n=30	.72 .04 n=24	$F(3,85)=2.8$ p<.04 (HV)	
Visual Size Perception Task Context	53.1 12.2 n=17	46.6 15.1 n=19	47.1 10.6 n=22	40.0 12.6 n=18	$F(3,73)=2.81$ p<.04 (HV)	
No Context	27.3 2.6	26.8 2.7	26.7 3.2	29.0 2.0	$F(3,73)=2.86$ p<.04 (HV)	

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance. PD=Paranoid Schizophrenia/Schizoaffective disorder; NPD=Non-Paranoid Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

6.6.3 Discussion

The results of the analyses confirm the findings of Study 2. Comparison between chronic paranoid and non-paranoid forms of schizophrenia/schizoaffective disorder did not find evidence for enhanced responsiveness to Gestalt properties of stimuli (hypothesis 3b). On the contrary, there were statistical trends towards reduced responsiveness to Gestalt properties in the visual size perception and visual closure tasks. A similar pattern of performance was observed in the contour integration task where patients with elevated levels of paranoid symptomatology were more impaired in their ability to detect grouping among noncontiguous elements comprising a closed (i.e., circular) contour.

7. GESTALT PERCEPTION AND THEORY OF MIND IN SCHIZOPHRENIA

7.1 Aims of the Study

The study examined a specific aspect of social cognition in schizophrenia, Theory of Mind (ToM), in relation to impairments in Gestalt perception in schizophrenia. Based on past research which indicated a link between dysfunctional Gestalt perception and ToM in the general population and in other psychiatric disorders (Jarrold et al., 2000), it was hypothesized that schizophrenia patients with impairments in Gestalt perception would also be characterized by deficits in ToM (hypothesis 5). In addition, acute and chronic patients with schizophrenia and schizoaffective disorder were compared on cognitive measures to explore the relationship between chronicity, Gestalt perception, and ToM.

7.2 Method

7.2.1 Participants

Three groups of patients participated in the study: 1) a group of patients with schizophrenia (n=40). Twenty-seven patients were recruited from inpatient-units for chronic psychotic disorders at New York Presbyterian Hospital, Weill Medical College of Cornell Universities (n=17), Stratheden Hospital, Fife NHS Trust (n=5), and Bellesdyke

Hospital, Forth Valley NHS Trust (n=5). Thirteen schizophrenia patients were recruited from a unit for acute psychotic disorders at New York Presbyterian Hospital, Weill Medical College; 2) Sixteen patients with non-schizophrenia psychotic disorders. Eleven patients were recruited from a unit for acute psychotic disorders at New York Presbyterian Hospital, Weill Medical College. Five patients were recruited from an outpatient department and two patients from a unit for chronic psychotic disorders at the same hospital; 3) a psychiatric control group (n=26) consisting of in- and outpatients with non-psychotic psychiatric disorders. All patients in this study had participated in studies 2 and 3. Composition of the non-schizophrenia psychotic and non-psychotic psychiatric groups in terms of DSM-IV diagnosis can be seen in Table 7.1.

Table 7.1

DSM-IV Diagnosis of Non-Schizophrenia Psychotic and Non-Psychotic Psychiatric Disorders Groups

	Non -Schizophrenia Psychotic	Non-Psychotic Disorders
Diagnosis	(n=16)	(n=26)
Schizoaffective Disorder	11	
Psychosis NOS	1	
Mood Disorder w. Psychotic Features	4	
Without " "		5
Personality Disorder		11
Substance Abuse		10

7.2.2 Measures

The following measures were employed in this study: 1) the Shipley Institute of Living Scale (Shipley, 1940) for the assessment of verbal intelligence; 2) the SCID (First et al., 1995) and PANSS (Kay et al., 1986) for the examination of psychopathology; 3) the visual size perception task (computerized version) and the version of the contour integration task which involved the manipulation of the average spacing between the background elements and spacing between elements of the closed contour to examine Gestalt perception; and 4) the Eyes Test (Baron-Cohen et al., 2001), the first-order ToM Task, and the Hinting Task (Corcoran et al., 1995) to examine ToM.

7.3 Results

7.3.1 Demographic and Clinical Variables

Demographic Data Demographic data are presented in Table 7.2. There was a trend for the schizophrenia group to have a higher proportion of male participants than the other groups. Furthermore, patients with a diagnosis of schizophrenia had significantly less years of education and a lower level of verbal IQ than the non-psychotic psychiatric control group. There was a statistical trend for an earlier onset of illness for the schizophrenia group.

Table 7.2

Means, Standard Deviations, and Mean Differences for Demographic and Clinical Variables of Participants

Variable	Schizophrenia (n=40) M	SD	Non-Schizophrenia Psychotic (n=16) M	SD	Non-Psychotic Disorders (n=26) M	SD	Signific. Level	Post hoc
Age (in years)	37.4	7.6	40.0	8.9	36.7	8.8	$F(2,80)=.81$ p>.45 (HV)	
Sex (Male/Female)	34/6		11/5		16/10		$\chi2(2)=4.89$ p<.09	
Education (in years)	11.4	2.8	12.7	2.4	12.9	1.5	$F(2,80)=4.27$ p<.02 (IV)	S<CT
Age of onset[1] (in years)	20.5	4.5	23.9	9.5			$t(55)=1.95$ p<.06 (IH)	
Shipley Vocabulary Score	25.6	6.5	25.7	6.9	28.9	5.6	$F(2,80)=5.4$ p<.008 (HV)	S<CT

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: criteria: p<.05); (HV): homogeneous variances; S=Schizophrenia ; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

[1] 'Age of onset' refers to the age at the first hospitalization/treatment of psychiatric symptoms

Statistical relationships between demographic variables and neurocognitive measures which would indicate possible confounds for the analysis of performance on the cognitive tasks were examined. The Eyes test was significantly correlated with more years of education and verbal IQ in the schizophrenia group. Similarly, performance in the Hinting task was associated with verbal IQ. In addition to the data from the individual ToM tasks, a ToM score was computed from the summed z-scores of the ToM measures. Supporting the relationship between level of education and verbal IQ and ToM, overall ToM performance was significantly correlated with the level of education and verbal IQ. A positive correlation was observed between age of onset and ToM performance,

indicating that patients with an earlier onset of a psychotic disorder were more impaired in ToM.

Table 7.3

Correlations between Demographic, Clinical, and Neurocognitive Measures Groups Combined (Row1), Schizophrenia Group (Row2), Non-Schizophrenia Psychotic Group (Row3), and Non-Psychotic Psychiatric Group (Row4)

	Age	Age of Onset	Education	Verbal IQ
Contour Integration Task	-.08	.05	.08	.11
	-.16	-.08	.18	.11
	.21	.15	-.27	.09
	-.08		-.15	.03
Visual Size Perception Task	.12	-.19	-.07	.14
	.09	**-45****	-.07	-.17
	.29	.30	.02	.40+
	.06		-.12	.20
Eyes Test	.16	.13	**.37****	**.42*****
	.26	.23	**.36***	.30+
	.15	-.07	.21	.39
	.10		-.07	.45*
Hinting Task	.06	.29+	.21+	**.23****
	.04	.29	.06	.18
	-.26	.28	.07	-.18
	.42*		-.07	.01
First-Order ToM Task	-.05	.30+	.13	.13
	-.12	.34+	-.11	-.02
	.23	.14	.38	.13
	-.22		.17	-.25
ToM Score	.07	**.34***	**.36****	**.42*****
	.08	**.45***	.30+	.29+
	.02	.10	.29	.18
	.09		.04	.21

Note: +=p<.1; *=p<.05; **;=p<.01;***=p<.005; ****=p<.0001

Intercorrelations Between Measures of Gestalt Perception and ToM Table 7.4 shows the correlations which were performed to investigate relationships between measures of Gestalt perception and ToM. Data from patients with schizophrenia, non-schizophrenia psychotic disorders, and other non-psychotic psychiatric disorders were entered. Such analyses would indicate whether dysfunctional Gestalt perception is related to impaired ToM (hypothesis 5) (Table 7.4). Combined correlations for the groups show significant negative correlations between the visual size perception task and two measures of ToM, the first-order ToM task and the Hinting task. The data suggest that reduced sensitivity to the surrounding context elements is associated with impaired ToM. Furthermore, a significant correlation was observed between the overall ToM-score and the context condition of the visual size perception task. These findings support the hypothesis that dysfunctional Gestalt perception is related to impaired ToM (hypothesis 5). Correlations between the contour integration task and ToM measures do not support this conclusion, however. It is important to note that the relationship between dysfunctional Gestalt perception and impaired ToM was not present in the non-psychotic psychiatric group, suggesting that this association is relatively specific to schizophrenia patients in this study.

Significant correlations were found between ToM measures except for the first-order ToM task and the Eyes Test.

Table 7.4

Correlations Between Measures of Gestalt Perception and ToM

Groups Combined (Row 1) Schizophrenia Group (Row 2), Non-Schizophrenia Psychotic Group (Row 3,) and Non-Psychotic Psychiatric Group (Row 4)

	Contour Integration Task	Visual Size Perception Task	Hinting Task	Eyes Test	First-Order ToM	ToM Score
Contour Integration Task						
Visual Size Perception Task	-.03 -.07 -.03 .17					
Hinting Task	.05 .06 -.14 .34	**-.32**** -.34+ -.43+ .04				
Eyes Test	.03 -.15 -.29 .03	.08 -.05 .43 .34	.26* .36+ .18 -.33			
First-Order ToM Task	-.10 -.01 -.43 -.19	**-.32**** **-.46*** -.23 -.12	.33** .32+ .36 .14	.17 .23 .02 -.03		
ToM Score	.05 .02 -.46 -.04	**.30*** **.50**** -.10 .05	**.74****** **.61**** **.67** .17	**.67****** .34+ **.66*** **.63****	**.72****** **.89****** **.69**** **.66*****	

Note. +=p<.1; *=p<.05; **=p<.01;***=p<.005; ****=p<.0001

PANSS Data Schizophrenia and non-schizophrenia psychotic patients were compared on their total scores and individual factors of the PANSS (see Table 7.5). Schizophrenia patients had significantly elevated scores on the PANSS factors 'disorganised', 'negative', and on the item 'conceptual disorganisation'. There was a trend for the

schizophrenia group to display higher symptom levels on the factor 'cognitive' than the non-schizophrenia psychotic group. Patients with non-schizophrenia psychotic disorders had significantly more depressed symptoms.

Table 7.5

Means, Standard Deviations, and Mean Differences for PANSS Scores for Patients with Schizophrenia and Non-Schizophrenia Psychotic Disorders

	Schizophrenia		Non-Schizophrenia Psychotic		Signific. Level
	(*n*=40)		(*n*=15)		
Factor/Item	M	SD	M	SD	
Total Score	78.2	15.5	73.3	23.1	*t*(54)= .91 p>. 36 (HV)
Positive	11.2	4.1	10.5	4.7	*t*(54)=.74 p>.46 (HV)
Negative	16.5	4.7	13.4	6.3	*t*(54)=1.98 p<.05 (HV)
Excitement	9.0	3.4	10.0	3.6	*t*(54)= -.95 p>.34 (HV)
Depression	10.9	3.3	14.3	4.9	*t*(54)=-2.9 p<.005 (HV)
Disorganisation	7.4	2.9	5.8	3.1	*t*(54)=1.76 p<.08 (HV)
Cognitive	13.5	4.9	11.8	3.2	*t*(54)=1.9 p<.07 (HV)
Conceptual Disorganisation	2.8	1.3	1.9	1.1	*t*(54)= 1.9 p<.07 (IH)

Note. (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance

7.3.2 Neurocognitive Correlates of the Five Factor Model of the PANSS

Of main interest were the correlations between PANSS factors and ToM measures. Significant correlations between measures of ToM and psychotic symptomatology were found. For the schizophrenia group, impairment in the Hinting Task was correlated with increased symptom ratings on the factors 'cognitive', 'disorganisation', 'positive', and 'negative'. Impaired performance was also positively correlated with overall levels of psychopathology. Combined symptom scores of patients with psychotic disorders produced significant correlations between the Hinting Task and the factors 'cognitive' and 'disorganisation'. There were also trends in the non-schizophrenia psychotic disorders group towards a significant correlation between the factors 'cognitive' and 'disorganisation' and the Hinting Task which did not reach statistically significant levels due to the relatively small number of patients in this group. No additional significant correlations were observed between the first-order ToM task and the Eyes Test and psychotic symptomatology.

Overall ToM performance was significantly correlated with the factor 'cognitive' in the schizophrenia group. The same relationship was observed when scores of both psychotic disorders group were combined. In addition, there were trends towards significant correlations between the overall ToM performance and the PANSS factors 'disorganisation', 'negative', and general psychopathology. No significant correlations were obtained between factors of the PANSS and overall ToM performance in the non-schizophrenia psychotic disorders group.

The correlation between measures of Gestalt perception and factors of the PANSS were similar to those reported in Studies 2 and 3.

Table 7.6

Correlations Between Measures of Gestalt Perception and ToM and Factors of the PANSS, Schizophrenia and Non-Schizophrenia Psychotic Groups Combined (Row1), Schizophrenia Group (Row2), and Non-Schizophrenia Psychotic Group (Row3)

Factor	Visual Size Perception Task	Contour Integration Task	First-Order ToM Task	Hinting Task	Eyes Test	ToM Score
Total PANSS Score	.25+	**-.28***	-.08	**-.34***	-.07	-.25+
	.38*	**-.32***	-.08	**-.33***	-.06	-.27
	-.05	-.30	.21	-.31	.10	.02
Cognitive	**.29***	**-.36***	-.21	**-.52***	-.12	**-.40***
	.35*	**-.49***	-.22	**-.50***	-.10	**-.39***
	.17	-.03	-.12	-.49+	.10	-.11
Depression	.10	**-.29***	.10	.21	.14	.24+
	.21	**-.30***	.03	.16	.10	.15
	-.16	-.22	-.06	-.19	-.19	-.16
Disorganisation	**.37****	**-.26**	-.01	**-.44*****	-.01	-.28+
	.44**	**-.41****	.05	**-.42****	.05	-.23
	.31	-.07	.15	-.47+	.15	-.13
Excitement	-.08	-.20	.05	.02	-.21	-.06
	-.08	-.15	.05	.01	-.31+	-.09
	-.01	-.22	-.07	-.19	-.11	-.15
Positive	**.32***	-.16	-.03	-.26+	.27+	-.06
	.39*	-.12	-.06	**-.31***	.27	-.10
	.26	-.23	.04	-.27	.39	.09
Negative	.11	-.07	-.10	-.26+	-.12	-.26+
	.27+	-.11	-.06	**-.33***	-.04	-.19
	-.32+	-.32	.28	-.11	.11	.18

Note. +=p<.1; *=p<.05; **=p<.01;***=p<.005; ****=p<.0001

7.3.3 Gestalt Perception and ToM in Schizophrenia, Non-Schizophrenia Psychotic Disorders, and Non-Psychotic Psychiatric Disorders

Table 7.7

Means, Standard Deviations, and Results of Analysis of Variance for ToM Measures

Test		Schizophrenia (n=40) M SD	Non-Schizophrenia Psychotic (n=16) M SD	Non-Psychotic Disorders (n=26) M SD	Signific. Level	Post hoc
Eyes Test		18.2 5.3 n=37	22.7 5.1 n=15	25.3 4.8 n=25	$F(2,75)=15.03$ p<.0001 (HV)	S<CT S<P
Hinting Task		12.4 4.9 n=40	15.6 2.3 n=14	17.9 1.8 n=25	$F(2,75)=17.03$ p<.0001 (IH)	S<CT S<P
First-Order Theory Mind	ToM	17/23 n=39	1/13 n=15	2/22 n=24	$\chi2(2)=12.25$ p<.002	S<CT S<P
	Reality	4/36	0/15	0/24	$\chi2(2)=4.21$ p>.12	
	Memory	1/39	0/15	0/24	$\chi2(2)=1.01$ p>.60	
ToM[1] Score		- 1.32 2.0 n=37	.84 1.27 n=14	1.63 .99 n=24	$F(2,73)=26.34$ p<.0001 (IH)	S<CT S<P

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; S=Schizophrenia; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders [1] Means and Standard Deviations for Z-scores

Missing Data As can be seen in Table 7.7, not all patients completed the test battery. Specifically, schizophrenia patients with pronounced paranoid symptoms refused or discontinued the Eyes Test. Several of these patients reported symptoms of anxiety while looking at the eye region of faces in this test.

Eyes Test There was a significant main effect of group. Post-hoc Scheffé indicated that the schizophrenia group had significantly lower scores compared to both the non-schizophrenia psychotic disorders and non-psychotic psychiatric disorders group.

Hinting Task The groups differed significantly in the number of hints correctly interpreted. As in the Eyes Test, patients with schizophrenia were significantly more impaired than both the non-schizophrenia psychotic disorders and non-psychotic psychiatric disorders group.

First-Order ToM Task Significant differences were found for the ToM question. This difference was also significant when patients were excluded who did not pass the reality question, $\chi_2(2)=8.57$, $p<.014$. Post hoc analysis showed that schizophrenia patients were significantly more impaired in this task than both the non-schizophrenia psychotic disorders group and non-psychotic psychiatric controls.

ToM Score Patient groups were also compared on the overall ToM score which was computed from z-scores of the three tasks. As expected, patients with schizophrenia were significantly more impaired than both the non-schizophrenia psychotic disorders group and the non-psychotic psychiatric disorders group.

Analysis of Covariance In order to control for the effects of differences in education and verbal IQ between groups, analyses of covariance were carried out for the overall ToM score and the Eyes Test. Correlations between task performance and level of education

and verbal IQ (Table 7.3) suggested that both variables could confound performance on these tasks. Although there was a significant effect of education and verbal IQ in the Eyes Test, differences between groups were still significant when differences in education and verbal IQ were controlled for (education: $F(2,75p)=10.27$, $p<.001$; verbal IQ: $F(2,75)=10.09$, $p<.001$). Similarly, there were significant effects for both variables on overall ToM performance. As in the previous analyses, differences between groups remained statistically significant (education: $F(2,73)=19.58$, $p<.001$; verbal IQ: $F(2,73)=19.48$, $p<.001$).

Table 7.8

Means, Standard Deviations, and Results of Analysis of Variance for Measures of Gestalt Perception

	Schizophrenia	Psychotic Non-schizophrenia	Non-Psychotic Disorders	Signific. Level	Post hoc
	(n=40)	(n=16)	(n=26)		
Test	M SD	M SD	M SD		
Contour Integration Task	.73 .05 n=40	.75 .05 n=16	.72 .03 n=25	$F(2,79)=1.73$ p>.19 (HV)	
Visual Size Context Perception Task	44.4 14.6 n=40	45.2 10.9 n=16	40.6 12.6 n=19	$F(2,72)=.77$ p>.47 (HV)	
No Context	26.4 3.2	26.2 3.1	28.9 2.0	$F(2,72)=5.88$ p<.004 (HV)	S<CT P<CT

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; S=Schizophrenia ; P=Non-Schizophrenia Psychotic Disorders; CT=Non-Psychotic Psychiatric Disorders

Contour Integration Task As in Studies 2 and 3, no significant differences emerged between the groups on the background-element to contour-element density ratio or delta (D).

Visual Size Perception Task There were no significant differences in the context condition of the visual size perception task. There was, however, a main effect of group for performance in the control condition. Post hoc Scheffé tests showed that both patient groups with psychotic disorders were less accurate in the estimation of circles which were not surrounded by context circles than the non-psychotic psychiatric control group.

7.4. Discussion

Data from three tasks which examined ToM in patients with chronic and acute schizophrenia suggest that schizophrenia patients are deficient in the ability to 'mentalize'. These results support previous findings which have reported significant impairment in ToM in schizophrenia. Specifically, the data from the Hinting Task replicates the findings from a study by Corcoran et al. (1995) which employed the same set of stories in patients with schizophrenia. Impaired eye recognition on a revised version of the Eyes Test (Baron-Cohen et al., 2001) supports the results of a previous study with schizophrenia patients (Kington, Jones, Watt, Hopkin, & Williams, 2000) which used an earlier version of this test. The finding that patients with schizophrenia are impaired in first-order ToM has not found consistent support in previous studies. The

findings from a study by Doody, Götz, Johnstone, Frith, and Owens (2001) suggested intact first-order ToM whereas Frith and Corcoran (1996) and Pickup and Frith (2001) reported significant impairment in patients with schizophrenia.

The second goal of the study was to examine the hypothesis that dysfunctional Gestalt perception is related to impairments in ToM (hypothesis 5). This hypothesis was partially supported in the study. Although patients with schizophrenia were not significantly impaired in the contour integration and visual size perception tasks, a significant correlation was obtained between overall ToM performance and impaired Gestalt perception in the visual size perception task, suggesting that more accurate estimation of the inner disks was related to deficits in mentalizing. Examination of the correlations between individual ToM tasks and visual size perception also indicates that this relationship does not hold for all ToM tasks. Significant correlations emerged only for the Hinting and visual size perception tasks whereas no significant correlation were found for the first-order ToM and the Eyes Test.

A relationship between deficits in ToM and dysfunctional visual cognition is compatible with the recent results from a study by Sergi and Green (2002). In this study, deficits in visual masking procedures in outpatients with a diagnosis of schizophrenia were related to reduced performance in the Half-Profile of Nonverbal Sensitivity (Rosenthal, Hall, Di Matteo, Rogers & Archers, 1979), a measure of social perception in which participants have to judge social cues, i.e., bodily gestures, facial expressions etc, from a videotape.

Correlations between ToM and Gestalt perception and psychotic symptomatology confirmed the results of the Studies 2 and 3. Besides performance in the visual size

perception and contour integration tasks, overall ToM scores were significantly correlated with the PANSS factors 'cognitive', suggesting that patients with increased disorganisation were more impaired in ToM. This relationship was not present in the non-schizophrenia psychotic group. Examination of the correlations between individual ToM tasks and factors of the PANSS showed that only the Hinting task was significantly correlated with psychotic syndromes. The PANSS factors 'cognitive', 'disorganisation', 'positive' and 'negative' correlated significantly with performance in this task. No significant correlations were obtained for the first-order ToM and the Eyes Test. Previous research which examined ToM and psychotic symptomatology have reported differential symptom correlates of ToM deficits in schizophrenia. The studies by Langdon et al. (1997) and Mazza, De Risio, Roncone, and Casachia (2001), for example, found that ToM deficits correlated with elevated levels of negative symptoms. Supporting the present findings, Sarfati, Hardy-Baylé, Brunet, and Widlöcher (1999) reported that ToM impairments are related to disorganisation in schizophrenia.

The present results suggest that deficits in ToM are not the result of lower levels of education and reduced verbal IQ in schizophrenia since differences in ToM performance in the Eyes Test and overall ToM score were still significant even when education and verbal IQ were entered as covariates. This finding would be consistent with previous research which has demonstrated ToM deficits in schizophrenia in tasks that assessed the comprehension of visual jokes (Corcoran et al., 1997) and comic strips (Sarfati et al., 1997), requiring less explicit verbal skills in the judgement of intentions of other people. The relationship between enhanced visual size perception and impaired ToM in schizophrenia furthermore indicates that such deficits may be reflecting a specific

deficit in the use of contextual information to recognize the mental states of others as opposed to a generalized deficit.

Finally, a significant correlation was observed between overall ToM performance and age of onset. It has been proposed that early onset of psychosis is indicative of neurodevelopmental schizophrenia (Jones et al., 1992) and impaired ToM may constitute another feature of this subtype of schizophrenia.

7.5 Comparison between Disorganised Schizophrenia/Schizoaffective Disorder vs. Non-Disorganised Schizophrenia/Schizoaffective Disorder vs. Non-Schizophrenia Psychotic Disorders vs. Non-Psychotic Psychiatric Disorders

7.5.1 Aims of the Study

On the basis of the findings from the first analysis which indicated that impairments in ToM are correlated with the disorganisation syndrome in schizophrenia, differences between disorganised and non-disorganised patients with schizophrenia and schizoaffective disorder in ToM were examined. Patients who received a rating higher than 3 (mild) on the PANSS item 'conceptual disorganisation' were assigned to the 'disorganised' group (n=12) whereas subjects who scored lower than 3 were assigned to a 'non-disorganised' group (n=36). Of the twelve patients in the disorganised group, four were recruited from an acute inpatient unit at Weill Medical College and two patients had

a diagnosis of schizoaffective disorder. In the non-disorganised group, 20 patients were chronic patients and 16 patients where recruited from a unit for acute psychotic disorders. Of the 36 patients in the non-disorganised schizophrenia/schizoaffective group, six participants had a diagnosis of schizoaffective disorders. Three patients with a diagnosis of schizoaffective disorder who were recruited from an outpatient department and five patients with psychotic disorders other than schizoaffective disorder where dropped from the analysis. Disorganised and non-disorganised patients were compared to the non-psychotic psychiatric control group (n=26).

7.5.2 Results

7.5.2.1 Demographic and Clinical Variables

Demographic and Clinical Variables Table 7.8 displays the main demographic variables. A significant main effect of group was found for verbal IQ between groups. Post hoc Scheffé tests indicated that the non-disorganised schizophrenia/schizoaffective group had a significantly lower verbal IQ than the non-psychotic psychiatric control group. Both psychotic disorders group were characterized by similar levels of verbal IQ and years of education.

Table 7.9

Means, Standard Deviations, and Mean Differences for Demographic and Clinical Variables of Participants

Variable	Disorganised Schizophrenia/ Schizoaffective (n=12) M SD	Non-Disorganised Schizophrenia Schizoaffective (n=38) M SD	Non-Psychotic Disorders (n=26) M SD	Signific. Level	Post hoc
Age (in years)	41.3 9.7	37.1 7.2	35.4 9.5	$F(2,75)=1.41$ p.>.25 (HV)	
Sex (Male/Female)	11/1	28/8	16/10	$\chi 2(2)=4.34$ p>.11	
Education (in years)	11.8 2.7	11.7 3.0	12.9 1.5	$F(2,75)=1.99$ p>.14 (IH)	
Age of onset (in years)	19.0 2.9	22.1 6.2		$t(2,49)=1.6$ p>.12 (IH)	
Shipley Vocabulary Score	24.7 6.1	23.0 7.6	28.9 5.6	$F(2,75)=5.02$ p<.01 (HV)	NDS<CT

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; DS=Disorganised Schizophrenia/Schizoaffective Disorder; NDS=Non-Disorganised Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Psychiatric Disorders; CT=Non-Psychotic Psychiatric Disorders

PANSS Data The three groups were compared on their total scores and individual factors of the PANSS (Table 7.10). The disorganised schizophrenia/schizoaffective group was characterized by higher levels of general psychopathology and scores on the PANSS factors 'disorganisation', 'cognitive', 'positive', and on the item 'conceptual disorganisation'. The difference between the two groups on the factor 'depression' did not reach statistical significance.

Table 7.10

Means, Standard Deviations, and Mean Differences for PANSS Scores for Disorganised Schizophrenia/Schizoaffective Disorder vs. Non-Disorganised Schizophrenia/ Schizoaffective Disorder Groups

	Disorganised Schizophrenia/ Schizoaffective		Non-Disorganised Schizophrenia/ Schizoaffective		Signific. Level
	(*n*=12)		(*n*=36)		
Factor/Item	M	SD	M	SD	
Positive	15.2	2.9	10.1	4.1	*t*(46)=4.12 (HV) p<.0001
Negative	18.0	4.4	15.4	5.3	*t*(46)=1.52, (HV) p>.13
Depression	12.1	3.5	11.4	4.2	*t*(46)=.49 (HV) p<.06
Disorganisation	11.4	2.2	5.9	1.9	*t*(46)= 8.47 (HV) p<.0001
Cognitive	18.8	3.8	11.7	3.1	*t*(46)=6.74 (HV) p<.0001
Excitement	10.6	4.3	8.9	3.3	*t*(46)=1.41 (HV) p>.15
Total Score	95.8	17.7	72.6	16.0	*t*(46)=4.73 (IV) p<.0001
Conceptual Disorganisation	4.6	.67	2.1	.89	*t*(46)=8.83 (HV) p<.0001

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance

7.5.2.2 Gestalt Perception and ToM in Disorganised Schizophrenia/Schizoaffective Disorder, Non-Disorganised Schizophrenia/Schizoaffective Disorder, and Non-Psychotic Psychiatric Disorders

Table 7.11

Means, Standard Deviations, and Results of Analysis of Variance for ToM Measures

Test		Disorganised Schizophrenia/ Schizoaffective (n=12) M SD	Non-Disorganised Schizophrenia Schizoaffective (n=36) M SD	Non-Psychotic Disorders (n=26) M SD	Signific. Level	Post hoc
Eyes Test		19.8 5.3 n=11	18.8 5.5 n=33	25.3 4.8 n=25	$F(2,67)=11.06$ p<.0001 (HV)	DS<CT NDS<CT
Hinting Task Task		9.4 4.3 n=12	13.9 3.3 n=35	17.9 1.8 n=25	$F(2,70)=23.2$ p<.0001 (IH)	DS<CT NDS<CT DS<NDS
First-Order ToM	ToM	6/6 n=12	11/23 n=34	2/23 n=25	$\chi2(2)=7.93$ p<.02	DS<CT NDS<CT[1]
	Reality	0/12	4/35	0/25	$\chi2(2)=4.49$ p>.11	
	Memory	0/12	1/38	0/25	$\chi2(2)=1.07$ p>.58	
ToM[2] Score		-2.1 1.7 n=11	-.58 2.1 n=32	1.7 .99 n=24	$F(2,64)=21.21$ p<.00 (IH)	DS<CT NDS<CT NDS<DS

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; DS= Disorganised Schizophrenia/Schizoaffective Disorder; NDS=Non-Disorganised Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Psychiatric Disorders; CT=Non-Psychotic Psychiatric Disorders

[1] This comparison was not significant if patients who did not pass the reality question were excluded

[2] Means and Standard Deviations for Z-scores

Eyes Test There was a significant main effect of group. Post-hoc Scheffé tests indicated that the disorganised and non-disorganised schizophrenia/schizoaffective groups had significantly lower scores compared to the non-psychotic psychiatric control group. The schizophrenia/schizoaffective groups did not differ from each other.

Hinting Task The groups differed significantly in the number of hints correctly interpreted. As in the Eyes Test, patients in the disorganised and non-disorganised schizophrenia/schizoaffective groups were significantly impaired compared to the non-psychotic psychiatric controls. Intergroup differences were also found for the schizophrenia/schizoaffective groups. Disorganised patients interpreted significantly less hints than the non-disorganised schizophrenia/schizoaffective group.

First-Order ToM Task Significant differences were found for the ToM question. Post-hoc tests indicated that both psychotic groups differed significantly from the non-psychotic psychiatric control group. However, only the difference between the disorganised schizophrenia/schizoaffective group and the non-psychotic psychiatric group were statistically significant when only those patients were considered who passed the reality question.

ToM Score There was a significant main effect of group for the overall ToM score. Post hoc Scheffé indicated that patients in the disorganised schizophrenia/schizoaffective group were more impaired than both the non-disorganised schizophrenia/schizoaffective group and the non-psychotic psychiatric control group. The comparison between the non-

disorganised schizophrenia/schizoaffective group also reached statistically significant levels.

Table 7.12

Means, Standard Deviations, and Results of Analysis of Variance for Measures of Gestalt Perception

Test		Disorganised Schizophrenia/ Schizoaffective (n=12) M SD	Non-Disorganised Schizophrenia Schizoaffective (n=36) M SD	Non-Psychotic Disorders (n=26) M SD	Signific. Level	Post hoc
Contour Integration Task		.75 .07 n=12	.72 .05 n=36	.72 .04 n=24	$F(2,69)=2.16$ p>.12 (HV)	
Visual Size Perception Task	Context	52.3 10.1 n=12	41.6 13.8 n=36	40.5 12.6 n=19	$F(2,64)=3.70$ p<.03 (HV)	DS<NDS
	No Context	26.4 2.4	26.3 3.2	28.9 2.0	$F(2,70)=5.90$ p<.02 (HV)	NDS<CT

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; DS=Disorganised Schizophrenia/Schizoaffective Disorder; NDS=Non-Disorganised Schizophrenia/Schizoaffective Disorder; P=Non-Schizophrenia Psychotic Psychiatric Disorders; CT=Non-Psychotic Psychiatric Disorder

Contour Integration Task No significant differences emerged between the groups on the background-element to contour-element density ratio or delta (D).

Visual size perception task There was a main effect of group for the number of circles correctly identified in the context condition of this task. Post hoc Scheffé tests indicated

that the disorganised schizophrenia/schizoaffective group was significantly more accurate in the estimation of the inner disk compared to the non-disorganised group. There was a trend for a statistically significant difference between the disorganised schizophrenia/schizoaffective group and the non-psychotic psychiatric control group.

There was also a significant main effect of group for the control condition 'no context'. The results showed a statistical trend for disorganised schizophrenia/ schizoaffective patients to identify fewer circles than the non-psychotic psychiatric controls. The intergroup comparison between non-disorganised schizophrenia/ schizoaffective and non-psychotic psychiatric group was statistically significant.

7.5.3 Discussion

Comparisons between disorganised and non-disorganised patients with schizophrenia/schizoaffective disorder suggest that disorganised patients are characterized by more severe impairments in ToM than non-disorganised patients as indicated by significant differences on the Hinting Task and overall ToM score. The study confirms findings from research by Sarfati et al. (1999) which demonstrated that disorganised schizophrenia patients are characterized by deficits in the ability to attribute intentions to other people. Differences in ToM in this study varied with individual tasks, however. Thus, impairments in first-order ToM were only present in the disorganised schizophrenia/schizoaffective group when patients who did not pass the reality question were excluded. Disorganised and non-disorganised schizophrenia/schizoaffective patients did not differ on the Eyes Test. Data from the Hinting Task suggest that disorganised

patients are characterized by more severe impairments which, to a lesser degree, are also present in non-disorganised patients.

The comparison between the schizophrenia/schizoaffective groups also allows conclusions regarding the role of IQ in ToM deficits in schizophrenia. Although the two schizophrenia/schizoaffective groups differed significantly in ToM performance, both groups were characterized by similar levels of verbal IQ and levels of education. Accordingly, impaired performance in ToM tasks in schizophrenia cannot be solely attributed to reduced IQ.

Differences on the two measures of Gestalt perception were observed. Patients with disorganised schizophrenia/schizoaffective disorder were significantly more accurate in the context condition of the visual size perception task. The study thus demonstrates that more severe impairment in ToM in schizophrenia is accompanied by reduced responsiveness to Gestalt properties of stimuli (hypothesis 5). Although patients in the disorganised group were more impaired in the contour integration task than both the non-disorganised patients and the non-psychotic psychiatric controls, differences in this task did not reach statistically significant levels.

7.6 Comparison Between Acute Schizophrenia/Schizoaffective Disorder vs. Chronic Schizophrenia/Schizoaffective Disorder vs. Non-Psychotic Psychiatric Disorders

7.6.1 Aims of the Study

In order to examine the effects of chronicity and outcome on ToM and Gestalt perception in schizophrenia and schizoaffective disorder, patients with acute and chronic schizophrenia/schizoaffective disorder were assigned into an acute schizophrenia/ schizoaffective group (n=20) and into a chronic schizophrenia/schizoaffective group (n=28). The two groups were compared to patients with non-psychotic psychiatric disorders (n=26). The acute schizophrenia/schizoaffective group consisted of seven patients with schizoaffective disorder and 13 patients with schizophrenia. Twenty-seven of the 28 patients in the chronic group were diagnosed with schizophrenia.

7.6.2 Results

7.6.2.1 Demographic and Clinical Variables

A significant main effect of group was observed for the level of education. Post hoc Scheffé tests indicated that the chronic schizophrenia group had significantly less years of education than the non-psychotic psychiatric group. There was a trend for chronic patients with schizophrenia to have an earlier onset of psychiatric symptoms than the acute schizophrenia group. The three groups did not differ in the variables age and sex proportion.

Table 7.13

Means, Standard Deviations, and Mean Differences for Demographic and Clinical Characteristics of Participants

Variable	Chronic Schizophrenia/ Schizoaffective (n=28) M SD	Acute Schizophrenia Schizoaffective (n=20) M SD	Non- Psychotic Disorders (n=26) M SD	Signific. Level	Post hoc
Age (in years)	37.9 8.6	38.1 7.3	37.5 8.2	$F(2,72)$=.19 p>.83(HV)	
Sex (Male/Female)	23/5	16/4	15/11	$\chi 2(2)$=3.46 p>.18	
Education (in years)	11.1 2.6	12.5 3.1	12.9 1.5	$F(2,72)$=4.10 p<.03 (IH)	CS<AS
Age of onset (in years)	19.4 3.8	22.5 5.5		$t(47)$=1.95 p<.06 (HV)	
Shipley Vocabulary Score	23.2 9.2	23.2 5.2	28.9 5.6	$F(2,72)$=5.23 p>.008 (IH)	CS<CT AS<CT

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; CS=Chronic Schizophrenia/Schizoaffective Disorder; AS=Acute Schizophrenia/Schizoaffective Disorder; CT=Non-Psychotic Psychiatric Disorders

PANSS Data Chronic schizophrenia/schizoaffective disorder and acute schizophrenia/ schizoaffective disorder groups were compared on the overall score and individual factors of the PANSS (Table 7.14). No significant group differences emerged for the individual factors nor for general levels of psychopathology.

Table 7.14

Means, Standard Deviations, and Mean Differences for PANSS Scores for Chronic Schizophrenia/Schizoaffective Disorder and Acute Schizophrenia/Schizoaffective Disorder Groups

Factor/Scale	Chronic Schizophrenia Schizoaffective (n=28) M	SD	Acute Schizophrenia Schizoaffective (n=20) M	SD	Signific. Level
Total Score	79.8	17.3	78.3	18.7	$t(46)=.29$ p>.77 (HV)
Positive	11.6	4.3	10.8	4.6	$t(46)=.75$ p>.46 (HV)
Negative	17.3	4.7	15.9	5.2	$t(46)=1.03$ p>.31 (HV)
Depression	11.3	4.3	11.9	3.8	$t(46)=.48$ p>.64 (HV)
Disorganisation	7.6	3.2	6.7	3.0	$t(46)=1.07$ p>.29 (HV)
Cognitive	13.5	4.7	13.5	4.3	$t(46)=.03$ p>.98 (HV)
Excitement	7.6	3.2	9.9	4.0	$t(46)=1.14$ p>.26 (HV)
Conceptual Disorganisation	2.9	1.3	2.5	1.4	$t(46)=1.2$ p>.24 (HV)

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance

7.6.2.2 ToM and Gestalt Perception in Chronic Schizophrenia/ Schizoaffective Disorder vs. Acute Schizophrenia/Schizoaffective Disorder vs. Non-Psychotic Psychiatric Disorders

Table 7.15

Means, Standard Deviations, and Results of Analysis of Variance for ToM Measures

Test		Chronic Schizophrenia/ Schizoaffective (n=28) M SD	Acute Schizophrenia/ Schizoaffective (n=20) M SD	Non-Psychotic Disorders (n=26) M SD	Signfic. Level	Post hoc
Eyes Reading Test		18.1 5.7 n=27	20.4 4.9 n=17	25.3 4.8 n=25	$F(2,66)=10.35$ p<.0001 (HV)	CS<CT AS<CT
Hinting Task		12.3 4.9 n=28	13.5 4.3 n=19	17.9 1.8 n=25	$F(2,70)=12.59$ p<.0001 (IH)	CS<CT AC<CTA
First-Order ToM	ToM	12/16 n=28	5/13 n=18	2/22 n=24	$\chi2(2)=7.79$ p<.02	CH<CT
	Reality	2/26	2/16	0/24	$\chi2(2)=2.53$ p>.28	
	Memory	1/27	0/19	0/24	$\chi2(2)=1.52$ p>.47	
ToM[1] Score		-1.52 2.1 n=27	-.05 1.75 n=16	1.62 -.99 n=24	$F(2,68)=21.95$, p<.0001 (IH)	CS<CT AS<CT CS<AS

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; CS=Chronic Schizophrenia/Schizoaffective Disorder; AS=Acute Schizophrenia/Schizoaffective Disorder; CT=Non-Psychotic Psychiatric Disorders

[1]Means and Standard Deviations for Z-scores

Eyes Test There was a significant main effect of group. Post-hoc Scheffé indicated that both chronic and acute patients with schizophrenia/schizoaffective disorder had significantly lower scores compared to the non-psychotic psychiatric control group. The schizophrenia/schizoaffective groups did not differ from each other.

Hinting Task The groups differed significantly in the number of hints correctly interpreted. As in the Eyes-Test, patients in the disorganised and non-disorganised schizophrenia/schizoaffective groups were significantly impaired compared to the non-psychotic psychiatric control group.

First-Order ToM Task Significant differences were found for the ToM question in the first-order ToM task. Post-hoc Scheffé tests indicated that only the chronic schizophrenia/schizoaffective group differed significantly from the non-psychotic psychiatric control group.

ToM Score There was a significant main effect of group for the ToM score. Post hoc Scheffé indicated that patients in the chronic schizophrenia/schizoaffective group were more impaired than both the acute schizophrenia/schizoaffective group and the non-psychotic psychiatric disorders group. The comparison between the acute schizophrenia/schizoaffective group and the non-psychotic psychiatric group also reached statistically significant levels.

Table. 7.16

Means, Standard Deviations, and Results of Analysis of Variance for Measures of Gestalt Perception

Test		Chronic Schizophrenia/ Schizoaffective (n=28) M SD	Acute Schizophrenia/ Schizoaffective (n=20) M SD	Non-Psychotic Disorders (n=26) M SD	Signific. Level	Post hoc
Contour Integration Task		.73 .05 *n*=27	.73 .05 *n*=20	.72 .04 *n*=24	*F*(2,70)=.54 p>.58 (HV)	
Visual Size Perception Task	Context	48.6 13.1 *n*=27	37.7 12.9 *n*=20	40.5 12.5 *n*=19	*F*(2,65)=4.69 p<.01 (HV)	CS<CT
	No Context	26.8 2.8	25.4 2.7	29.0 2.0	*F*(2,65)=8.28 p<.001 (HV)	AS<CT

Note. Post hoc comparisons were computed with the Scheffé test; (IV): inhomogeneous variance (Levine statistic: p<.05); (HV): homogeneous variance; CS=Chronic Schizophrenia/Schizoaffective Disorder; AS=Acute Schizophrenia/Schizoaffective Disorder; CT=Non-Psychotic Psychiatric Disorders

Contour Integration Task No significant differences emerged between the groups on the background-element to contour-element density ratio or delta (D).

Visual Size Perception Task There was a significant main effect of group for both the number of circles identified in the context and control conditions of the visual size perception task. Post hoc Scheffé tests indicated that the chronic patients with schizophrenia were significantly more accurate than the acute schizophrenia/schizoaffective group. Intergroup difference between the chronic schizophrenia group and the non-psychotic psychiatric disorders group did not reach statistically significant levels.

Statistically significant differences also emerged for comparisons in the control condition. The acute schizophrenia/schizoaffective group was less accurate in size estimation than the non-psychotic psychiatric group. The post hoc comparison between the chronic schizophrenia/schizoaffective group and the non-psychotic psychiatric group did not reach statistical significance.

7.6.3 Discussion

Comparisons between chronic and acute forms of schizophrenia/schizoaffective disorder on measures of Gestalt perception and ToM suggest that chronicity and outcome are associated with more severe ToM deficits and impaired Gestalt perception. Schizophrenia patients who were recruited from rehabilitation units for chronic psychotic disorders were characterized by significantly reduced responsiveness to Gestalt properties of stimuli in the visual size perception task than patients who had an acute psychotic episode but who were subsequently discharged. This finding corresponds with previous research which reported that dysfunctional Gestalt perception is related to chronicity of illness (Parnas et al., 2001) and a predictor for rehabilitation outcome in patients with chronic schizophrenia (Knight & Silverstein, 1998). Differences were also observed for performance on ToM tasks. Specifically, patients with chronic schizophrenia had a significantly reduced overall ToM score than the acute schizophrenia/schizoaffective group and were characterized by a deficit in first-order ToM which was not present in the acute schizophrenia/schizoaffective group. Poor social functioning is thought to be associated with heightened vulnerability to relapse and rehospitalization after discharge (Anthony & Liberman, 1992) which is likely to be mediated by poor social cognition.

These results cannot be attributed to differences in symptomatology since both groups had comparable levels of disorganisation and did not differ on any other factor of the PANSS. The groups differed on other variables, however, which might be relevant for the differences observed. Although acute and chronic patients had similar levels of verbal IQ, patients in the chronic schizophrenia group had significantly less years of education than the non-psychotic psychiatric controls.

The differences between the psychotic groups may also be related to the higher number of patients with schizoaffective disorder in the acute group. In a separate analysis, patients with acute and chronic schizoaffective disorder (n=7) were compared to both chronic and acute patients with schizophrenia. Overall, the results suggest that schizoaffective patients were largely unimpaired in ToM but performed similarly to the acute patients in the visual size perception and contour integration tasks.

8. DISCUSSION

The aim of the research was to investigate Gestalt perception in schizophrenia spectrum disorders with a battery of novel tasks and to examine specific hypotheses regarding the nature of such deficits and their clinical and cognitive correlates. Previous studies found evidence for dysfunctional Gestalt perception in schizophrenia spectrum disorders (e.g., Place & Gilmore, 1980; Silverstein et al., 1996) but others (e.g., Rief, 1991; Chey & Holzman, 1997) did not support this finding. The type of dysfunction identified also varied across studies. The deficits in Gestalt perception reported by Carter et al. (1996) and Granholm et al. (1999), for example, are not compatible with the notion that schizophrenia spectrum disorders are characterized by reduced responsiveness to Gestalt properties of stimuli. These divergent findings can be related to differences in the tasks employed, the diverse patient populations studied, and experimental designs which do not allow a differentiation between generalized performance deficiencies and a specific cognitive deficit. There is also conflicting evidence as to which syndromes correlate with dysfunctional Gestalt perception. Past research has associated all three syndromes of schizophrenia spectrum disorders (positive, negative, and cognitive) with dysfunctional Gestalt perception.

The results reported in this thesis may clarify several of these issues. The main finding which emerged from the four studies which examined Gestalt perception in schizotypy (Study 1) and both acute and chronic patient groups with a diagnosis of schizophrenia/schizoaffective disorder (Studies 2-4), is that impairments in Gestalt perception are specific to disorganised forms of schizophrenia spectrum disorders. This

conclusion is supported by data which show that: 1) dysfunctional Gestalt perception is correlated with the PANSS factors 'disorganisation' and 'cognitive'. No other syndromes were consistently associated with cognitive deficits (Studies 2-4); 2) dysfunctional Gestalt perception is pronounced in patients and non-clinical subjects with elevated levels of thought disorder (Studies 1-4); and 3) reductions in the PANSS factor 'cognitive' emerged as the only predictor for improvement on measures of Gestalt perception in acute schizophrenia (Study 2). This research is the first to demonstrate that diverse clinical and non-clinical populations within the schizophrenia spectrum share a common impairment in Gestalt perception which is linked to the disorganisation component of psychotic symptomatology. This impairment is unlikely to be the result of a generalized deficit in schizophrenia spectrum disorders since dysfunctional Gestalt perception could be demonstrated in tasks in which reduced responsiveness to Gestalt properties of stimuli resulted in a performance advantage. Superior task performance was found in all studies of the research. Finally, the data from Study 4 provide evidence to support the view that dysfunctional Gestalt perception in schizophrenia spectrum disorders may be related to deficits in ToM.

Thus, the findings of this research provide a novel perspective on Gestalt perception in schizophrenia spectrum disorders. In contrast to previous research (e.g., Goodarzi et al., 2000; Place & Gilmore, 1980; Silverstein et al., 2000), which demonstrated that dysfunctional Gestalt perception is associated with schizophrenia spectrum disorders, the research could not confirm this relationship (hypothesis 1). Instead, the present research suggests that a subgroup within the schizophrenia spectrum disorders with disorganised symptoms displayed a prominent impairment in this

cognitive function. The absence of overall group differences raises the question whether the experimental tasks were not powerful enough to detect differences between groups. The post hoc power analyses (Appendix B) suggest that the measures of Gestalt perception employed in this research differed significantly in power. Thus, the negative findings in the initial analyses in Study 1 which tested for overall group differences between schizotypal and low schizotypal participants could be interpreted as reflecting the small effects of the tasks employed. However, the results of this study were recently confirmed in a study by Siva (2001) which investigated Gestalt perception in schizotypy with the computerized version of the visual size perception task which was also used in Studies 3 and 4. Siva demonstrated that schizotypal participants with elevated scores on the factor 'disorganisation' of the SPQ (Raine et al., 1991) were more accurate in size perception than non-disorganised schizotypal participants. Significant differences between schizotypal and non-schizotypal participants were not found. These data mirror the findings obtained in Study 1 where thought disordered schizotypal participants were significantly more accurate in the visual size perception task (manual version) than non-thought disordered and low-schizotypal participants. In addition, significant group differences were not found in the large majority of studies in the present research with experimental tasks that had an adequate degree of statistical power. The finding that dysfunctional Gestalt perception was only associated with a subgroup of schizophrenia spectrum disorders with elevated levels of disorganisation can, therefore, not be interpreted as reflecting low statistical power of the measure of Gestalt perception used in the present research.

The influence of a sampling bias cannot be ruled out completely. It is possible that the inclusion of a large number of patients from a single site created an 'environmental mold situation' wherein the association between cognitive dysfuntions and a subtype of schizophrenia spectrum disorders may reflect an artifact of sampling bias. However, this is unlikely for several reasons: 1) patients recruited from the 'Second Chance Program' at New York Presbyterian Hospital were similar in premorbid functioning and disability to previous patient populations in which dysfunctional Gestalt perception was found (S. Silverstein, personal communication, February 1, 2003); 2) the association between a disorganised subtype of schizophrenia spectrum disorders and dysfunctional Gestalt perception was found in several patient groups, both chronic and acute, as well as in non-clinical populations with elevated levels of schizotypy.

Comparison with previous studies nonetheless suggests that patients studied in this research differed in clinically relevant variables. Compared to the study by Silverstein et al. (2000), for example, which reported significant differences between patients with chronic schizophrenia, non-schizophrenia psychotic disorders, and normal controls on a contour integration task, schizophrenia patients in Study 3 were characterized by significantly lower levels on the PANSS factors 'cognitive' ($t(57) = 2.61$, $p<.01$) and 'disorganisation' ($t(57) = 2.28$, $p<.04$) than schizophrenia patients in the Silverstein et al. study. On the basis of this finding, one could hypothesize that lower levels of disorganisation in schizophrenia patients contributed to the negative findings in this research since disorganised symptoms emerged as the main clinical correlate of dysfunctional Gestalt perception.

Differences in symptomatology and cognitive functioning could possibly be attributed to the high proportion of schizophrenia patients who were treated with atypical antipsychotic medication in this research. The comparison with schizophrenia patients in the Silverstein et al. study does not support this conclusion. In both studies, the proportion of patients who were treated with atypical antipsychotics was the same (>90%). The evidence on the efficacy of atypical medication in improving cognitive functioning is also controversial. Studies have demonstrated both improved performances on neuropsychological test batteries (Purdon, Jones, Stip et al., 2000) and symptomatology (Manschreck, Redmond, Candela & Maher, 1999) as well as absent or minimal effects (Green, Marder, Glynn et al., 2002).

Alternatively, it has been speculated that disorganised (hebephrenic) forms of schizophrenia are disappearing within industrialized societies (Morrison, 1974). This trend may represent the impact of early psychopharmacologic intervention on the clinical presentation. Accordingly, patient samples in current research studies may include a greater number of patients with subtypes of schizophrenia which are characterized by relatively intact cognitive and intellectual abilities, i.e., paranoid or undifferentiated schizophrenia.

The finding that impaired Gestalt perception is specific to disorganised forms of schizophrenia spectrum disorders is compatible with previous research (Silverstein et al, 1996) in which dysfunctional Gestalt perception was related to a subtype of schizophrenia. Studies by Knight et al. (2000) and Silverstein et al. (1996), for example, demonstrated that impaired Gestalt perception was only found in patients with poor premorbid social functioning but not in schizophrenia patients with good premorbid

histories and the results of a study by Cox and Leventhal (1978) showed that dysfunctional Gestalt perception was present in non-paranoid schizophrenia patients whereas paranoid patients had intact Gestalt perception.

The pattern of performance in experimental tasks for disorganised forms of schizophrenia spectrum disorders suggests that such deficits reflect impairments in the organisation of visual stimuli based on context (Hypothesis 1a). The research design was guided by a process-orientated approach (Knight & Silverstein, 2000) to predict a theory-driven pattern of performance that should be found when Gestalt perception should function either adequately or inadequately. Moreover, the experimental tasks in this research represent robust measures of Gestalt perception. Performance for disorganised forms of schizophrenia spectrum disorders precisely confirmed the predictions. Participants with clinical and non-clinical forms of disorganised schizophrenia spectrum disorders were impaired in the contour integration and visual closure tasks where dysfunctional Gestalt perception was hypothesized to lead to a performance deficit. In the visual size perception task, patients with disorganised forms of schizophrenia spectrum disorders displayed a performance advantage across all studies which was the result of the insensitivity to the surrounding visual context. This result was obtained with two different paradigms which were developed over the period of the research. Reduced sensitivity to contextual elements in the visual size perception task refutes the predictions derived from a general deficit model since this model cannot account for a specific task superiority (Knight & Silverstein, 2000).

Performance advantages in the contour integration and visual closure tasks were not expected on the basis of the a priori hypothesis that schizophrenia spectrum disorders

are characterized by reduced responsiveness to Gestalt properties of visual stimuli (hypothesis 1). Nevertheless, the results obtained in these tasks do raise the question whether deficits in task performance are primarily the result of impaired Gestalt perception or reflect confounds from generalized performance deficiencies in schizophrenia spectrum disorders. Performance in the contour integration and visual closure tasks were not significantly correlated with the visual size perception task, except for Study 3. Significant correlations between these tasks would have provided evidence for the hypothesis that performance was linked to a single, underlying impairment in Gestalt perception resulting both in performance advantages and disadvantages across tasks. The absence of correlations between the majority of tasks also did not confirm the hypothesis that different measures of Gestalt perception are related to a single construct (hypothesis 2). Robust correlations were observed between the visual closure and contour integration tasks which were not present in the non-psychotic psychiatric group. This could be interpreted as further evidence against the hypothesis that reduced performance in schizophrenia spectrum disorders in both tasks reflects a generalized performance deficiencies. Performance in both tasks may be driven by illness-related factors of psychotic disorders leading to a statistical association which does not reflect a primary impairment in Gestalt perception. However, a significant correlation was found between the visual size perception and visual closure tasks in Study 3 as well as a statistically significant association and statistical trends between the contour integration and visual size perception tasks in Studies 1 and 2 for schizophrenia patients and schizoptypal participants. These relationships were not observed in other patient groups and suggest that a single cognitive mechanism accounted for these results.

There are other arguments which speak against the interpretation of the results in the contour integration and visual closure tasks in terms of generalized performance deficiencies in schizophrenia spectrum disorders. Impairments in both tasks were reliably correlated with elevated levels on the PANSS factors 'disorganisation' and 'cognitive' in patients with schizophrenia, replicating the findings of a number of previous studies (Izawa &Yamamoto, 2002; Silverstein et al., 1998a, 2000) which reported an association between clinical disorganisation and impaired Gestalt perception in schizophrenia spectrum disorders. If reduced performance in the visual closure and contour integration tasks reflected primarily illness-related factors, other psychotic syndromes should be related to impairments in Gestalt perception. Negative symptoms, for example, describe various symptoms which interfere with neuropsychological assessment, i.e., apathy, poor rapport etc, and are associated with impairments in multiple cognitive functions (Bilder et al., 1985; Liddle, 1987b). Despite this relationship, no significant correlations were found for performance in the visual closure and contour integration tasks and elevated levels of negative symptoms across studies in schizophrenia patients. Significant impairments in contour integration were also demonstrated in schizotypal, thought disordered participants, supporting the hypothesis that impairments in Gestalt perception in the contour integration task, for example, are not the result of neuroleptic medication, chronic understimulation etc., which are associated with the clinical forms of schizophrenia spectrum disorders.

The deficit in Gestalt perception in the present research differs significantly from previous findings in the literature. A large body of evidence suggested that schizophrenia spectrum disorders are characterized by significant impairments in Gestalt perception,

primarily in tasks in which preceding context mediated through top-down contextual information is used to organise information efficiently (Knight & Silverstein, 1998). Dysfunctional Gestalt perception can be further remediated by strengthening contextual, top-down input (Silverstein et al., 1996), and perceptual grouping involving the earliest stages of visual processing appears to be intact (Rabinowicz et al., 1996). Thus, it is unclear to what extent impairments in Gestalt perception in schizophrenia spectrum disorders are also related to a deficient use of concurrent context. The evidence from the present research suggests that concurrent context is also impaired in schizophrenia spectrum disorders. The contour integration and visual size perception tasks are examples of Gestalt perception in which the grouping of stimulus elements is dependent on concurrent context. Preserved contour integration, for example, has been demonstrated in a visual agnosic patient with intact V1 but severely damaged occipital areas beyond V1, highlighting the sufficiency of V1 in mediating contour integration (Giersch, Humphreys, Boucart, & Kovásc, 2000). Although attentional factors are known to modulate the strength of contextual interactions in primary in V1 (Gilbert, Ito, Kapadia, & Westheimer, 2000), it is unlikely that dysfunctional Gestalt perception in both the contour integration and visual size perception tasks are primarily due to the impaired modulation of contextual top-down influences. Attentional modulation of context effects in the visual size perception task is relatively small, for example, in comparison to the effect of the context elements on the estimation of target circles (Coren & Girgus, 1980).

In contrast to the visual size perception and contour integration tasks, performance in the visual closure task may critically involve higher cortical areas which are responsible for retrieval of information from long-term memory. Studies examining

the neural correlates of Mooney faces and learning of degraded Mooney-like images suggest that perception recruits parietal areas that have been implicated in mental imagery and visual working memory (Dolan et al., 1997; Rodriguez et al., 1998). On the basis of these findings, Dolan et al. (1997) proposed that reconstruction of object (or face) representations from fragmentary evidence reflect an interaction of mnemonic, imagery, and attentional processes with category specific stimuli. The reduced ability of disorganised patients with schizophrenia spectrum disorders to perceptually group the fragmented component parts of faces in the visual closure task may, therefore, be interpreted as a deficit in the matching of current sensory input with memory and possibly attentional processes.

The hypothesis that schizophrenia spectrum disorders are characterized by dysfunctional Gestalt perception is also supported by the phenomenology of the disorder which was reviewed in chapter 1 (pp. 27). These reports indicate that patients lose the ability to perceive coherent objects in their natural context, both at the level of individual objects and of the overall coherence of a visual scene. Moreover, the findings of this and previous research confirm a number of specific hypotheses based on phenomenological data. Matussek (1987) proposed that deficits in Gestalt perception are related to the severity of the illness. This is supported by Study 2, for example, which demonstrates that deficits in Gestalt perception are pronounced during periods of symptom exacerbation and remit with reductions of symptoms. Matussek (1987, p.91) also proposed that awareness of appropriate contextual relationships could be brought about by drawing attention to relevant information, but that this awareness of context would be of only limited duration and would soon disintegrate. The ability to improve perceptual

organisation and other forms of context processing in schizophrenia through attentional manipulations has been demonstrated experimentally (Silverstein et al., 1996a, Study 2), as has the temporary nature of the effect (Nuechterlein 1977).

The association between the PANSS factors 'disorganisation' and 'cognitive' and impaired Gestalt perception confirms the hypothesis that dysfunctional Gestalt perception in schizophrenia spectrum disorders is related to the disorganisation syndrome (hypothesis 3). This association was only partially supported in Study 1. In this study, dysfunctional Gestalt perception was found not to correlate with the factor 'disorganisation' of the SPQ. However, the comparison between thought disordered and non-thought disordered schizotypal participants indicated that thought disorder was related to dysfunctional Gestalt perception. Thought disorder has been consistently identified as a core component of the disorganisation syndrome (Cuesta & Peralta, 1995).

The finding that dysfunctional Gestalt perception is linked to the disorganisation syndrome contrasts with a body of work in this field which reported both negative (Doninger et al., 2001) and positive symptoms (Carter et al., 1998; Goodarzi et al., 2000; Peters et al., 2002) as clinical correlates of dysfunctional Gestalt perception in schizophrenia spectrum disorders. The association between positive symptoms of schizophrenia spectrum disorders and dysfunctional Gestalt perception was partially supported by the significant correlation between reduced sensitivity to context elements in the visual size perception task and elevated levels of positive symptoms in Studies 2, 3, and 4. In addition, schizophrenia patients with elevated levels of paranoid symptomatology, a positive symptom, were characterized by dysfunctional Gestalt perception on some cognitive tasks in Studies 2-3. However, correlations between

positive symptoms and superior performance were consistently smaller than the associations between the PANSS factors 'disorganisation' (Studies 2-4) and 'cognitive' (Studies 3&4) and reduced context sensitivity and dysfunctional Gestalt perception was not present in the majority of tasks for paranoid schizophrenia patients in Studies 2-3.

The present research provides novel perspectives on the specificity of dysfunctional Gestalt perception in schizophrenia and other psychotic disorders. Impairments in Gestalt perception were not found in non-schizophrenia psychotic disorders, except for Study 2. Patients in this group were characterized by performance which was comparable to the schizophrenia group. Subsequent analysis in which patients with schizoaffective disorder were excluded suggested that patients with non-schizophrenia disorders were not impaired. Performance for this group was also more indicative of a generalized deficit, as performance was significantly correlated with elevated negative symptoms. Differences between the groups emerged also in the relationship between psychotic symptomatology and cognitive performance. Thus, the association between the disorganisation syndrome and dysfunctional Gestalt perception was a specific feature of schizophrenia.

The present research was also concerned with providing evidence for the hypothesis that dysfunctional Gestalt perception represents a mediating vulnerability marker (hypothesis 4). Dysfunctional Gestalt perception was found in thought disordered schizotypal participants and in chronic and acute patients with schizophrenia/ schizoaffective disorder. Performance of acute patients varied with clinical state (Study 2) which would be consistent with the concept of mediating vulnerability marker. The preliminary evidence from Study 2 suggests that not all measures of Gestalt perception

may fulfill these criteria, however, since performance in the visual size perception task, condition 'enlarging', was relatively stable between testing points and not correlated with changes in symptomatology.

The results from Study 4 suggest that dysfunctional Gestalt perception may be related to deficits in ToM (hypothesis 5). Reduced context-sensitivity in the visual size perception task was correlated with impaired performance in ToM tasks. Disorganised patients with schizophrenia/schizoaffective disorder were also significantly more impaired in ToM, which was accompanied in this group by superior performance in the visual size perception task. A relationship between dysfunctional Gestalt perception and impaired ToM in schizophrenia spectrum disorders would be consistent with recent evidence from developmental psychology and cognitive neuroscience, demonstrating that Gestalt perception may be critical for the early development of precursors of ToM. Blakemore and Decety (2001) proposed, on the basis of psychophysical and functional neuroimaging evidence, that biological motion is processed as a special category from which mental states, such as intentions, are automatically inferred. Biological motion perception is a paradigmatic example of Gestalt processes and the source from which infants derive their first interpretations of other people's intention. Baldwin, Baird, Saylor, and Clark (2001), for example, demonstrated that 10-11-month-old infants are sensitive to the organisation of intentional actions by parsing ongoing behaviour along the boundaries correlated with the initiation and completion of intentions. Impairments in Gestalt perception may not only impact on possible precursors of ToM but also contribute to patients' enduring deficits in social cognition. Cramer, Bowen, and O'Neill (1992) hypothesized that impaired social judgement in patients with schizophrenia

reflected a reduced ability to organise observed behaviour based on expectations generated by previous experiences. Dysfunctional Gestalt perception may also impact on the rapid judgement of facial cues, for example, a crucial component in social interaction which involves holistic, perceptual processes (Young, Hellawell, & Hay, 1987).

8.1 Evaluation of Models of Cognitive Dysfunctions in Schizophrenia Spectrum Disorder

An explicit aim of the present work was to evaluate the findings from the perspective of current models of cognitive dysfunctions in schizophrenia spectrum disorders. Table 8.2 presents a comparative summary of how well each model can account for the findings of the research. The table illustrates that the model by Phillips and Silverstein (in press) accounts best for the findings of this research. The model predicts that dysfunctional cognitive processes in schizophrenia spectrum disorders involve deficits in both the processing of concurrent and preceding contextual information and that such deficits are related to disorganisation in schizophrenia spectrum disorders. These predictions found consistent support throughout the studies in this research.

The pattern of performance on measures of Gestalt perception in the present work is not compatible with several models of cognitive dysfunctions in schizophrenia spectrum disorders. For example, Nuechterlein and Dawson (1984) assume that cognitive deficits in schizophrenia spectrum disorders are the result of a "reduced amount of processing capacities available for task-relevant cognitive operations" (p. 192). Although

Table 8.2

Evaluative Summary of the Validity of Six Models of Cognitive Dysfunctions in Schizophrenia Spectrum Disorders

Model	Definition of Cognitive Deficit	Location of Cognitive Deficit	Clinical Correlates	Pathophysiology
Attentional Dysfunction				
Chapman & McGhee (1961), Frith (1979)	-	-	-	=
Nuechterlein & Dawson (1984)	--	0	--	=
Context Processing				
Hemsley & Gray Gray et al. (1991a)	-	-	-	=
Cohen-Servan Schreiber (1992)	+	-	-	=
Phillips & Silverstein (in press)	+	+	+	=
Abnormal Lateralization				
Cutting (1985)	+	0	0	=
Magaro (1980)	+	+	--	=

Note: -- The data are not compatible with the model as currently formulated
- The data are inconsistent with the current model, but significant changes in the model could accommodate the results
0 The data are neither consistent nor inconsistent with the model
+ The data are consistent with model
= The data cannot be related to this hypothesis of the model

this model accounts reasonably well for performance on tasks which involve high momentary processing load, such as the CPT and Span of Apprehension Test, it is difficult to conceive how this limited capacity model can account for deficits in cognitive tasks which rely mainly on early visual processing. Specifically, the model cannot explain why cognitive deficits in schizophrenia spectrum disorders should also be apparent where cognitive deficits result in performance advantages in tasks which rely on Gestalt perception.

The models of Chapman and McGhie (1961) and Frith (1979) posit that cognitive impairments in schizophrenia spectrum disorders arise out of a selective and inhibitory dysfunction of attention which is the result of a breakdown in the filter mechanism that determines which items enter awareness. These models have a considerable explanatory power to account for phenomenological changes in self-experience (Chapman & McGhie, 1961) and positive symptoms (Frith, 1979), but both accounts suffer a from lack of specificity in predicting and explaining patterns of performance on cognitive tasks in patients with schizophrenia (Knight, 1993). For example, the models do not propose a *specific* cognitive dysfunction which underlies the deficits in the selective mechanisms of attention which could explain impaired and superior performance in tasks of Gestalt perception in schizophrenia spectrum disorders.

The critical role of perceptual grouping in information processing suggests that a number of hypothesized deficits in attention could be viewed as secondary to dysfunctional Gestalt perception in schizophrenia spectrum disorders. Theories of visual cognition assume that Gestalt perception functions to define objects automatically and preattentively in the visual field (Treisman, 1988). As a result, Gestalt perception is a

prerequisite for the attentional and serial analysis of relevant objects in the visual field and for automatic access to object-related semantic information (Boucart, Humphreys, & Lorenceau, 1995). From this perspective, it could be argued that deficits in pre-attentive perceptual grouping lead to reduced processing capacity loads since the breakdown in parallel, automatic processing would require more serial processing strategies which would strain attentional capacity resources (Knight, 1993). Such a hypothesis is consistent with evidence which suggests that patients with schizophrenia are deficient in perceptual tasks which require the ability to automatize the processing of less prepotently organised stimuli (Silverstein et al., 1998) and with the subjectively experienced loss of automaticity and spontaneity (Table 8.3).

Table 8. 3

Phenomenology of Action and Control in Schizophrenia

"I have to do everything step by step by now, nothing is automatic. Everything has to be reconsidered." (McGie & Chapman, 1961, p. 108)

"I have to put out thoughts and put them together. I can't control the actual thoughts I want." (Chapman, 1966, p.237)

"I take more time to things because I am always conscious of what I am doing. If I could just stop noticing what I am doing, I would get things done a lot faster." (McGhie & Chapman, 1961, p.108)

The predictions by Magaro (1980, 1981) with regards to the different cognitive styles of paranoid and non-paranoid schizophrenia spectrum disorders could not be confirmed. Although the general hypothesis of the cognitive deficit in schizophrenia defined as "...an inability to integrate perceptual and conceptual processes in a normal manner" (1981, p. 653), is compatible with the results, details of the model are not. According to Magaro, paranoid and non-paranoid forms of schizophrenia are characterized by differential encoding strategies. Non-paranoid patients rely mainly on automatic processing, whereas paranoid patients encode information in a serially, controlled fashion as a result of 'rigid' conceptual (top-down) processes (1981, p. 651). This assumption contrasts with the cognitive deficits in non-paranoid schizophrenia patients in tasks which involved pre-attentive, automatic stimulus grouping. More importantly, the present research was unsucessful in demonstrating that paranoid and non-paranoid patients differ significantly in Gestalt perception. In Studies 2 and 3, schizophrenia/schizoaffective patients with elevated levels of paranoid symptomatology were not characterized by enhanced Gestalt perception (hypothesis 3a). On the contrary, paranoid patients were displaying a *reduced* responsiveness to Gestalt properties of stimuli on some tasks. The failure to confirm this hypothesis may also, in part, be explained by the relatively high level of disorganised symptoms in the paranoid group in Studies 2 and 3 which was comparable to that of non-paranoid patients. Disorganisation and paranoia are seen as opposite ends of a dimensional pathology underlying schizophrenia by Magaro (1981). Therefore, the differentiation between paranoid and non-paranoid patients on the basis of the single PANSS item 'suspiciousness' may not have allowed to differentiate two distinct patient groups with differential cognitive styles.

The results of the present research are compatible with the models of Hemsley and Gray (Gray et al., 1991a, 1991b; Hemsley, 1987, 1994) and Cohen and Servan-Schreiber (1992) which posit that impaired cognition in schizophrenia spectrum disorders reflect deficits in the processing of contextual information. However, these models do not fully account for the cognitive dysfunctions in schizophrenia spectrum disorders in this research nor for the consistent finding across studies that impairments in Gestalt perception are correlated with the disorganisation syndrome. Both models assume that impairments in context processing are restricted to information from either long-term memory[1] (Hemsley, 1987, 1994) or working memory (Cohen & Servan-Schreiber, 1992). Concurrent context is unlikely to be mediated by memory resources and reflects primarily stimulus properties.

Finally, Cutting (1985) proposed that a variety of cognitive dysfunctions in schizophrenia spectrum disorders are the result of schizophrenia patients' 'concentration on detail, at the expense of the theme' (p. 300). This hypothesis is obviously compatible with the conclusion of the present research that schizophrenia spectrum disorders are characterized by reduced responsiveness to Gestalt qualities of stimuli. The model, however, suffers from a lack of specificity regarding the nature of such deficits. In addition, no specific predictions are made which symptoms are related to dysfunctional cognition in schizophrenia spectrum disorders.

[1] A study by Jones, Hemsley, and Gray (1991), however, reported evidence for deficits in context processing which could be interpreted as being consistent with the notion of deficits in the processing of concurrent context.

8.2 Gestalt Perception, the Schizophrenic Spectrum, and Neurodevelopmental Disorders

Impairments in both ToM and Gestalt perception have also been observed in autistic spectrum disorders. Happe (1996) reported that children with autism show reduced sensitivity to contextual elements in a visual size perception task which was identical to one used in this work. Other studies have demonstrated reduced sensitivity to Gestalt properties of stimuli with numerous paradigms of Gestalt perception in both children (Plaisted, Swettenham, Rees, 1999; Riordan, 2000; Shah & Frith, 1993) and high-functioning adults with autism (Plaisted, O'Riordan & Baron-Cohen, 1998). Furthermore, ToM deficits in autism were reported for the first-order ToM task and the Eyes Test, and there is evidence to suggest that ToM impairment in autism are also related to dysfunctional Gestalt perception. Jarrold et al. (2000) found that superior performance in the embedded figures test was correlated with reduced ToM ability in autistic children. These results are similar to the findings of Study 4.

Parallels between cognitive dysfunctions in schizophrenia and autism are also evident from the phenomenology of autism (Ornitz, 1969). Perceptual disturbances appear in all sensory modalities and often coincide with the onset of autism. These perceptual disturbances bear a remarkable similarity to the phenomenology of the prodromal and acute stage of schizophrenia. An autistic person described her difficulties looking at people and pictures as follows: "I am not looking at the whole but rather just the outline or the part. I cannot look at a picture completely, but only small sections at a time" (Jocliffe, Landsdown, & Robinson, 1992).

Similarities between schizophrenia and autistic spectrum disorders go beyond cognitive dysfunctions. There is also evidence to suggest that adult autism may share symptom dimensions which, in the present research, have been linked to dysfunctional Gestalt perception, such as thought disorder (Dykens, Volkmar & Glick, 1991) and disorganisation (Konstantareas & Hewitt, 2001). Even though it is well established that core autism and schizophrenia can be differentiated by age of onset, sex distribution, family history, clinical appearance, and outcome, shifts in psychopathology from autism to schizophrenia have been continuously discussed (Petty, Ornitz, Michelman, & Zimmerman, 1984; Wolf, 2000). Finally, several theories have been proposed which implicate common pathophysiological mechanisms to account for the similarities in cognitive and behavioural deficits, such as a right hemisphere dysfunction (Cutting, 1990), impairments in ToM (Frith, 1992), dysfunctional binding (Brock, Brown, Boucher, & Rippon, 2002), and impaired cognitive coordination (Phillips & Silverstein, in press).

Possible similarities in cognition, symptoms, and pathophysiology between autism and schizophrenia would be compatible with the hypothesis that a group of schizophrenia patients is characterized by neurodevelopmental abnormalities which may be distinguished from other forms of schizophrenia. Autistic disorders are currently categorized as pervasive developmental disorder (PDD) (DSM-IV; American Psychiatric Association, APA, 1994) and other neurodevelopmental syndromes which are characterized by deficient Gestalt perception, share cognitive deficits and non-psychotic symptoms similar to those observed in schizophrenia (Silverstein & Palumbo, 1995).

Murray, Callaghan, Castle, and Lewis (1992) introduced a neurodevelopmental classification of schizophrenia, proposing that congenital schizophrenia, in contrast to adult-onset schizophrenia, is a consequence of abberrant brain development during fetal and neonatal life. Such patients show structural brain abnormalities, cognitive impairment, male predominance, early onset, and poor outcome. In contrast, adult-onset schizophrenia is itself heterogeneous. It is a remitting disorder that is more frequent in females than in males, exhibits positive but not negative symptoms, and has much in common with affective psychosis.

The results from this and prior research suggest that dysfunctional Gestalt perception may constitute a marker for a neurodevelopmental subtype of schizophrenia spectrum disorders. Patients with chronic, disorganised schizophrenia and impaired Gestalt perception in this research fulfilled many of the criteria for 'neurodevelopmental schizophrenia'. Disorganised patients with chronic schizophrenia/schizoaffective disorder in Studies 3 and 4 were predominantly male and were characterized by an earlier onset of symptoms and pronounced ToM deficits than patients with acute or non-disorganised schizophrenia/schizoaffective disorder, for example. Importantly, chronic schizophrenia patients overall were significantly more impaired in Gestalt perception than acute patients (Study 4), suggesting that outcome and chronicity are related to dysfunctional Gestalt perception. Previous research has supported the hypothesis of a relationship between dysfunctional Gestalt perception and neurodevelopmental schizophrenia by demonstrating that dysfunctional Gestalt perception is most pronounced in patients with a poor premorbid social history, poor outcome, and response to behavioural and

pharmacological treatment, and reduced nailfold plexus visibility, a putative biological marker for schizophrenia (Knight & Silverstein, 1998).

The association between disorganisation and dysfunctional Gestalt perception is consistent with this point of view. The disorganisation component in psychosis corresponds to the schizophrenia subtype hebephrenia which is most closely related to Kraepelin's original formulation of dementia praecox as a disorder with early onset, poor outcome, and cognitive impairments. A recent twin study of symptom dimensions of psychosis (Cardno, Sham, Murray, & McGuffin, 2001) showed that the disorganisation syndrome has a particularly high genetic loading. Although Murray et al. (1992) initially proposed that negative symptoms are the adult manifestation of childhood development impairments, recent evidence from this research group (Van Os et al., 1993) indicated that the disorganisation syndrome, besides negative symptoms, was strongly associated with poor premorbid social adjustment. Similarly, studies by Deister and Marneros (1993) and Fenton and McGlashan (1991) reported that disorganised schizophrenia patients were characterized by the most unfavorable premorbid social adjustment.

Strong evidence for a link between neurodevelopmental abnormalities and the disorganisation dimension of psychotic symptoms was demonstrated in a study by Krebs et al. (2003). In sample of 107 patients with schizophrenia, neurological soft signs were systematically examined and related to current symptomatology. In a multiple regression analysis, only the disorganisation factor was significantly correlated with neurodevelopmental abnormalities.

8.3 Gestalt Perception, Phenomenology, and Schizophrenia

The relationship between dysfunctional Gestalt perception, outcome, and aspects of schizophrenic symptomatology raises the question of the wider relevance of these cognitive deficits for the understanding of the disorder. The consistent association of impaired Gestalt perception with the characteristic disorganisation of thought, language, and behaviour in schizophrenia spectrum disorders is indicative of a comprehensive deficit in the generation of coherent, organised cognitive and behavioural activity. Evidence from the normal psychological literature supports this view. Context processing, for example, is not specific to visual perception but is implemented by cortical algorithms which operate across cognitive domains to implement processes such as perceptual grouping in vision and language (Phillips & Singer, 1997). Language comprehension from this perspective can be seen as the binding of words or concepts into coherent thought and linguistic structures, except that in these cases, the binding is based on context-appropriate meaning (Logan & Zbrodoff, 1999). There is evidence to suggest that schizophrenia is also characterized by deficient context processing in language. Kuperberg, McGuire, Tyler, and David (1998), for example, reported that schizophrenia patients show reduced context sensitivity in language perception. Spitzer, Beuckers, Beyer, Maier, and Hermle (1994) found the same for language production in schizophrenia.

Deficits in Gestalt perception in schizophrenia spectrum disorders may therefore reflect a global impairment in the coordination of cognitive processes. Further phenomenological evidence (Table 8.4) suggests that the loss of the overall Gestalt

extends to other cognitive processes, including auditory perception and motor coordination. This formulation would be compatible with previous theoretical thinking characterizing the essential disturbance in schizophrenia, for example, as 'intrapsychic ataxia' (Stransky, 1904), 'loss of inner unity' (Kraepelin, 1909), 'neural integrative defect' (Meehl, 1962), or 'schizophrenia' (Bleuler, 1911/1950), which all imply that the essential disorder lies in the interplay between various mental faculties. Notably, Bleuler (1911/1950, p. 276) viewed the 'loosening of associations' in schizophrenia as the most likely criteria for the 'primary disturbance' of schizophrenic cerebral pathology which, in the present research, was consistently linked to dysfunctional Gestalt perception. Similarly, recent models by Andreasen (1999), Friston (1999), Edelman and Tononi (2001), and Parnas, Bovet, and Innocenti (1998) have laid emphasis upon pathophysiological mechanisms which involve multiple cortical areas and their coordination as opposed to earlier work, which saw the core pathology in schizophrenia as restricted to a specific area of the brain.

Table 8.4

Phenomenology of Perception and Action in Schizophrenia

"It's the same with listening. You can hear snatches of conversation and you can't fit them together." (McGhie & Chapman, 1961, p.106)
"I don't like moving fast. I feel there would be a breakup if I went to quickly. ... I can prevent this from happening by going completely still and motionless" (Chapman & McGhie, 1961, p.106)

Cognitive disorganisation can be related to other syndromes of schizophrenia. Studies of self-experienced cognitive deficiencies in the early and acute stages of schizophrenia have indicated that changes in the structure of experience occur from which psychotic symptoms develop (Klosterkötter, 1992). Linking the phenomenology of the purely subjective experience of key symptoms of the disorder to the psychobiological level is a necessary step to evaluate whether such constructs are valid (Klosterkoetter, 1992; Sass, 1992) and to demonstrate possible pathways between objectifiable cognitive dysfunctions and the development of the main characteristic symptoms of psychosis. Previous formulations by Hemsley (1998), Sass and Uhlhaas (in press), and van den Bosch (2000) have attempted to link dysfunctional context processing to wider aspects of the disorder. Hemsley proposed that a disturbance in the operation of context underlies disruptions in the 'sense of self' in schizophrenia. Sass & Uhlhaas and van der Boer have attempted to link dysfunctional context processing to changes in self-experience and other symptoms of the disorder. The relevance of phenomenology may go beyond the purely descriptive role, however. Concepts of phenomenology may also be useful to elucidate the relevance of cognitive dysfunctions to psychopathology by conceptualizing such deficits in terms of central concerns of phenomenology, such as intentionality (Mishara, Parnas & Naudin, 1998).

From a phenomenological perspective, the perceptual world has an inherent meaning and sense in which self and world create a unity, an indivisible whole (Metzinger, 1999). Meaning and phenomenal unity are the result of Gestalt processes which intend the organisational forms and structures of the visual field which are characterized by a Gestalt-coherence (Gurwitsch, 1964). Such wholes create processes

and properties which impose conditions on their constituent parts (Wertheimer, 1922). These organisations are the prerequisite for actions and understanding of the perceptual world since, for it to appear intelligible, meaning arises out of organisation. Koehler (1929, p.152) suggests that "...for its gradual entrance into the sensory field, meaning follows the line drawn by natural organisation".

This perceptual pre-reflective intentionality has been described by Husserl (1973, 1982) as *passive synthesis*, an automatic process which intends the manifold features of an object into unified wholes. The relevance of this process goes beyond its contribution to individual percepts in affirming the existence of objects per se, since it is only through the continuity of context that the individual percepts of an object are linked. Continuity of context and organisation are also a necessary part of the stream of consciousness (James, 1890). The phenomenal stream of conscious experience is characterized by the continuous emergence of novel organisations which are, at the same time, linked to each other by the context of preceding organsations which provide a frame of reference from which novel organisations emerge (Gurwitsch, 1964).

From a phenomenological perspective, the perceptual disturbances described by Matussek (1987), Conrad (1952), and others (e.g., Chapman, 1966, McGhie & Chapman, 1961; Cutting & Done, 1989), therefore, indicate not only a change in perception per se but a profound change in the level of intentionality. The perceptual world appears transformed, acquired more distance and is characterized by a fragmentation of meaning (Zahavi & Parnas, 1998). Coinciding with this change in intentionality is a change in self-experience (Table 8.6) or *ipseity*, a basic sense of self-coinciding or the implicit sense of being a center of consciousness and intentionality (Sass, 2000, p.152). In parallel with the

disorganisation of cognitive structures, the perceptual world appears meaningless, one in which the self is not intimately involved but appears alien. This deficit in pre-reflective perceptual intentionality (Parnas & Sass, 2002) has been described as loss of *common sense*. Common sense describes aspects of affectivity and judgement which arise out of a primordial unity of thinking, will, and feeling which is directed towards the world (Blankenburg, 1969). It refers to the capacity to weigh things and to sense the appropriateness of our acts, notably our acts of language and communication (Naudin, Azorin, Mishara, Wiggins, & Schwartz, 2000).

A number of accessory symptoms (Bleuler, 1911/1950) may be related to such a primary disturbance in pre-reflective perceptual intentionality. These could constitute regulatory phenomena to compensate for profound changes in self-experience (Carr & Wale, 1986) which occur when the (already weakened) structure of experience encompassing the patient and the world dissolves. There is consistent evidence in the literature to support the claim that delusions are preceded by major changes in sensory experiences, especially visual perception, and that these may constitute *basic symptoms* from which delusional perceptions, for example, develop. Klosterkötter (1992) examined the emergence of first rank symptoms from the first symptomatological precursors to complete psychotic phenomena with the Present State Examination (PSE) and with the Bonn Scale for the Assessment of Basic Symptoms (BASB). In this sample, 96% of the initial self-experienced deficiencies in the prodromal stage were disturbances of perception. Other studies (McGhie & Chapman, 1961; Chapman, 1966; Cutting & Done, 1989; Phillipson & Harris, 1985) supported and extended these findings although the percentage of perceptual disturbances was slightly lower.

Table 8.6.

Phenomenology of Self-Experience in Schizophrenia

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1. "I only saw fragments: a few people, a kiosk, a house. To be quite correct, I cannot say that I saw all of that, because the objects seemed altered from the usual. They did not stand together in an overall context, and I saw them as meaningless details. The way to the university also seemed to be like that. My impressions did not flow as they normally do. If I had not continuously reminded myself where I was going, I would just as gladly have stood still." (Matussek, 1987, p. 92)

2. "My eyes met a chair, then a table; they were alive, too, asserting their presence. I attempted to escape their presence, with its existence. I attempted to escape their hold by calling out their names. I said, "chair, jug, table, it is a chair." But the words echoed hollowly, deprived of all meaning, it had left the object, was divorced from it, so much so that on one hand it was a living, mocking thing, on the other, a name, robbed of sense, an envelope emptied of content." (Sechehaye, 1970, p.40-41)

Delusions have been linked by Matussek (1987), for example, to a loss of the Gestalt of the visual field in which new contextual relationships are formed which are the basis of the delusional belief. Accordingly, delusions may be described as a phenomenon of emergence, a transformation of the patient's being-in-the-world (Bovet & Parnas,

1993). From the perspective of cognitive psychology, Carr and Wale (1986) linked positive symptoms to the phenomenon of illusory conjunctions which bears a close resemblance to the formulation of Matussek. They describe such symptoms as "...instances of ideational organisation, creations of higher cortical processes by which disorganised inputs are ordered or structured to ideational schemata" (p.150). There is experimental evidence to support that abnormal illusory conjunctions occur in schizophrenia (Brennan & Hemsley, 1984) although this has not been confirmed by other studies (e.g., Carr, Dewin, & Lewin, 1998). Delusions as ways to reorganise chaotic sensory input are indicated in reports of patients who describe how new meaningful connections arise in response to disorganisation (Table 8.7).

Table 8.7

Phenomenology of Delusional Thinking

"I had very little ability to sort the relevant from the irrelevant. The filter had broken down. Completely unrelated events became intricately connected in my mind." (MacDonald, 1964, p.175-176, cited in Freeman, 1974)
"Out of these perceptions came the absolute awareness that my ability to see connections had been multiplied many times over." (Matussek, 1987, p.96)

Sass (1992) described changes in self-experience in terms of *hyperreflexivity* which may also be related to disturbances in pre-reflective perceptual intentionality in schizophrenia. As a consequence of the loss of Gestalt in the visual field, objects appear as framed or 'weighted' which causes objects to seem strange or hypersignificant (Matussek, 1987, p. 93-94). This weakening of an organising and orienting perspective leads to forms of attention that are hyper-focused, that is "...forms of exaggerated awareness in which a subject takes itself as its own object" (Parnas & Sass, 2002, p. 106) which reinforce the fragmentation of the visual field, inducing new experiences of mental fragmentation and 'loss of self'. Experimental and phenomenological evidence supports this claim. Prolonged viewing reduces the efficiency of global processing in tasks of Gestalt perception (Ninose & Gyoba, 2003), for example, and subjective experiences reveal how hyperreflexive forms of awareness may lead to delusional experiences (Table 8.8). Hyperreflexive forms of awareness may, therefore, constitute the nucleus from which first rank symptoms develop. Sass (1992) conclude that "We can understand, then, how a person who steps back from his own experience might begin to feel as if his sensations and thoughts originated outside his own body or mind..."

Table 8.8

Hyperreflexive Awareness in Schizophrenia

"A schizophrenic patient reported after his psychosis had subsided that his attention had been attracted by the gently swinging cord of a light switch on the wall. He had failed to notice that the cord had been touched by someone else. 'What on earth is that?'

Table 8.8 (cont.)

He stared at the cord on the wall. ... And suddenly he had the impression that it was not the cord which was moving to and fro, but the wall. He then concluded that the end of the world had come." (Matussek, 1987, p. 93)
"I became increasingly aware of the separate life of my own mind. Without informing me of its intentions, without thinking, which seemed to me the means by which ...my mind allowed me to participate...I found myself doing things impulsively, thinking things (except that it was not thinking in the usual sense, there was no process of conscious deliberate thought...)" (Peters, 1949, p. 268, cited in Freedman, 1974)

A schizophrenia patient may also withdraw from the world as the result of the loss of the tacit-explicit structuring of experience which may cause a variety of symptoms which are associated with the negative syndrome in schizophrenia (Table 8.9). A hyperconscious awareness may lead to an energetic deficit since the habitual use of a consciously controlled mode of information processing leads to mental exhaustion (van den Bosch, 1995) and to withdrawal, slowing, and inactivity which are characteristic for the negative syndrome (Sass, 2000). Similarly, a patient may adapt to the primary cognitive disorganisation with reduced activity to cope with the overstimulation associated with disorganisation in acute schizophrenia (Carr & Wale, 1986).

Table 8.9

Phenomenology of 'Negative' Symptoms

"Since the mechanisms of the mind have been destroyed in its continuity, I can no longer think except in fragments. When I do think, the major part of the stock of terms and vocabulary which I have personally accumulated is unusable, being rusty and forgotten *somewhere*, but even after the term has appeared, the underlying thought collapses, the contact is suddenly broken, the underlying nervous response no longer corresponds to the thought, the mechanism has broken down-and *I am talking about the times when I am thinking!!!*" (Artaud; in Sonntag, 1976)
"I just turned off all my senses and I don't see anything and I don't hear anything. Things going on around me don't affect me" (Chapman, 1966, p. 232)

8.4. Issues for Future Research into Gestalt Perception in Schizophrenia Spectrum Disorders

The findings of this research have implications for future investigations in this field. The research has demonstrated that, on the level of symptoms, dysfunctional Gestalt perception may be specific to disorganised forms of schizophrenia spectrum disorders. Therefore, future studies need to adopt research strategies to examine cognitive

dysfunctions at various levels of complexity, ranging from the main syndromes to individual symptoms, e.g., thought disorder (Peralta & Cuesta, 2001). The results clearly showed that this research strategy increases the power of the research design significantly for finding differences in cognitive dysfunctions in schizophrenia spectrum disorders. Negative findings in past studies in this field may have occurred due to the absence of such an approach. Moreover, linking specific syndromes and symptoms with cognitive dysfunctions is a viable strategy to reduce the heterogeneity of schizophrenia spectrum disorders through identifying clinical correlates of distinct information processing approaches. Although the findings could not support the hypothesis by Magaro (1980, 1981), the failure to characterize groups of schizophrenia patients with distinct cognitive styles may have been the results of the methodological limitations of the present research discussed earlier on. There is, nevertheless, evidence to indicate that schizophrenia spectrum disorders are more heterogeneous. Although differences were not statistically significant, non-disorganised forms of schizophrenia spectrum disorders, for example, showed enhanced Gestalt perception in the visual size perception task compared with other psychotic disorders and non-psychotic psychiatric controls (Study 2) or non-schizotypal controls (Study 1) and performed better in the visual closure and contour integration tasks than other psychotic disorders (Study 2 & 3).

The identificantion of subgroups within the schizophrenia spectrum should not occur only along the lines of the overt symptoms. Although the symptoms of psychosis are intimately related to disturbances in cognitive dysfunctions (Carr & Wale, 1982; Hemsley, 1977, 1994), this relationship does not have to hold for the entire course of the disorder. For example, the majority of cognitive dysfunctions remain stable whereas

symptoms are characterized by a fluctuating course. Moreover, the same cognitive dysfunctions may produce different clinical symptom in psychotic disorders (Knight, 1992). The problematic status of the symptoms of psychosis as the point of departure for the research into the pathophysiology of schizophrenia spectrum disorders is also evident from the conceptual and methodological difficulties in the search for meaningful and coherent syndromes discussed earlier on. For these and other reasons, approaches to identify the core bio-behavioural mechanisms in schizophrenia should also be based on cognitive indices that may be closer to the essential aspects of schizophrenia (Tsuang et al, 2000).

From the perspective of the current research, dysfunctional Gestalt perception may be indicative of a subtype of schizophrenia, neurodevelopmental schizophrenia. This hypothesis is consistent with evidence from the present research and from prior work which have linked dysfunctional Gestalt perception to poor premorbid social functioning, disorganised symptoms, elevated nailfold plexus visibility, poor response to behavioural and pharmacological treatment, and dysfunctional ToM (Knight & Silverstein, 1998). Further studies are necessary to support and strengthen this hypothesis. For example, the relationship between indices of abnormal development, such as obstetric complications, minor physical abnormalities, in patients with dysfunctional Gestalt perception may be relevant. Comparisons between neurodevelopmental schizophrenia and autism in ToM, Gestalt perception, and disorganised symptoms could provide new perspectives on the relationship between the two disorders. Although there is preliminary evidence to suggest that poor premorbidity may be related to disorganisation in schizophrenia spectrum disorders, it would be necessary to carry out further studies which specifically test this

hypothesis. Such research could also investigate whether poor premorbidity is related to dysfunctional ToM. A linkage between poor premorbidity, dysfunctional Gestalt perception, neurodevelopmental markers, and ToM would strengthen the hypothesis that dysfunctional Gestalt perception is indicative of a specific disease trajectory which is possibly distinct from late-onset, adult schizophrenia.

Any research which aims to uncover mechanisms of dysfunctional cognition in schizophrenia spectrum disorders crucially depends on the validity of tasks employed and a research design which allows the differentiation between generalized performance deficiencies and a specific cognitive deficit. Failure to use cognitive tasks with adequate construct validity and replicability in the normal psychological literature will leave studies vulnerable to many of the methodological problems discussed earlier (Knight & Silverstein, 1998). The present research has demonstrated that carefully selected tasks, which allow a theory-driven patterns of performance, were successful in identifying a cognitive dysfunction in Gestalt perception which could be demonstrated in diverse clinical and non-clinical populations.

Related issues are relevant for theoretical models of cognitive dysfunctions in schizophrenia spectrum disorders. Such models need to be formulated at an appropriate level of generality to account for large sets of data, but have to be equipped with sufficient specificity to be falsifiable. Although a group of cognitive models which emphasize dsyfunctional context processing in schizophrenia spectrum disorders was successful in accounting for the experimental data of this research, the generality of notions such as 'context' may also constitute a major stumbling block in the search for the underlying cause of cognitive dysfunction in schizophrenia spectrum disorders.

Different investigators, for example, think of context in different ways (Pickering, 1993) and there is disagreement as to which cognitive processes should belong to this category. The possible heterogeneous character of the contextual processing and its disturbances is also evident from the data of this research. Several measures of Gestalt perception showed no statistical relationship. Although there is evidence from developmental studies to support this finding (Quinn, Bhatt, Brush, & Grimes, 2002), the heterogeneous character of contextual processes will impede the search for a common underlying impairment in cognitive dysfunction in schizophrenia spectrum disorders. Future studies could employ multiple measures of context processing which examine dysfunctional context processing in language and perception, for example, to address the heterogeneity of impairments in context processing in schizophrenia.

Linking cognitive dysfunctions to biological abnormalities in schizophrenia spectrum disorders may be useful to test and constrain models of cognition. The rapid progress in the neurosciences has led to an explosion of knowledge and techniques which link mind and brain, and several of the models of cognitive dysfunctions discussed explicitly linked these areas and provided evidence for a relationship (Gray et al., 1991; Perlstein et al., 2001). Yet, few studies have explicitly examined neural mechanisms of dysfunctional Gestalt perception in schizophrenia spectrum disorders. It has been proposed that Gestalt perception is related to synchronous oscillations in the gamma band range (Phillips & Singer, 1997). Demonstration of reduced gamma-oscillations in relation to dysfunctional Gestalt perception in schizophrenia spectrum disorders would support a central hypothesis of the model by Phillips & Silverstein (in press) that dysfunctional coordination is associated with changes in synchronous gamma rhythms. Research

examining the temporal correlates of cognitive activity in schizophrenia spectrum disorders could be complemented by techniques which analyze the spatial distribution of neural activity. Recent methodological advances in functional magnetic resonance imaging (fMRI) allow the analysis of the activity both within and between cortical regions (Friston, Ungerleider, Jezzard, & Tuner, 1995). This evidence would be useful to determine which cortical regions and their interactions which are involved in dysfunctional Gestalt perception and to test differential hypotheses of the underlying pathophysiology, i.e., right hemisphere underactivation (Cutting, 1990) vs. hypoactive prefrontal cortex (Cohen & Servan-Schreiber, 1992) vs. hippocampus (Gray et al., 1991) vs. distributed impairment (Phillips & Silverstein, in press).

Several of the models discussed proposed that dysfunctional cognition in schizophrenia is the result of abnormal, multiple neurotransmitter systems. The study of psychopharmacological agents which act upon the NMDA-glutamate receptors is of particular interest. Phillips & Silverstein (in press) assume that the NMDA-receptor plays a crucial role in cognitive coordination, and Gestalt perception should be impaired if the activity of the NMDA receptor is reduced. Although there is support from studies which have examined the impact of NMDA antagonists on measures of context processing, i.e., CPT and mismatch negativity (Umbricht et al., 2000), the evidence linking NMDA-hypofunction and dysfunctional Gestalt perception is so far lacking.

The relationship between NMDA-hypofunction and Gestalt perception could be explored with NMDA-agonists as well. Javitt et al. (2001) reported that glycine, an NMDA-agonist, improved context-processing on the AX-CPT task and significantly improved negative symptoms in patient with schizophrenia. Comparison of Gestalt

perception between schizophrenia patients with atypical and typical medication regimes may also prove interesting since atypical antipsychotics, such as clozapine and olanzapine, have differential effects on NMDA receptors which distinguishes them from typical antipsychotics, such as haloperidol (Goff & Coyle, 2001).

In summary, the findings of the present research allow a number of conclusions regarding dysfunctional Gestalt perception in schizophrenia spectrum disorders:

1) Dysfunctional Gestalt perception is related to a specific subtype of schizophrenia spectrum disorders. In the present research, this subtype was characterized by elevated symptoms on the disorganisation component of psychotic symptoms.
2) Dysfunctional Gestalt perception can be related to impairments in both the processing of concurrent and preceding context.
3) Dysfunctional Gestalt perception as measured by cognitive tasks are not related to generalized performance deficiencies but represent a specific deficit in the organisation of stimulus elements based on context. This conclusion is supported by the pattern of performance of patients in experimental tasks which were characterized by performance advantages and disadvantages. Performance advantages for patients in experimental tasks are not consistent with the predictions derived from a generalized deficit model nor with theories which posit that dysfunctional Gestalt perception in schizophrenia spectrum disorders is secondary to attentional deficits, for example.
4) The results provide preliminary evidence that ToM deficits may be related to dysfunctional ToM in schizophrenia spectrum disorders.

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APPENDIX

Appendix A

Conference Presentations and Publications Based on Research Included in this Thesis

Publications:

Sass, L.A., & Uhlhaas, P.J. (in press). Phenomenology, context, and self-experience. Commentary on Behavioral and Brain Sciences target article 'Converging of Evidence of Biological and Psychological Perspectives on Cognitive Coordination in Schizophrenia'.

Uhlhaas, P.J., & Silverstein, S.M. (in press). Gestalt Psychology and schizophrenia: The continuing relevance of Gestalt Psychology for an understanding of schizophrenia. *Gestalt Theory.*

Uhlhaas, P.J., Silverstein, S.M. & Phillips W.A. (submitted). Schizotypy, thought disorder, and visual context. *Schizophrenia Research.*

Silverstein, S.M, & Uhlhaas, P.J. (submitted). Gestalt Psychology and schizophrenia: The forgotten paradigm in abnormal psychology. *American Journal of Psychology.*

Published Conference Abstracts:

Uhlhaas, P.J., Silverstein, S.M., & Phillips, W.A. (2003). Dysfunctional cognitive coordination in acute schizophrenia: Converging evidence from three theoretically motivated tasks, *Schizophrenia Research, 60* (Suppl. 1), 184.

Uhlhaas, P.J., Silverstein, S.M., & Phillips, W.A. (2002). Klinische Korrelate der Gestaltwahrnehmung bei akut Schizophrenen. *Nervenarzt 73* (Suppl.),.193.

Conference Presentations:

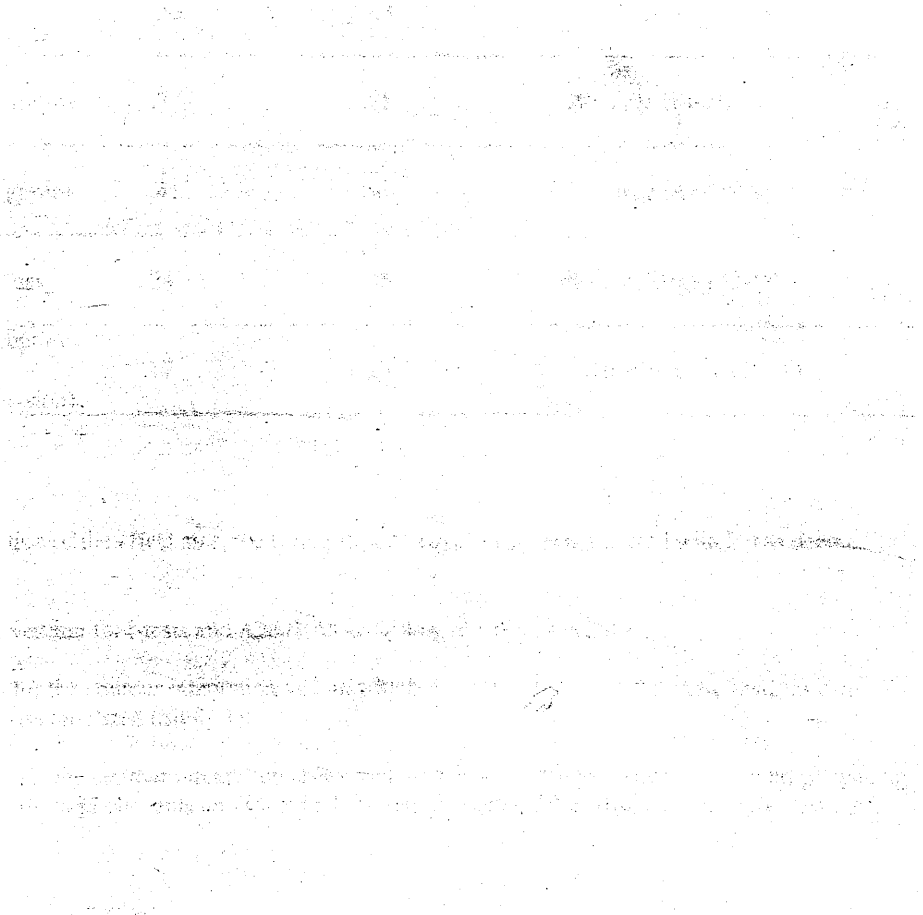
Phillips, W.A., Silverstein, S.M., Uhlhaas, P.J., Anandaciva, S. (2003). Cognitive disorganisation in schizophrenia may be due to NMDA-hypofunction. Workshop on 'Synaptic Dusfunction in Schizophrenia', Poster presented at the Centre for International Meetings on Biology, Madrid.

Uhlhaas P.J., Silverstein, S.M., & Phillips, W.A. (2002). Gestaltwahrnehmung bei Störungen des Schizophrenen Spektrums. Paper presented at the Kongress of the Deutsche Gesellschaft für Psychiatrie und Nervenheilkunde, Berlin.

Uhlhaas P.J., Silverstein, S.M., & Phillips, W.A. (2001, December). Gestalt Perception in Schizophrenia Spectrum Disorders. Paper presented at the Max-Planck Institute for Brain Research, Frankfurt.

Uhlhaas, P.J., Silverstein, S.M., Phillips, W.A. (2001, November). Schizotypy, thought disorder and visual context. Poster presented at the Annual meeting of the Society for Research in Psychopathology, Madison, Wisc.

Uhlhaas, P.J. (2000). Phenomenological perspectives on Gestalt perception in acute schizophrenia. Paper presented at the International Workshop on "Cognition and Neuropathology in Schizophrenia", Center for Computational and Cognitive Neuroscience, University of Stirling.



Appendix B

Post Hoc Power Analyses for Measures of Gestalt Perception[1]

Task	Effect Size	Power	Effect Size[2] Convention
Visual Size Perception Task (manual version)			
Condition			
Reducing	.25	.27	small (t-test)
Enlarging	.36	.43	small/medium (t-test)
Contour Integration Task [3]	.77	.88	large (t-test)
Contour Integration Task	.41	.93	large (ANOVA)
Visual Closure Task	.24	.35	medium/large (ANOVA)
Visual Size Perception Task (computerized version)	.17	.25	medium (ANOVA)

[1] For the calculation of the effect size, the smallest, theoretical value was selected which was deemed sizeable.

[2] Effect size convention for t-tests and ANOVAs according to Cohen (1989).

[3] Power analysis for the contour integration task in which the orientation jitter between adjacent elements of the contour was manipulated (Study 1).

[a] Power Analysis for the contour integration task which involved the manipulation of the average spacing between the background elements and spacing between elements of the closed contour (Studies 2-4).

Date (Mo., Dy., Yr.)	Location	Service	
Age	Doctor		If No Plate, Print Name, Sex, and History No.

THE NEW YORK PRESBYTERIAN HOSPITAL-WEILL MEDICAL COLLEGE OF CORNELL UNIVERSITY

Consent Form for Clinical Investigation

Project Title: Clinical Correlates of Perceptual Organization in Acute Schizophrenia

Subject: _____ **Research Project No:** _____

Consent form for subjects with a diagnosis of schizophrenia

You are invited to participate in a study examining the relationship between visual perception and symptoms in people with schizophrenia. Psychologists and Physicians of the New York Presbyterian Hospital-Weill Medical College of Cornell University hope to learn more about the nature of perception in schizophrenia and whether visual perception is related to changes in symptoms and behaviors. You were selected as a possible participant for this study because you have been diagnosed with schizophrenia. Your clinician has no objection to your participation in this research.

If you decide to participate, Dr Silverstein and Peter Uhlhaas will meet with you twice during the course of your stay at this hospital. At each meeting, you will complete 6 tests. Each meeting can be divided into several sessions depending on how many tests you would like to do in one session. One of the tests requires you to look at a computer screen, the other tests require you to look at information on cards or read out a list of words. We will also ask you about symptoms of schizophrenia that you may or may not have had during the last 2 weeks.

The first test is a measure of the ability to perceive shapes formed by randomly arranged dots on a card. You will be shown 15 cards, which contain varying numbers of black dots against a grey background. Some of these elements combine to form a circular shape, and your task is to find, and trace with your finger, the circular shape on each card. There is a 30-second limit for each card, and the test typically takes between 4-10 minutes.

The second test examines the ability to estimate the size of circles. In the first part of the experiment, two circles will be displayed on a computer screen of which one appears on its own and the other surrounded by a group of circles. You will be asked to indicate, which of the two circles appears to be bigger in size by pressing a key on a computer keyboard. You will be shown about 30 displays, and the test takes about 10 minutes.

In the second part of this experiment, you will see a similar display. This time, however, you will be asked to select a circle from a wheel, which is the same size as the target circle. This part of the experiment will take about 25 minutes.

IRB APPROVED
Approved: 05·11·01
Expires: 04·20·02

In the third test, you will be shown two sets of drawings in which parts of the drawing are missing. The drawings will depict everyday objects in black and white ink drawings, such as a human face or a telephone. You will be asked to indicate what you see in these drawings and your descriptions will be tape-recorded. Each set consists of 40 cards and will take 10 minutes to complete.

We cannot promise that you will benefit in any way from participating in this project. If you do not decide to participate but you would like learn nevertheless something about our research, we are more than willing to explain aspects of it to you. Although there are no serious risks associated with the tasks in this study, you may become tired or strained during testing. You also may feel uncomfortable with questions about your mental state during the interview. Any questions you feel uncomfortable about, you do not have to answer. If you feel tired or uncomfortable, please let the experimenter know.

It is important for you to know that no standard treatments will be withheld from you if you participate in this research.

Any information obtained during this study and identified with you will remain confidential and will be disclosed only with your permission. Each study participant will be given an identification number, and only this number will appear on data stored here. Information needed to link study data with the names of study participants will be kept on a separate computer from the rest of the data, ensuring confidentiality for all study participants.

You will receive monetary compensation in the form of $5 per hour for completing the tests and interviews. Participants take part in this experiment at no costs.

Your decision whether or not to participate will not prejudice your future relations with the New York Presbyterian Hospital-Weill Medical College of Cornell University. If you decide to participate, you are free to discontinue participation at any time.

In accordance with Federal regulations, we are obligated to inform you about the Medical Center's policy in the event physical injury occurs. If, as a result of your participation, you experience physical injury from known or unknown risks of the research procedures as described, immediate medical care and treatment, including hospitalization if necessary, will be available. No monetary compensation, however, is available, and you will be responsible for the costs of such medical treatment, either directly or though your medical insurance and/or other forms of medical coverage. Further information can be obtained by calling (212) 746-6026.

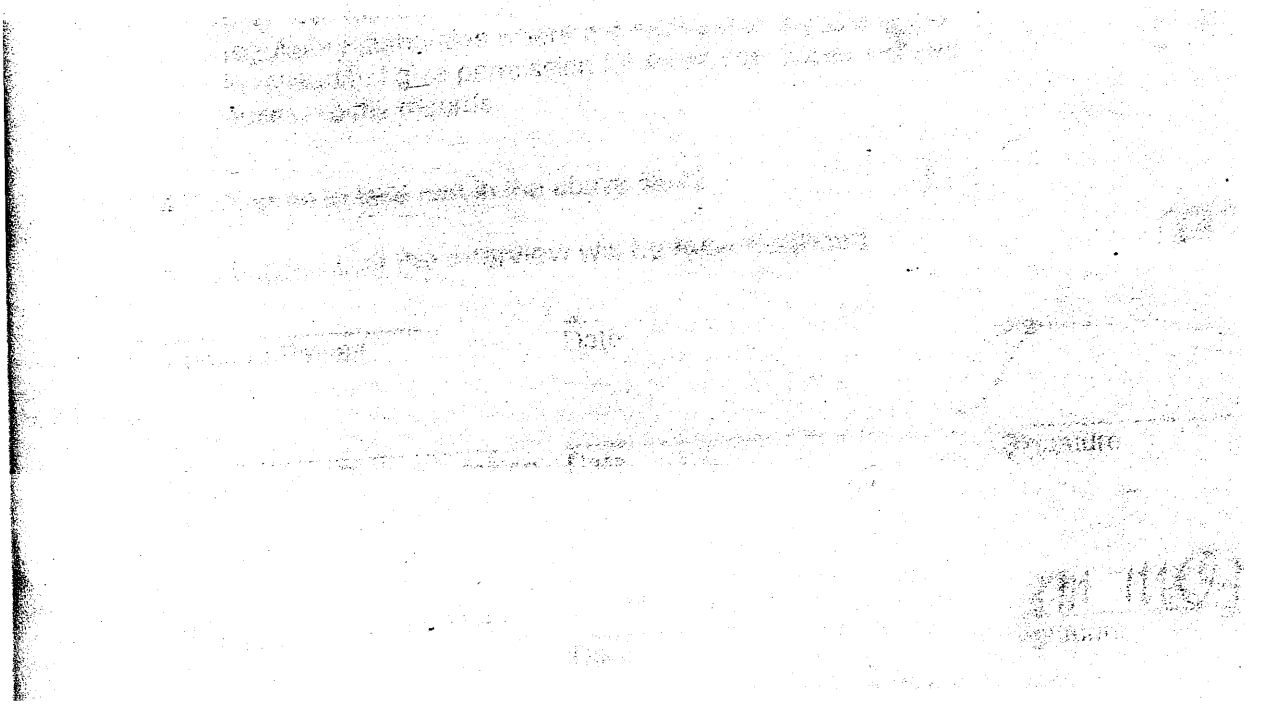
If you have any questions regarding your rights as a research subject or concerning a research related injury, please call (212) 746-6026.

If you have any questions, please ask us. If have any additional questions later, Peter Uhlhaas will be happy to answer them. He can be reached at (914) 997-5763. If you prefer, you can write to him at the following address: New York Presbyterian Hospital, Cornell Westchester Division, 21 Bloomingdale Road, White Plains, NY 10605.

You will be given a copy of this form to keep.

You are making a decision as to whether or not to participate. Your signature indicates that you have read the information provided above and have decided to do so. You may withdraw at any time without prejudice after signing this form should you choose to discontinue participation in this study.

Signature of Subject	Date	Time	AM PM
Signature of Investigator	Date	Time	AM PM
Signature of Witness	Date	Time	AM PM



Fife Primary Care
NHS TRUST

DEPARTMENT OF CLINICAL PSYCHOLOGY
STRATHEDEN HOSPITAL
CUPAR
FIFE
KY15 5 RR
Tel. No. 01334 652611 ext. 336
Fax. No. 01334 655380

Study Number:
Patient Identification Number for this trial:

CONSENT FORM

Title of Project: Visual Perception in Psychiatric Disorders

Name of Researcher: Peter Uhlhaas

Please initial box

1. I confirm that I have read and understand the information sheet dated 13/7/00 Version Nr1 for the above study and have had the opportunity to ask questions. ☑

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☑

3. I understand that sections of any of my medical notes may be looked at by responsible individuals or from regulatory authorities where it is relevant to my taking part in research. I give permission for these individuals to have access to my records. ☑

4. I agree to take part in the above study. ☑

5. I agree that the interview will be tape-recorded ☑

Name of Patient	Date	Signature

Name of Person taking consent (if different from researcher)	Date	Signature

PETER LIHLHAAS	26/9/00	PM UHL
Researcher	Date	Signature

1 for patient; 1 for researcher; 1 to be kept with hospital notes
DECLARATION OF HELSINKI

POSITIVE ABOUT DISABLED PEOPLE

CHARTER MARK
Awarded for excellence
to Nutrition and Dietetic Department

Forth Valley Primary Care NHS Trust

14/1/2000 Nr. 1

Patient Information Sheet

Visual Perception in Schizophrenia

You are being invited to participate in a research study. Before you make a decision it is important for you to understand the nature of the research and what it will involve. Please take time to read the following information carefully and discuss it with friends, relatives or members of staff. You can ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Old Denny Road, Larbert, FK5 4SD
Telephone: 01324 570700 Facsimile: 01324 562367

1. Purpose of the study

The present study is part of a PhD thesis which investigates various mental aspects in schizophrenia such as perception, language and memory. The study hopes to provide additional evidence on the nature of these functions in schizophrenia which may have relevance for the understanding and therapy of schizophrenia.

2. Why have I been chosen?

In order to find out about perception in schizophrenia, for example, we are interested in studying people who have been diagnosed with schizophrenia as this is a good way to learn more about it. You will be one of 20-25 participants who will take part in the study.

3. Do I have to take part?

It is up to you to decide whether or not to take part. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. This will not affect the standard of care you receive.

4. What will happen to me if I take part?

If you would like to participate in the study, you will be required to take part in 6 brief sessions, which will last about 20-40 minutes each. A number of simple psychological tests will be undertaken in which you will be asked, for example, to describe a photograph or diagram. Your descriptions will be tape-recorded. Throughout the session, it is important that you concentrate on the task and follow the instructions.

5. What are the possible disadvantages and risks of taking part?

There are no risks in this study if you decide to participate.

6. What are the possible benefits of taking part?

There is no clinical benefit to be gained by you from participating in this study. However, there is a chance to learn something about the nature of research in psychology and the underlying processes of everyday activities.

7. What if something goes wrong?

If you feel that the person responsible for the study has treated you unfairly or the experiment did cause you distress, which was not addressed beforehand, your doctor or nurse will make a note of your complaint and will address this with the researcher.

8. Will my taking part in this study be kept confidential?

If you consent to take part in the research any of your medical records may be inspected by the research for purposes of analysing results. All information, which is collected, about you during the course of the research will be kept strictly confidential.

9. What will happen to the results of the research study?

There is chance that the collected information will be used for the writing of an academic piece of work or for the publication in a scientific journal. In this case, no information about the identity of participants will be included in any subsequent reports. If participants are interested in obtaining reports or published Articles of the research, copies will be supplied by the researcher to participants.

10. Who is organising and funding the research?

The present study is part of PhD thesis, which is funded by the Carnegie Trust for the Universities of Scotland. The principal researcher is a research student in the Department of Psychology, University of Stirling

11. Who has reviewed the study?

The study has been reviewed by the Research Ethics Committee of the Forth Valley Health Board and the Ethics Committee of the Department of Psychology, University of Stirling.

12. Contact for Further Information

If you would like to have further information, please contact:

Peter Uhlhaas, BSc
Department of Psychology
University of Stirling
Stirling FK 9 4 LA