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Subtypes of social perception deficits in schizophrenia

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Abstract

Persons with schizophrenia exhibit consistent deficits in emotion perception (recognizing the emotional expressions of others), but it is currently unclear if their performance represents a specific deficit in identifying emotions only or is a more generalized deficit across different perception tasks. To address this question, it is important to compare emotion perception with face and general visual perception to assess the type of deficit present. The equivocal nature of previous research may suggest the presence of subtypes with different levels and patterns of performance on social perception measures. In this study, we administered measures of emotion, face, and general perception to a sample of 100 persons with schizophrenia. These scores were then subjected to a cluster analysis to determine if different subtypes were present. Two distinct subtypes were identified, and both subtypes scored lower than normal controls across all three measures of perception, suggesting the presence of a generalized performance deficit. One subtype was characterized by mild to moderate impairment and the other showed more severe impairment. The cluster solution was stable, and the subtypes also differed on other variables not used in the cluster analysis (external validation). More specifically, persons in the mild to moderately impaired subtype reported fewer positive symptoms, and this subtype contained more persons with paranoid schizophrenia as compared to the more severely impaired subtype. The implications of the results for the study of social cognition in schizophrenia are discussed.

Keywords: Emotion perception; Generalized versus specific deficit; Social perception; Cluster analysis

1. Introduction

Facial affect or emotion perception can be defined as the ability to decode, recognize, and identify emotional expressions (Edwards et al., 2002). Previous research has shown that persons with schizophrenia consistently perform lower than normal controls and persons with other psychiatric disorders on tasks of facial affect perception (see Edwards et al., 2002; Mandal et al., 1998; Penn et al., 2006 for reviews). It is important to increase our understanding of emotion perception deficits due to their link with impaired social functioning in schizophrenia (as reviewed in Couture et al., 2006; Penn et al., 2001). Specifically, deficits in emotion perception and other social cognitive processes (set of inter-related cognitive processes related to social stimuli) have been linked to poorer adaptive functioning on the treatment ward and in the community (Hooker and Park, 2002; Ihnen et al., 1998; Kee et al., 1998; Mueser et al., 1996; Penn et al., 1996). Researchers have been increasingly interested in the role of social

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cognition in schizophrenia, and there is some evidence that social cognition directly predicts (Brune, 2005; Roncone et al., 2004) or mediates social functioning (Addington et al., 2006; Sergi et al., 2006). Finally, social cognition also appears to be a stronger predictor of functioning than non-social cognition (Penn et al., 1996; Pinkham and Penn, 2006).

In addition to deficits on emotion perception tasks, it is possible that persons with schizophrenia may also show deficits on other types of perception tasks such as general face perception. Thus, an unanswered question is whether these deficits are "specific" to emotion perception or involve other areas of perception. Several studies have supported the presence of a "generalized" deficit in schizophrenia, as impairments were found across emotion and face perception tasks (Addington and Addington, 1998; Kerr and Neale, 1993; Salem et al., 1996). In contrast, other researchers have argued for the presence of a specific deficit in emotion perception only (Edwards et al., 2002; Mandal et al., 1998; Novic et al., 1984; Penn et al., 1997, 2006).

Representing a combination of the two conclusions, Penn et al. (2000) found that a specific deficit was present in persons from acute care settings and a generalized deficit was present in persons from chronic or long-term care settings. In terms of clinical variables, researchers have emphasized the role of paranoia on social perception with some studies finding that persons with paranoid schizophrenia have improved social and emotion perception abilities which may be due to improve cognitive functioning or better pre-morbid social functioning (Davis and Gibson, 2000; Kline et al., 1992; Lewis and Garver, 1995). In contrast, more recent, symptom based research (using participants with different levels of paranoia) has found impairment in emotion perception abilities (see Combs et al., 2006; Peer et al., 2004; Williams et al., 2004). It is believed that as paranoia increases, a number of cognitive and perceptual biases come on-line such as problems in visual attention, perceptions of hostility for ambiguous social situations, and a tendency to make decisions with little evidence (e.g., jumping to conclusions bias; see Penn et al., 2006). Finally, there is evidence that other variables such as gender, length of illness, and medication type are also related to social perception abilities (Herbener et al., 2005; Kohler et al., 2000; Mueser et al., 1996; Scholten et al., 2005).

The interpretation of previous studies is further complicated by the fact that the measures used to assess emotion and face perception may have differed in their psychometric properties. Thus, it is possible that persons with schizophrenia performed lower because the tasks were more difficult (as discussed in Penn et al., 1997). One method to examine the generalized versus specific deficit model is to employ the differential deficit design with tasks that have comparable (or at least reported) psychometric properties such as internal consistency and difficulty level (Chapman and Chapman, 1978; Kerr and Neale, 1993; Penn et al., 2000). Finally, since emotion and face perception are social perception tasks, it has been suggested that to test the generalized deficit model, a general visual perception task that does not involve social stimuli be included (Penn et al., 2000).

Given that some researchers have found a generalized deficit and others a specific deficit, it appears that considerable heterogeneity exists in the area of social and emotion perception. Thus, it is possible that subtypes with different levels and patterns of performance may exist, but little research has been conducted to identify these subtypes in social cognitive research. One method that may be useful in identifying subtypes is cluster analysis. Cluster analysis derives subtypes based on similarities in performance across different measures and serves to reduce sample heterogeneity that can sometimes obscure research findings. Also, cluster analysis allows researchers to examine a number of variables at the same time, which is important since previous research has generally focused on single constructs or relationships (paranoia, diagnosis, symptom severity). The notion of different subtypes in schizophrenia research is not new, and several studies have found support for a number of distinct subtypes with differing levels of cognitive impairment (Goldstein and Shemansky, 1995; Goldstein et al., 1998a,b). However, these previous studies have examined cognitive performance on measures of memory, language, and executive functioning, not social cognition.

The purpose of this study is two fold. First, based on previous research, we will explore relationships between social perception and other theoretically important variables such as demographics (gender, length of illness, medication type, etc.), symptoms (thought disorder, paranoia, etc.), diagnosis (paranoid vs. non-paranoid schizophrenia), and cognition (WRAT-III). Second, we will use cluster analysis to determine if subtypes with different levels and patterns of performance are present across measures of emotion, face, and general perception. Subtype performance will be compared to normative scores to provide evidence as to the presence of a generalized or specific deficit (i.e., is the performance on these measures lower than normals and if so, what scores are lower?). Although this study is primarily exploratory in nature, we predict that a subtype with a generalized deficit across all three

measures and a subtype with a specific deficit in emotion perception will emerge (see Penn et al., 2000). Following the cluster analysis, we will examine these subtypes for additional differences in psychiatric symptoms, clinical history, and demographic variables that may help explain these subtypes (i.e., external validity, Aldenderfer and Blashfield, 1986).

2. Methods

2.1. Participants

Participants included one hundred persons ($n=72$ males, 28 females), recruited from four inpatient psychiatric hospitals in Louisiana and Oklahoma (Table 1). Two of the sites were acute care facilities ($n=58$) and two were long-term care facilities ($n=42$). Participants were diagnosed with a schizophrenia using the Structured Clinical Interview for DSM-IV (SCID-I/P; First et al., 2001). Assuming equal groups, chi-square analyses of gender and ethnicity revealed that there were more males than females (χ^2 ($N=100$) $=19.36$, $p<0.0001$) and more African Americans than Whites (χ^2 (2; $N=100$) $=51.38$, $p<0.0001$) in the sample. Participants were excluded from the study if they met DSM-IV-TR criteria for substance dependence within the previous 3 months, could not provide informed consent, if they scored below third grade reading level on the Wide Range Achievement Test, 3rd Revision (WRAT-III; Wilkinson, 1993), or if they had a documented neurological condition other than schizophrenia.

Table 1
Summary of participant demographics

Variable	Mean (SD)
N	100
Age (years)	38.28 (9.37)
Educational level (years)	12.31 (9.10)
Gender	–
Male (n)	72
Female (n)	28
Ethnicity	–
Caucasian (n)	41
African American (n)	59
DSM-IV Diagnosis	–
Paranoid Schizophrenia (n)	66
Nonparanoid Schizophrenia (n)	34
Length of illness (years)	15.66 (9.56)
On Atypical Antipsychotics (n)	54
CPZ equivalents (mg/day)	795.80 (566.16)
BPRS Total Score (range 24–168)	50.97 (13.85)
Affect (range 5–35)	9.85 (4.59)
Anergia (range 4–28)	8.51 (3.82)
Disorganization (range 3–21)	5.72 (2.23)
Thought Disorder (range 4–28)	12.07 (4.81)
WRAT-III Reading	78.00 (21.01)

BPRS = Brief Psychiatric Rating Scale; WRAT = Wide Range Achievement Test, 3rd Edition; CPZ = Chlorpromazine Equivalents (Woods, 2003).

2.2. Measures

2.2.1. Clinical measures

The SCID-I/P was used to derive a clinical diagnosis based on DSM-IV criteria (First et al., 2001). Participant diagnoses were made by two clinical researchers using all available data (DC and DLP). The expanded version of the Brief Psychiatric Rating Scale (BPRS) was used to assess a participant's current level of symptomatology over the previous 2-week period of time (Lukoff et al., 1986). The BPRS contains 24 items, which cover a wide-range of psychiatric symptoms. The BPRS is rated on a 1 to 7 Likert scale with a score of 1 indicative of no pathology and a score of 7 indicative of severe pathology. For this study, we examined the BPRS total score and the factor scores of thought disorder, anergia, affect, and disorganization (Mueser et al., 1997). The researchers were trained to adequate reliability with a criterion-trained rater on the BPRS and SCID (ICC's > 0.80+). The WRAT-III (Wilkinson, 1993) reading subtest was used to screen participants for problems in reading and can also serve as an estimate of pre-morbid intellectual functioning (Pinkham and Penn, 2006; Kremen et al., 1995). Medication type and dosage were collected from participant medical charts and were transformed into chlorpromazine equivalents for analysis (Woods, 2003).

2.2.2. Perception measures

Emotion perception was examined using the Face Emotion Identification Test (FEIT; Kerr and Neale, 1993). The FEIT was developed using the photographs developed by Ekman (1976) and Izard (1971). Nineteen items are presented that cover six emotional states (happiness, sadness, anger, surprise, fear, and shame). The expressions are presented on videotape for 15 s and participants are asked to identify each emotion. Scores range from 0 to 19 with higher scores indicative of better emotion perception abilities. The FEIT contains both positive (happy and surprise) and negative emotional expressions (anger, fear, sadness and shame). The FEIT was developed using both normal and psychiatric samples and has been widely used in clinical research (Penn et al., 2000). Internal consistency from previous studies was 0.74 for clinical samples and 0.56 to 0.71 for

control samples (Kerr and Neale, 1993). For the present study, the internal consistency and difficulty level of the FEIT was 0.57 and 0.51, respectively.

Face perception was examined with the Test of Facial Recognition (TFR; Benton et al., 1978). The TFR requires participants to look at a variety of faces (between 3 and 6 depending on the item) and match those choices to a target face in terms of identity. All of the TFR faces are non-emotional in nature. TFR scores range from 0 to 54, and higher scores indicate better facial perception abilities. Internal consistency for the TFR in previous studies has ranged from 0.41 to 0.47 (Kerr and Neale, 1993). For the present study, the internal consistency and difficulty level of the TFR was 0.53 and 0.74, respectively.

General visual perception was measured with the Visual Form Discrimination Task (VFDT; Benton et al., 1994). Similar to the TFR, the VFDT presents each participant with a target geometric design in which the person must match to one of four geometric response options. Of the four response options, three options are distracters, and one is the correct target. The VFDT consists of 16 trials and scores range from 0 to 32. Higher scores indicate better visual perceptual abilities. For the present study, the internal consistency and difficulty level of the VFDT was 0.73 and 0.82, respectively.

2.3. Procedure

Data were collected from the records of 100 participants who were part of previous studies on emotion perception and schizophrenia (see Penn and Combs, 2000; Penn et al., 2000). A clinical psychology doctoral student administered all of the measures. Participants gave their written consent and were tested individually, within a single session. The FEIT task was presented on a 13-in. television screen using a videocassette recorder. Both the VFDT and the TFR were administered from test booklets using standard administration instructions. Participants were paid a stipend for completing the study.

2.4. Data analytic plan

First, we report correlations between the social perception measures and demographics (gender, ethnicity, length of illness, medication type, etc.), symptoms (thought disorder, paranoia, negative symptoms, etc.), diagnosis (paranoid vs. nonparanoid schizophrenia), and cognition (as measured by the WRAT-III). Second, we report on the use of cluster analysis to derive subtypes based on scores from the FEIT, TFR and VFDT. Third, we determine if the subtypes are related to differences on other variables in an attempt to validate the subtypes (e.g., are they meaningful and related to additional differences on other variables not used in the cluster analysis).

3. Results

3.1. Correlational data

As presented in Table 2, there were significant relationships between the FEIT, site (acute vs. chronic), BPRS thought disorder factor score, medication type (atypical vs. ypical), and DSM-IV diagnosis (paranoid vs. nonparanoid). Thus, persons from chronic care settings, those who were taking atypical antipsychotic medications, and those who are diagnosed with paranoid schizophrenia showed higher FEIT scores. In contrast, higher levels of thought disorder were linked to lower FEIT scores. On the TFR, there was a significant relationship with the BPRS disorganization factor score such that greater levels of disorganization are linked to lower facial recognition scores. However, it should be noted that all of these correlations were modest in magnitude and accounted for between 4 and 5% of the variance of social perception scores.

3.2. Cluster analysis

The FEIT, TFR, and VFDT served as the dependent variables of interest in the cluster analysis. Cluster

Table 2
Correlations of perception measures with variables

Variable	FEIT	TFR	VFDT
Age (years)	.02	.05	.03
Education (years)	.05	.11	.12
Gender (male vs. female)	.10	.11	−.02
Site (acute vs. chronic)	.20 *	.09	.08
Length of illness (years)	.02	.03	.07
Medication type (atypical vs. typical)	.20 *	.09	.08
BPRS total score	−.17	−.13	−.02
BPRS anergia	−.04	.00	.03
BPRS affect	−.05	−.02	.00
BPRS thought disorder	−.29 **	−.10	−.03
BPRS suspiciousness item	.06	−.11	.05
BPRS disorganization	−.16	−.27 **	−.00
Diagnosis (paranoid vs. nonparanoid)	.25 *	.01	.01
WRAT-III reading	−.02	.12	.20

FEIT = Face Emotion Identification Task; TFR = Test of Facial Recognition; VFDT = Benton Visual Form Discrimination Test; BPRS = Brief Psychiatric Rating Scale; WRAT = Wide Range Achievement Test, 3rd Edition.
* $p < .05$ (two-tailed).
** $p < .01$ (two-tailed).

analysis was performed using the SPSS two-step cluster method, which is a type of hierarchical agglomerative method in which clusters of increasing size are formed at each step. The two-step cluster method places participants into pre-clusters (step 1), followed by the placement of participants into a final cluster (step 2). The distance measure was the log-likelihood statistic, which is appropriate for continuous and dichotomous data. We examined a range of 1 to 10 cluster solutions and determined that a two cluster solution as the best fit for the data based on the Schwarz Bayesian Criterion (BIC) and a review of the agglomeration schedule. Since cluster analysis can be affected by scores of different ranges, these variables were transformed into standardized *Z* scores (based on normative scores reported in Penn et al., 2000) prior to examination. We acknowledge that there is some debate about the need for the standardization of variables in cluster analysis (see Ariyawardana and Bailey, 2003; Ketchen and Shook, 1996; Milligan and Cooper, 1988 for reviews of this topic). However, we conducted the cluster analysis using both raw scores and standardized scores and there was no difference in the cluster solution. For this study, the use of standardized scores will allow a direct comparison of test performance with normal controls, which is important in determining if a generalized or specific deficit is present. Finally, to examine the reliability of the cluster solution, we repeated the cluster analysis using a variety of iterative (e.g., K Means) and agglomerative cluster methods (e.g., Ward's method with squared Euclidean distance) and found identical results. Thus, there is converging evidence that a two-cluster solution is present in the data.

In terms of cluster performance, scores on the FEIT, TFR, and VFDT in their original units of measurement and in standardized Z scores are presented in Table 3 to facilitate comparisons with previous research. Cluster 1 consisted of 46 participants and cluster 2 consisted of 54 participants. As evident in Fig. 1, both clusters scored

Table 3
Performance on emotion and general perception tasks by cluster

Task	Cluster 1				Cluster 2			
	Z score		Raw score		*Z* score		Raw score	
	M	SD	M	SD	M	SD	M	SD
FEIT	−2.86	1.18	8.00	2.56	−1.19	.85	11.61	1.81
TFR	−2.48	2.17	39.74	6.22	−1.54	1.84	42.44	5.27
VFDT	−4.11	3.12	24.00	5.05	−1.20	1.47	28.70	2.38

Z scores computed from normative data (Penn et al., 2000); FEIT=Face Emotion Identification Task; TFR=Test of Facial Recognition; VFDT=Benton Visual Form Discrimination Test.

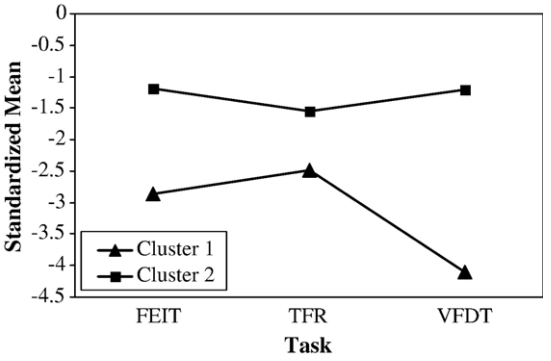

Fig. 1. Standardized means for the social and general perception measures by cluster.

below the normal control group on all three social perception tasks. Cluster 1 showed the most impaired performance, and cluster 2 showed evidence of mild to moderate impairment.

In order to examine differences in level of performance between the clusters, we conducted a MANOVA with cluster as the between-subjects factor and the three social perception measures as the dependent variables. Overall, we found a significant multivariate effect for group, $F(3, 96)=52.3$, $p=0.0001$. Post-hoc analyses using a series of one-way ANOVA's revealed significant differences on the FEIT, $F(1, 98)=67.4$, $p=0.0001$, the TFR, $F(1, 98)=5.5$, $p=0.02$, and the VFDT, $F(1, 98)=37.1$, $p=0.001$ with cluster 1 showing lower scores on these measures as compared to cluster 2. As a separate analysis, we decided to examine the FEIT for differences in positive and negative emotions. We found that there were significant differences between the clusters on the identification of positive, $t(99)=2.7$, $p=0.007$ ($M=2.9$ vs. 3.3; range 0–4) and negative, $t(99)=7.5$, $p<0.0001$ ($M=5.0$ vs. 8.2; range 0–15) emotional expressions, with cluster 1 showing the lowest scores across both affective valences.

To examine if there were differences in the pattern of performance within each subtype, we conducted two repeated measures ANOVA's with the FEIT, TFR, and VFDT as the repeated measures variable. For cluster 1, there was a significant differences across the tests, $F(2, 44)=5.2$, $p=0.009$, with scores on the VFDT significantly lower than the TFR (Sidak corrected $p=0.006$) and a trend for differences with the FEIT (Sidak corrected $p=0.09$). There was no differences across the tests for cluster 2, $F(2, 52)=0.8$, $p=0.46$.

To examine the meaningfulness of the clusters (external validation), we conducted several additional analyses to determine if there were additional differences between the clusters on demographic, clinical, and

symptom variables. In terms of symptom severity, there was no differences on the BPRS total score, $t(99)=1.1$, $p=0.23$, or on the BPRS factor scores of Anergia, $t(97)=0.23$, $p=0.82$, Affect, $t(98)=-.75$, $p=0.46$, or Disorganization, $t(95)=0.54$, $p=0.59$. However, cluster 1 did show higher levels of Thought Disorder, $t(98)=2.47$, $p<0.02$. The clusters were not different on age, $t(98)=0.02$, $p=0.98$, years of education, $t(96)=-1.02$; $p=0.31$, WRAT-III reading subtest scores, $t(75)=-.28$, $p=0.78$, length of illness, $t(93)=-.25$, $p=0.81$, location (acute vs. long-term care facility; χ^2 ($N=100$)$=1.8$, $p=0.17$), setting (Louisiana vs. Oklahoma, χ^2 ($N=100$)$=0.24$, $p=0.61$) or chlorpromazine equivalent dosage, $t(73)=0.80$, $p=0.43$. DSM-IV diagnosis was coded as either paranoid or nonparanoid schizophrenia for examination. There was a greater number of participants with paranoid schizophrenia ($n=40$) than participants with nonparanoid schizophrenia in cluster 2, χ^2 ($N=100$)$=12.5$, $p=0.001$.

To assess the stability of the derived cluster solution, a split-half replication was conducted. After randomly dividing the sample into equal parts, the cluster analysis was repeated on each sample. Results showed that 84% and 98% of participants were correctly placed in their original clusters, yielding an overall classification total of 91%. This rate of classification stability is excellent and supports the stability of the cluster solution (Aldenderfer and Blashfield, 1985).

4. Discussion

This study sought to determine if subtypes with different levels and patterns of performance could be derived based on variety of social and general perception tasks. Using cluster analysis, two homogeneous subtypes were identified based on their scores on the Face Emotion Identification Test, Benton's Test of Facial Recognition, and the Visual Form Discrimination Task. Both clusters showed performance deficits across all three measures when compared to normative data. Not only was emotion perception lower for both subtypes (for positive and negative emotions as well), but both groups showed deficits on face and general perception as well. Based on these results, the data seems to support the presence of a generalized deficit model for across social and general perception tasks in schizophrenia (Kerr and Neale, 1993; Mueser et al., 1996; Penn et al., 1997; Salem et al., 1996). We did not find evidence of a specific deficit, which would be characterized as poor emotion perception in the presence of intact face or visual perception (see Feinberg et al., 1986; Novic et al., 1984; Penn et al., 2000).

In terms of subtype performance, cluster 1 was the most severely impaired and showed scores roughly three standard deviations below that of normal controls; scores on visual perception were significantly lower than face perception suggesting a different pattern of performance. Cluster 2 showed mild to moderate levels of impairment with scores about one standard deviation below normal, which is commonly found in studies on cognitive performance in schizophrenia (Heinrichs, 2005). There were no differences in pattern of performance across the tests for cluster 1, as the social perception scores were relatively equal. The identification of two distinct subtypes is consistent with previous research in which groups comprised of severely impaired and mild/moderately impaired participants were derived (Goldstein and Shemansky, 1995; Goldstein et al., 1998a). In contrast, we did not identify a subtype with normal or near normal performance, which is sometimes found in research on cognitive functioning, although the presence of a normal performing schizophrenia group is somewhat controversial (Allen et al., 2003; Goldstein et al., 2005; Palmer et al., 1997). It should be noted that we did not classify participants according to their individual performance, which may have identified these normal performing individuals. Also, cluster analysis examines data at the group level of analysis not the individual level. Finally, the cluster solution appears to be stable based on the split-half replication procedure (see Aldenderfer and Blashfield, 1984).

A crucial aspect of cluster analysis is the examination of external correlates and criterion variables that may help elucidate and interpret the cluster solution. Thus, the subtypes should also show meaningful differences on other variables not used in the cluster solution. There are two findings of interest regarding this issue. First, the mild to moderately impaired cluster showed a greater number of persons with paranoid schizophrenia although not all participants with this diagnosis were assigned to this cluster. It is widely believed that persons with paranoid schizophrenia show better cognitive functioning (Bornstein et al., 1990; Goldstein et al., 2005; Strauss, 1993; Zalewski et al., 1998). Our results are consistent with evidence that persons with paranoid schizophrenia perform better on emotion perception tasks than with nonparanoid schizophrenia (Davis and Gibson, 2000; Kline et al., 1992; Lewis and Garver, 1995). In contrast, there was no effect when paranoia was examined at the symptom level (see Combs et al., 2006; Peer et al., 2004). We suspect that other factors

such as a better pre-morbid social functioning associated with a diagnosis of paranoid schizophrenia may be important in these results.

Second, there was evidence for differences in positive symptoms reflective of thought disorder between the two clusters. Cluster 1 (the severely impaired group) showed greater clinician ratings of thought disorder based on the BPRS than cluster 2, which could suggest that the positive symptoms of schizophrenia (e.g. hallucinations, non-persecutory delusions) could interfere with performance on the perception tasks via a compromised attentional system (Combs and Gouvier, 2004; Hall et al., 2004; Gessler et al., 1989; Kohler et al., 2000). This difference in symptoms may also reflect the composition of the subtypes with cluster 1 containing relatively more persons with nonparanoid schizophrenia. To reconcile our findings with Penn et al. (2000), it has been demonstrated that persons in the acute phase of schizophrenia show the poorest performance on social cognition measures and this is consistent with our findings for cluster 2, which had higher levels of thought disorder and also the most impaired performance across the measures. Since there were no differences between clusters based on facility type (acute versus chronic setting), we must conclude that symptom level and diagnosis are important determinants of performance. It should be noted that many persons in chronic settings show elevated levels of psychosis despite longer periods of treatment. Finally, we found no differences between BPRS rated negative symptoms and cluster membership.

Limitations of the study include the lack of inclusion of a measure of pre-morbid social functioning as some studies have found a relationship between pre-morbid social functioning and emotion perception abilities (Mueser et al., 1990, 1996). Also, a comprehensive neuropsychological examination was not conducted to determine if the clusters were impaired on other types of cognitive tasks, which would have provided further evidence for the presence of a generalized deficit instead of a specific focus on perception tasks. In this study, our only measure of cognition was the WRAT-III, which at best can only provide an estimate of overall cognitive functioning. The study of the interaction between cognition and social cognition is ongoing, and the two processes are likely interrelated, but the exact relationship is not currently clear (Penn et al., 2006).

In closing, we would like to highlight three findings that may be of interest to clinical researchers. First, our results support the presence of a generalized deficit on measures of social perception as compared to a specific deficit, which is important in accurately characterizing the performance of persons with schizophrenia. Second, although both subtypes were impaired, cluster 1 also differed in pattern of performance and showed performance deficits greater than 95% of the population. This might suggest that these persons may need some type of cognitive remediation in order to fully participate and benefit from psychosocial treatment programs. Third, consistent with previous research, we found support for the role of positive symptoms and diagnostic classification in subtype performance, which may reflect the robustness of these findings across different data analytic procedures. It would be useful to see if these subtypes are stable over time and if changes in symptoms lead to consequent changes in test performance. Finally, as researchers learn more about social cognition in schizophrenia, we hope that these findings will lead to improved social and community functioning and a better quality of life for individuals with schizophrenia.

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