The Role of Attention in Affect Perception: An Examination of Mirsky’s Four Factor Model of Attention in Chronic Schizophrenia

by Dennis R. Combs and Wm. Drew Gouvier

Abstract

Attentional skills among people with schizophrenia may be related to deficits in affect perception. Such deficits can dramatically inhibit appropriate social functioning. We examined attention and affect perception in a sample of 65 people diagnosed with chronic schizophrenia. We used Mirsky’s four factor model of attention to assess attentional functioning. To measure affect perception, we used two reliable measures of emotion recognition, the Bell-Lysaker Emotion Recognition Test and the Face Emotion Identification Test. Multiple regression analysis showed that all four attentional factors and a diagnosis of paranoid schizophrenia were significantly predictive of affect perception scores. In contrast, psychiatric symptoms, medication levels, demographic variables, verbal fluency, and face recognition scores were not predictive of affect perception scores. The four factors of attention accounted for 78 percent of the variance in affect perception scores. These results emphasize the role that attentional abilities play in affect perception for people with schizophrenia.

Keywords: Attention, affect perception, schizophrenia, social functioning.


Many researchers believe that schizophrenia is essentially a social-cognitive disorder (Bellack 1992; Penn and Mueser 1996; Penn et al. 1997; Kohler et al. 2000). People diagnosed with schizophrenia demonstrate various social impairments such as poor affect perception, deficient social skills, decreased recognition of nonverbal cues, and social competence deficits (Bellack 1992; Salem et al. 1996; Penn et al. 1997). Schizophrenia has also been associated with a range of information-processing and neuropsychological deficits (Saykin et al. 1991, 1994; Schwartz et al. 1992; Zalewski et al. 1998), and some researchers believe that problems in cognitive functioning may affect people’s ability to learn, exhibit, and express social skills and behaviors (Morrison et al. 1988b; Bellack 1992; Penn et al. 1997, 2000). Researchers have become increasingly interested in the possible link between information processing and social functioning (Bellack 1992; Comblatt et al. 1992; Freedman et al. 1998; Bellack et al. 1999; Penn et al. 2000; Addington et al. 2001). However, studies examining this relationship are few and have been inconsistent in their findings regarding which cognitive variables are linked to adaptive social functioning (Green 1996).

One aspect of social behavior needing further study is the ability to perceive and identify another person’s affective or emotional state (affect perception). Many empirical studies have shown consistent deficits in affect perception among those diagnosed with schizophrenia (Doughtery et al. 1974; Muzekari and Bates 1977; Novic et al. 1984; Cramer et al. 1989; Archer et al. 1992; Kerr and Neale 1993; Schneider et al. 1995; Salem et al. 1996; Mandal et al. 1998; Penn and Combs 2000; Penn et al. 2000), and some researchers believe that these deficits are the most debilitating of all the social impairments found in schizophrenia (Morrison et al. 1988b). These findings raise the question of what variables contribute to these deficits.

Deficits in affect perception and other social behaviors may stem from cognitive impairments associated with schizophrenia (Bellack 1992; Green 1993; Addington and Addington 1998; Mandal et al. 1998; Morrison et al. 1988b). Bellack (1992) stated that successfully completing most social perception tasks requires substantial cognitive demands. A better understanding of the relationship between information-processing abilities and affect perception may lead to a better understanding of the characteristics of the disorder. In fact, several studies have found that affect-perception skills were related to adaptive social functioning and social skills in both inpa-
Emerging evidence indicates that a particular cognitive variable, attention, may be an important component of affect perception. Theoretically, deficient attentional skills could impair affect perception by interfering with the ability to attend to and decode facial stimuli (Bellack 1992; Addington and Addington 1998; Mandal et al. 1998; Morrison et al. 1988b). Bruce and Young (1986) posited an important role for visual attention in face recognition and in affect/expression analysis. This theory was empirically demonstrated in a series of studies by Phillips and David (1997, 1998) in which people with delusions scanned more nonrelevant areas of the face. Thus, affect perception requires that people select which parts of the face to attend to and then maintain their attention to collect important information about another’s emotional state (Green 1996; Bryson et al. 1997; Addington and Addington 1998; Morrison et al. 1988a). Quite simply, if a person cannot fully attend to facial stimuli, then his or her capacity to decode and interpret emotional expressions will be concomitantly impaired.

Several empirical studies have examined the role of neuropsychological variables in affect perception. An examination of these studies showed consistent evidence that attention was a key variable in affect perception (Bryson et al. 1997; Addington and Addington 1998; Kee et al. 1998; Kohler et al. 2000)—arguably more important than memory, learning, motor functioning, and reasoning. Furthermore, because attention is a necessary precursor for processing incoming information, attention problems can affect many other higher order cognitive abilities (Mapou 1995).

Although attention may be a crucial factor in affect perception (Archer et al. 1992; Kerr and Neale 1993; Bryson et al. 1997; Mandal et al. 1998), only a few studies have specifically examined the aforementioned link between attention and affect perception. Bryson et al. (1997), Addington and Addington (1998), Kee et al. (1998), and Kohler et al. (2001) have all found some support for the role of attention in affect perception, although not all studies agree on its importance (Schneider et al. 1995; Morrison et al. 1988a). Specifically, attention span, the ability to shift attention, and sustained attention have all been found to be related to affect perception scores. However, these studies used unvalidated attentional measures, and these measures were not selected based on current theoretical models of attentional functioning (i.e., Mirsky et al. 1991).

In sum, theoretical and research evidence suggests that attention may be important in affect perception (Morrison et al. 1988b; Bellack 1992; Bryson et al. 1997; Mandal et al. 1998). To identify different emotional states, facial information must be attended to and perceived (Bellack 1992). Various research studies on affect perception have stated that attentional problems may be responsible for the observed deficits, but only a few have explored this topic empirically. Attention should be assessed in a way that is consistent with research on the multifactorial nature of the attentional process (Solberg and Mateer 1989; Mirsky et al. 1991). Finally, the relationship between attention and affect perception could have implications for the cognitive rehabilitation of these deficits (Hogarty and Flesher 1992; Green 1996). The study of attention in affect perception therefore has important theoretical, empirical, and clinical merit.

The purpose of this study was to explore the relationship between affect perception and attention in a sample of people with chronic schizophrenia using Mirsky’s four factor model of attention. Mirsky et al. (1991) identified four factors of attention (Shift, Sustain, Encode, and Focus-Execute) based on a Principal Components Analysis (PCA) of common neuropsychological measures. The four factor model of attention has been replicated in other samples of people with chronic schizophrenia (Steinhauer et al. 1991; Kremen et al. 1992). Previous research findings suggest that the Sustain, Shift, and Encode factors will best predict affect perception scores. In addition, because there is evidence that people with paranoid schizophrenia show improved affect perception scores, the relationship between diagnostic subtype and affect perception was also examined (Kline et al. 1992; Lewis and Garver 1995). Finally, two other neurocognitive measures (verbal fluency and general face perception) were included to examine what role, if any, these skills play in affect perception.

Method

Participants. The participants were 65 people diagnosed with chronic schizophrenia who were recruited from two large State psychiatric hospital settings in Louisiana: Southeast Louisiana State Hospital and the Eastern Louisiana Mental Health System. Both settings are tertiary care treatment centers for people with chronic mental illness. Table 1 summarizes participant demographic and clinical characteristics. A total of 36 males and 29 females participated in the study. By ethnicity, 17 were Caucasian, 47 were African-American, and 1 was Asian-American. There was no difference in the gender and ethnic makeup of the total sample, \( \chi^2 (2) = 1.3, p = 0.50 \). Comparison tests did not reveal any differences in attentional or affect perception measures based on gender, ethnicity, or hospital site. To be eligible for the study, participants were required to have a DSM-IV diagnosis of...
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**Schizophrenia Bulletin, Vol. 30, No. 4, 2004**

Table 1. Summary of participant demographics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total sample mean (SD)</th>
<th>Eastern Louisiana Mental Health System mean (SD)</th>
<th>Southeast Louisiana State Hospital mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>40.7 (7.9)</td>
<td>41.0 (8.0)</td>
<td>40.2 (8.0)</td>
</tr>
<tr>
<td>Education (yrs)</td>
<td>11.2 (1.7)</td>
<td>11.1 (1.8)</td>
<td>11.5 (1.6)</td>
</tr>
<tr>
<td>Gender (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>36</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>Female</td>
<td>29</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>Ethnicity (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>17</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>African-American</td>
<td>47</td>
<td>32</td>
<td>15</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>SCID–IP diagnosis (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paranoid schizophrenia</td>
<td>40</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>Undifferentiated schizophrenia</td>
<td>8</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Disorganized schizophrenia</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Schizoaffective disorder</td>
<td>13</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>CPZ equivalents (mg/d)¹</td>
<td>854.0 (494.5)</td>
<td>864.2 (534.7)</td>
<td>834.0 (415.8)</td>
</tr>
<tr>
<td>Antipsychotic medication type (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical</td>
<td>15</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>Atypical</td>
<td>34</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Combination</td>
<td>16</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Anticholinergic medication (%)</td>
<td>36</td>
<td>44</td>
<td>22</td>
</tr>
<tr>
<td>BPRS total score</td>
<td>53.8 (5.9)</td>
<td>54.3 (6.0)</td>
<td>52.8 (5.8)</td>
</tr>
<tr>
<td>AIMS score</td>
<td>0.17 (0.57)</td>
<td>0.21 (0.64)</td>
<td>0.09 (0.43)</td>
</tr>
<tr>
<td>Length of illness (mos)</td>
<td>218.8 (97.7)</td>
<td>220.5 (102.9)</td>
<td>216.5 (88.9)</td>
</tr>
<tr>
<td>Length of stay (wks)</td>
<td>86.0 (110.7)</td>
<td>84.4 (123.4)</td>
<td>89.2 (82.9)</td>
</tr>
<tr>
<td>Hospital admits (n)</td>
<td>11.1 (17.3)</td>
<td>13.6 (20.8)</td>
<td>6.4 (4.1)</td>
</tr>
<tr>
<td>WRAT–III, reading</td>
<td>79.8 (9.0)</td>
<td>79.4 (8.6)</td>
<td>80.7 (10.0)</td>
</tr>
</tbody>
</table>

Note.—AIMS = Abnormal Involuntary Movement Scale; BPRS = Brief Psychiatric Rating Scale; CPZ = chlorpromazine; SCID–IP = Structured Clinical Interview for DSM–IV; WRAT–III = Wide Range Achievement Test III.

¹Medication dosages were converted to chlorpromazine equivalents.

Schizophrenia, schizoaffective disorder, or psychotic disorder not otherwise specified. All participants were assessed using the Structured Clinical Interview for the DSM–IV (SCID–IP; First et al. 1995) to confirm diagnosis of schizophrenia. To examine the effects of diagnostic subtype on affect perception, two groups were formed: A paranoid group (paranoid schizophrenia) and a nonparanoid group (disorganized, undifferentiated, and schizoaffective). Psychiatric symptomatology was assessed using the Brief Psychiatric Rating Scale (BPRS; Lukoff et al. 1986). Tardive dyskinesia symptoms were assessed by a review of Abnormal Involuntary Movement Scale (AIMS) scores conducted by hospital staff. Data on type and dosage of antipsychotic medication were collected, and medication dosages were converted into standardized chlorpromazine equivalents (see Lehman and Steinwachs 1998 and Bezchlibnyk-Butler and Jeffries 2002 for CPZ conversion rates).

Participants who had documented substance abuse problems were required to be in remission or in a controlled environment for 3 months before participating. Substance abuse problems were ruled out by a review of substance screening tests on admission and by the SCID–IP substance abuse module. Other exclusion criteria included having a documented neurological condition (e.g., stroke, traumatic brain injury, or seizure disorder),
being too disorganized to give consent or complete the protocol, being deemed unsuitable for inclusion by hospital staff, or reading level below the fourth-grade level as assessed by the Wide Range Achievement Test III (WRAT-III) reading test (Wilkinson 1993).

Procedure for Selection of Participants. Participants were selected using a methodology employed in previous research studies in these settings (Penn and Combs 2000; Penn et al. 2000). Potential participants first received a general overview of the study. Next, a list of all people with diagnoses that met study eligibility criteria was constructed from the hospital roster. Participants either volunteered to take part in the study after the general overview or were identified (based on diagnosis) and approached for participation. One person refused to participate in the study, and two people refused to continue testing. In all three cases, the subject became disorganized, psychotic, and confused.

Demographic and Clinical Measures. A basic demographic questionnaire was used to obtain background information for each participant (e.g., length of illness, duration of current stay, number of inpatient hospitalizations, AIMS score, and medication type and dosage). This information was obtained from hospital records and an interview with the participant.

The SCID-I/P was used to derive a clinical psychiatric diagnosis based on the DSM-IV system (First et al. 1995). The BPRS assessed each participant’s current level of symptomatology over the previous 1- to 2-week period (Lukoff et al. 1986). The BPRS contains 24 items (rated on a scale of 1 to 7) that cover a range of psychiatric symptoms. The BPRS can be broken down into four factor scores: anergia, affect, thought disorder, and disorganization (Mueser et al. 1997). The principal investigator was reliability trained on the BPRS and SCID-I/P (Penn and Combs 2000; Penn et al. 2000). The WRAT-III (Wilkinson 1993) reading subtest was used to screen participants for problems in reading.

Measures of Attention. The measures of attention used in this study were selected based on Mirsky’s four factor model of attention: Focus-Execute, Encode, Sustain, and Shift (Mirsky et al. 1991, 1995). The Shift factor was composed of scores from the Wisconsin Card Sorting Test (WCST; Heaton 1981). WCST variables of interest were percentage correct, number of errors, and categories completed. The person must be able to disengage or shift attention from the previous response to the new set (e.g., color to form), which may be different from the reasoning/problem-solving aspects of the test (Mirsky et al. 1995; Spren and Strauss 1998). A computerized version of the WCST was used for ease of examination. The Sustain factor was based on scores from the conventional version of the Continuous Performance Test (CPT; obtained from the University of California at Los Angeles), which required the person to respond by clicking a mouse button each time the number “0” appeared (Nuechterlein 1991). Of the 480 total numbers presented, only 120 were targets. Variables of interest from the CPT included number of hits, total number of errors (misses and false alarms), and mean reaction time (Mirsky et al. 1991, 1995; Kremen et al. 1992). The CPT also provided a sensitivity index (d’; based on signal detection theory), which measured the person’s sensitivity to correctly respond to targets and ignore distracter numbers. The Focus-Execute factor was based on scores from the Trail Making Test (Reitan and Davison 1974; time in seconds) and Digit Symbol–Coding subtest (number correct) from the WAIS-III. The final factor, Encode, was based on scores from the Digit-Span subtest (number correct) and Arithmetic subtest (number correct) of the WAIS-III.

Affect Perception Measures
Bell-Lysaker Emotion Recognition Test (BLERT). The BLERT is a 21-item videotaped presentation of seven different emotional states: happiness, sadness, anger, fear, disgust, surprise, and no emotion (Bell et al. 1997; Bryson et al. 1997). Each emotional state was presented for 10 seconds, and the subject had to decide which affective state was presented. Each emotion was displayed by a male actor who recited a series of three standard monologues concerning his job. The BLERT total score (range 0 to 21) was used in the analyses. The BLERT has good categorical stability data (κ = 0.76) and test-retest stability (5-month test-retest reliability was 0.76). The BLERT also has good discriminant and convergent validity (Bell et al. 1997; Bryson et al. 1997). In the present study, the internal consistency for this scale was 0.79.

Face Emotion Identification Test (FEIT). The FEIT was developed by Kerr and Neale (1993) using still photograph pictures taken from the work of Ekman (1976) and Izard (1971) and based on the generalized deficit model (Chapman and Chapman 1973, 1978). The FEIT consists of 19 (score range 0 to 19) videotaped pictures of six different emotional states: happiness, sadness, anger, surprised, afraid, and ashamed. The FEIT was developed as an affect perception test with acceptable reliability and validity. Previous reliability results showed an internal consistency value ranging from 0.56 to 0.71 (Kerr and Neale 1993). Comparable reliability results were replicated in another study using a similar state hospital sample (Penn et al. 2000). The FEIT has demonstrated good discriminant and convergent validity (Kerr
and Neale (1993). In the present study, the internal consistency for this scale was 0.75.

**Other Neurocognitive Measures.** To evaluate the person’s verbal fluency, the Controlled Oral Word Association test (COWA; Benton et al. 1994; Spreen and Strauss 1998) was administered. The test evaluates whether deficits in emotion recognition might be due to problems in general verbal fluency (language production) that might prevent the subject from generating the names for different emotions (Chen et al. 2000). The COWA requires the person to verbally generate as many items beginning with the letters F, A, and S as possible in 60 seconds, and a total score across all three letters was computed. The short form of the Benton Test of Facial Recognition (TFR; Benton et al. 1983) was administered as a control measure for the affect perception tasks. The test presented 27 pictures of different faces that the person matched in identity to a target face. Because the test controlled for the emotional content of the faces, it could serve as a pure face recognition test. The TFR has been used in previous studies to compare face perception and affect recognition (Salem et al. 1996; Penn et al. 2000).

**General Procedures.** The main component of the study was the administration of the measures of attention and affect perception. The measures of attention were administered individually and randomized before administration. The CPT and WCST were administered using a computerized testing format. These were followed by the COWA and the TFR. Finally, the affect perception measures (BLERT and FEIT) were administered. Each participant was compensated $5 for time and effort after completing the entire study protocol. The research protocol took approximately 1.5 to 2 hours to complete, and ample rest periods and breaks were provided to reduce the stress and fatigue associated with intensive testing.

**Data Analytic Plan.** The statistical analysis begins with summary scores based on the attentional and cognitive measures, followed by correlations between affect perception and the demographic and clinical variables. Because Mirsky’s four factor model has been replicated previously, and because the attentional factors found in this study (Shift, Sustain, Encode, and Focus-Execute) were very similar to Mirsky’s, the derivation of the factors using PCA is not reported. The factor scores computed from the PCA were used a predictor variables in the subsequent regression analyses. The dependent variable of interest is a standardized affect perception score composed of scores from the BLERT and FEIT. To determine which attentional factors were related to affect perception scores, we conducted a stepwise multiple regression analysis.

**Results**

**Summary Scores and Correlations.** Summary scores for the attentional, affect perception, and cognitive measures are presented in table 2. These scores are reported as raw scores (Mirsky et al. 1991). In addition, correlations between affect perception and the demographic and clinical variables can be found in table 3. Variables significantly correlated with affect perception included the COWAT ($r = 0.326, p = 0.002$), the TFR ($r = 0.450, p = 0.0001$), BPRS total score ($r = -0.329, p = 0.008$), and psychiatric subtype diagnosis ($r = -0.295, p = 0.008$).

**Multiple Regression Analysis.** We conducted a stepwise multiple regression analysis to determine which factor of attention was most predictive of affect perception scores. Predictor variables were the four factor scores generated from the PCA and other study variables related to affect perception scores (table 3). The BPRS total score, COWAT score, TFR score, and diagnostic subtype (para-
Table 3. Correlations between demographic, clinical, and affect perception variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Affect perception score (correlation coefficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>-0.20</td>
</tr>
<tr>
<td>Education</td>
<td>0.24</td>
</tr>
<tr>
<td>Facial recognition</td>
<td>0.45*</td>
</tr>
<tr>
<td>Verbal fluency</td>
<td>0.37*</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>-0.29*</td>
</tr>
<tr>
<td>BPRS total</td>
<td>-0.32*</td>
</tr>
<tr>
<td>Length of illness (mos)</td>
<td>-0.20</td>
</tr>
<tr>
<td>Length of stay (wks)</td>
<td>-0.15</td>
</tr>
<tr>
<td>Hospitalizations (n)</td>
<td>-0.24</td>
</tr>
<tr>
<td>AIMS</td>
<td>-0.21</td>
</tr>
<tr>
<td>Medication dose (CPZ equivalent)</td>
<td>-0.02</td>
</tr>
<tr>
<td>Medication type</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Note. —AIMS = Abnormal Involuntary Movement Scale; BPRS = Brief Psychiatric Rating Scale; CPZ = chlorpromazine.

1 Diagnosis was dummy coded as paranoid versus nonparanoid.

2 Medication type was coded as typical versus atypical.

A composite affect perception score (based on BLERT and FEIT) was the dependent variable in this analysis. This composite total score represented a more global, comprehensive measure of affect perception. Because scores from the BLERT and FEIT were found to be highly correlated (r = 0.85, p = 0.0001), the two affect perception scores were converted into standardized z scores based on sample means, and a composite affect perception score was computed (mean z scores from BLERT and FEIT). The conversion of these scores into z scores was needed to make the two measures comparable (see Salem et al. 1996 for a similar procedure) because the BLERT and FEIT have different numbers of test items and have different presentation formats (the BLERT has an audiovisual format and the FEIT is visual only). No differences in the regression results existed when the FEIT and BLERT were analyzed separately. The results of the stepwise multiple regression analysis are presented in table 4.

Overall, the four factors of attention and psychiatric diagnosis accounted for 81 percent of the variance in affect perception scores. The four factors of attention accounted for 78 percent of the variance in affect perception scores and diagnostic subtype accounted for 3 percent of the variance. The Shift factor had the highest predictive value (34.6%) followed by Encode (18.5%), Focus-Execute (14.7%), and Sustain (9.7%) factors. Examining the effect of diagnosis revealed that participants with paranoid schizophrenia had higher affect perception scores than participants with nonparanoid schizophrenia, F (1,63) = 7.3, p = 0.009. There were no differences in BPRS total or factor scores between the paranoid and nonparanoid groups. The other variables (COWAT, TFR, and BPRS) were not included in the stepwise analysis.

Supplementary Analysis. To determine whether attention was also important in face recognition, the four attentional factors were regressed against scores from the TFR. The four attentional factors predicted 20 percent of the variance in TFR scores (r = 0.45, r² = 0.20) compared with 78 percent in the affect perception scores. The Focus-Execute factor was the only significant predictor variable (r[64] = -2.0, p = 0.04).

Discussion

The stepwise multiple regression analysis showed that all four factors of attention, along with diagnostic subtype, were significantly related to affect perception scores. The Shift and Encode factors were found to be the strongest predictors of affect perception performance. The Focus-Execute and Sustain factors were also significant predictors but accounted for less variance. The four attentional factors accounted for 78 percent of the variance in affect perception scores. The attentional variables predicted emotion perception scores beyond that accounted for by general face perception, which suggests that basic face perception was not a significant factor for the affect perception task. In addition, the lack of a relationship with verbal fluency suggests that problems with affect perception are not related to verbal fluency deficits. No effect on affect perception was found for the BPRS symptoms scores, which will be discussed in more detail below.

Furthermore, the attentional factors were found to be min-
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Table 4. Stepwise Regression Analysis Results

<table>
<thead>
<tr>
<th>Step/variable</th>
<th>$r$</th>
<th>$r^2$</th>
<th>$\Delta^2$</th>
<th>$\beta$</th>
<th>$t$</th>
<th>Zero order</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Shift</td>
<td>0.597</td>
<td>0.356</td>
<td>0.346</td>
<td>0.581</td>
<td>10.4**</td>
<td>0.597</td>
</tr>
<tr>
<td>2. Encode</td>
<td>0.736</td>
<td>0.541</td>
<td>0.185</td>
<td>0.400</td>
<td>7.0**</td>
<td>0.430</td>
</tr>
<tr>
<td>3. Focus-Execute</td>
<td>0.830</td>
<td>0.689</td>
<td>0.147</td>
<td>-0.393</td>
<td>-7.0**</td>
<td>-0.384</td>
</tr>
<tr>
<td>4. Sustain</td>
<td>0.887</td>
<td>0.786</td>
<td>0.097</td>
<td>0.303</td>
<td>5.4**</td>
<td>0.312</td>
</tr>
<tr>
<td>5. Diagnosis</td>
<td>0.905</td>
<td>0.819</td>
<td>0.030</td>
<td>-0.186</td>
<td>-3.3*</td>
<td>-0.295</td>
</tr>
</tbody>
</table>

*Excluded variables in this analysis were the Brief Psychiatric Rating Scale total score, Controlled Oral Word Association Test, and the Benton Test of Facial Recognition. Diagnosis was dummy coded as paranoid versus nonparanoid.

* $p < 0.005$; ** $p < 0.001$

iminally predictive of face recognition scores (supplementary analysis), which suggests that attention may be more important in affect perception and less important for general face recognition (Kohler et al. 2001). The Focus-Execute factor was the only attentional variable predictive of face recognition. This result may be due to the demands of the test, in which the subject must select (focus) the target face and then respond (execute).

Bryson et al. (1997) and Kee et al. (1998) presented similar evidence that encoding skills, sustained attention, and the ability to shift attention were related to affect perception scores. Note that in the Bryson et al. study (1997), cognitive-attentional variables accounted for only 34 percent of the variance in affect perception as measured by the BLERT. The attentional variables used in the present study accounted for much more variance (78% versus 34%). The finding that participants with paranoid schizophrenia showed better affect perception scores is consistent with the results of Kline et al. (1992), Lewis and Garver (1995), and Toomey et al. (2002). Magaro (1981) and Strauss (1993) argued that people with paranoid schizophrenia have more intact cognitive abilities than people with nonparanoid schizophrenia. Because no differences in psychiatric symptoms on the BPRS existed between the paranoid and nonparanoid participants, we speculate that cognitive factors (which were not directly assessed) may be a source of the differences found in this study.

Surprisingly, no empirical relationship existed between affect perception and current psychotic symptoms (positive and negative), medication type or dosage, demographic, or other illness-related variables (table 3), suggesting that the affect perception scores found in this study may not be an artifact of these variables. Regarding illness-related variables, one study showed that a higher number of hospitalizations was paradoxically associated with better FEIT scores (Salem et al. 1996), whereas another study showed that the length of the current treatment episode was inversely correlated with the FEIT (Mueser et al. 1996). This present study did not find any association between length of illness or length of current treatment episode and affect perception scores. Previous research studies showed a modest association between affect perception and psychiatric symptoms, with negative symptoms associated with lower affect perception scores and more visual-spatial processing deficits (Borod et al. 1993; Kohler et al. 2000; Penn et al. 2000; Strauss 1993; Schneider et al. 1995). Although the BPRS total score was initially correlated with affect perception scores in the present study, its influence was better accounted for by the attentional and diagnostic variables. Researchers have hypothesized that the link between negative symptoms and poor affect perception stems from lower social functioning and poorer premorbid adjustment or the presence of structural brain impairments. However, not all studies have shown an association between negative symptoms and affect perception scores (Salem et al. 1996; Toomey et al. 2002), and currently the role of symptoms in affect perception remains unclear. Finally, and somewhat surprisingly, no relationship between affect perception and medication type or dosage was found. Many believe that the newer atypical antipsychotic medications may improve cognitive abilities (Nagamoto et al. 1996; Meltzer and McGurk 1999), which may in turn improve affect perception (Green 1996; Stip and Lussier 1996). However, research on this topic is limited (Toomey et al. 2002), and it is not known if the improvement in affect perception is due to indirect enhancement of cognitive abilities (e.g., attention or working memory) or affect perception directly. Conflicting evidence exists on whether traditional antipsychotic medications improve cognitive abilities (Allen et al. 1997; Sweeney et al. 1991) and the effects on affect perception may be dose related (Corrigan and Penn 1995).

How Does Attention Affect Emotion Perception? The results of this study showed that all four factors of attention were significantly related to affect perception scores. A proposed theoretical model on the relationship between attention and affect perception, which suggests how atten-
tional problems might lead to impairments in affect perception, is presented below.

First, because affect perception is a dynamic process and subject to constant change, the ability to shift attention from one facial expression to another is valuable. People impaired in this aspect of attention may become stuck on one particular emotion, and miss subsequent shifts in emotion. This study showed that the Shift factor is most predictive of affect perception scores and is arguably the most important of the four factors. Second, the ability to sustain attention over time may be important because people must constantly follow social dialogue to detect changes in emotional states. A person who constantly looks away and does not stay focused on the conversation at hand is more likely to miss important social and emotional cues. Bryson et al. (1997) argued that sustained attention leaves people ready to detect important aspects of emotion. Third, encoding of the entire face (and possibly other body cues) may also be important because narrowly focusing on a certain aspect of the face (e.g., only the eyes or mouth) may lead to the wrong conclusion regarding the expressed emotion. The effect of encoding can be seen in a study by Mandal and Palchoudhury (1989) in which persons with schizophrenia made more errors in affect perception when shown pictures of the whole face (more complex encoding) than shown only parts of the face.

The influence of the Focus-Execute factor of attention is more difficult to define. This factor is very similar to processing speed. The important aspects of this factor are (1) the ability to identify an important feature (to focus) and (2) the ability to respond to it (to execute). Those with delusions and schizophrenia tend to examine more nonrelevant areas of the face (Phillips and David 1997, 1998; Quirk 2000). Thus the person may not be focusing on the most relevant areas of the face to obtain the most information. The ability of the motor system to generate emotionally appropriate responses (through speech or nonverbal cues) is another key component of this factor. Even when participants in this study knew the correct emotion presented on the tape, that information may have been lost, or the emotion changed, if they did not respond quickly. Socially, if a person engaged in conversation does not respond (or is slow to respond) to an emotion, the other person may lose interest, become upset, or end the interaction. A study by Mandal and Rai (1987) showed that people with schizophrenia were slower to identify emotional pictures than a group of people with anxiety disorders and a control group.

Each attentional factor arguably could impair affect perception. A summary of the proposed theoretical relationship between attention and affect perception adopted in this study can be found in figure 1. The fact that all four factors of attention were related to affect perception suggests that this skill can become impaired in many areas in people with schizophrenia.

Limitations. Sample size is a concern for the multiple regression analysis. Multiple regression procedures should have a participant-to-variable ratio of at least 10:1 to ensure an appropriate degree of generalization (Diekoff 1992). For this study, the number of variables in the regression (8) was relatively acceptable to the number of participants (n = 65). In addition, the combination of the attentional measures (via PCA) into four independent factors further reduced the number of variables in the multiple regression analysis and provided orthogonality among the attentional factors (Diekoff 1992).

The sample has several limitations. First, the present study did not include a control group of normal people. Recent findings by Kohler et al. (2000) showed that cognitive variables in normal people have little relationship to affect perception and face-recognition performance, but a relationship between cognition and affect perception did exist for people with schizophrenia. Because cognition and affect perception may not be related in normal people, having a control group may be of little benefit to understanding the link between attention and affect perception in schizophrenia, in which cognitive deficits are more prominent (See Bryson et al. 1997 and Kee et al. 1998 for similar designs). Second, the sample used in this study could be placed at the severe end of the illness continuum based on length of current treatment, length of illness, and reading scores. The results of this study may differ from other studies with less impaired participants.

Some argue that affect perception tasks may be designed to highlight attentional problems in this population by having brief exposure times and reducing the number of visual and verbal cues available to the person (Bellack et al. 1996, 1999). In this study, the emotional stimuli were presented for brief periods of time (10 to 15 seconds), but the regression results of the BLERT (with cues/verbal material) and the FEIT (without cues) were similar. Therefore, even though stimulus presentation times were brief (which may be ecologically valid for emotional expression), there were no differences regarding the role of attention for the BLERT and the FEIT.

Finally, the measures of attention used in this study cannot be considered pure measures of attention; they most likely involve other cognitive abilities as well. In fact, most psychological measures require a combination of abilities for successful completion (Spreen and Strauss 1998). For example, the WCST has aspects of
attention, problem solving, motor skills, and abstract reasoning (Spreen and Strauss 1998). Mirsky et al. (1991) stated that difference between shifting attention and executive functioning (conceptual reasoning and flexibility) are unclear at present, but both have been linked to the frontal cortex. According to Posner and Petersen (1990), the Shift function is more related to eye movements produced in the superior colliculus than to frontal cortex functioning. Although the measures used in this study have significant attentional components, they do have other aspects that should be considered in the interpretation of these findings.

This study provided evidence for the role of attentional variables in affect perception. All four factors of attention were significantly related to affect perception scores. More information is needed to clarify the complex relationship between cognitive variables, symptoms, and medication factors in affect perception. Each factor likely affects the others, and empirical research could help uncover their individual and combined effects. This study represents a first step in understanding how a single cognitive skill, attention, can affect social functioning. We hope that future studies will further refine our understanding of attention and affect perception.
References


