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The Use of the Ego Impairment Index Across the Schizophrenia Spectrum

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The goal of this study was to assess perceptual and thought disturbance, as indexed by the Ego Impairment Index (EII; Perry & Viglione, 1991), a Rorschach-derived measure, across the schizophrenia spectrum. We hypothesized that there would be an increase in EII scores (indicating increased disturbance) across the spectrum from nonpatients to severely disturbed, hospitalized schizophrenia patients. Normal comparison participants \((n = 66)\), students with elevated scores on either the Perceptual Aberration/Magical Ideation or the Physical Anhedonia Scales \((n = 24)\), first-degree relatives of schizophrenia patients \((n = 36)\), participants diagnosed with Diagnostic and Statistical Manual of Mental Disorders (4th ed. [DSM–IV]; American Psychiatric Association, 1994) schizotypal personality disorder \((n = 36)\), outpatient schizophrenia participants \((n = 33)\), and hospitalized schizophrenia patients \((n = 56)\) were studied. As hypothesized, we found increased EII scores in all of the schizophrenia spectrum groups when compared against normal comparison participants. Furthermore, the EII was significantly different between the schizophrenia patients and the other schizophrenia spectrum groups. These findings support the use of the EII as a sensitive measure of perceptual and thought disturbance across the schizophrenia spectrum that yields specific information regarding the type of thinking problems that occur within schizophrenia spectrum subgroups.

Severe psychological disturbance is often characterized by impaired thought and perception and poor interpersonal relationships. Thought and perceptual disturbance is a multidimensional construct, defined as “impaired pace and flow of associations, errors in syntax, word usage, syllogistic reasoning, inappropriate levels of abstracting, failure to maintain conceptual boundaries, and a breakdown in the discrimination of internal perceptions from external ones” (Kleiger, 1999, p. 6). Thought and perceptual disturbance has long been regarded as a hallmark feature of schizophrenia spectrum disorders (Bleuler, 1950; Kraepelin, 1919).

Most studies of schizophrenia spectrum patients assess the level of the participant’s disturbance through the use of a clinical-interview-based rating scale, such as the Scale for the Assessment of Positive Symptoms (SAPS; Andreasen, 1984b). Accurate measurement of thought processes and content, however, is often difficult because the assessment is highly dependent on whether the participant is willing to discuss his or her thoughts in an open and honest fashion. Consequently, interview-based rating scales are subject to confounding variables such as rater bias, manifest behavior, and self-report linked distortions (Perry & Braff, 1994). Although symptom rating measures may capture the presence or absence of thought disturbance, relying on such measures for quantifying the subtle expression of thought disturbance is difficult. There are, however, sensitive performance-based tools for assessing disturbed thinking and perception that “reach beyond symptom description and into the processes of disorganization” (Hurt, Holzman, & Davis, 1983, p. 1281). These reliable assessment measures do not rely on clinical interview and therefore are particularly useful when assessing individuals on the boundary of the schizophrenic spectrum, who often have subtle thinking problems that do not meet the threshold for “thought disorder” (Coleman, Levy, Lenzenweger, & Holzman, 1996).

The Rorschach test has been used to assess psychological, thought, and perceptual disturbance beyond that which can be obtained via self-report and symptom rating scales (see Holzman, Shenton, & Solovay, 1986). The Rorschach is a high-processing demand, abstract problem-solving test. It can be conceptualized as a perceptual and cognitive “challenge” that induces the participant to use available cognitive, perceptual, and affective resources in organizing a response to the abstract problem (i.e., the interpretation of the Ror-
schach blot). In this way, Rorschach responses provide observable samples of disturbed thinking that can be scored for failures in cognition, perceptual accuracy, and flow of association. This study was designed to investigate a Rorschach-derived measure for assessing thought and perceptual disturbance, the Ego Impairment Index (EII; Perry & Viglione, 1991), as applied to individuals across the schizophrenia spectrum.

The EII was developed to quantify psychological disturbance via thought and perceptual impairment. The EII is based on the assessment of ego functions developed by Beres (1956). In the initial EII validation study, Perry and Viglione (1991) assessed disturbance in patients with Diagnostic and Statistical Manual of Mental Disorders (3rd ed. [DSM–III]; American Psychiatric Association, 1980) major depressive disorder before the onset of antidepressant treatment and following 9 weeks of treatment. They found that the baseline EII scores were predictive of treatment outcome after a priori parcelling out baseline self-report depression index scores (Beck Depression Inventory). They also found that the EII was stable over a 9-week period of treatment (r = .78) in the face of symptomatic change. Perry, McDougall, and Viglione (1995) then retested a subset of the depressed participants 5 years later and found that their EII scores correlated highly with their baseline scores (ρ = .68). In that study, the EII was also significantly correlated with measures of functional, interpersonal, and occupational adaptation.

The EII has also been shown to be stable in the face of pharmacological challenges. For example, in a randomized double-blind study, the EII was assessed in healthy men who were administered moderately high doses of amphetamine or placebo 2 weeks apart. There was no increase in disturbance during the amphetamine trial, as indexed by rating scales, nor did the participants’ EII scores differ during the placebo and amphetamine conditions. As expected, however, Rorschach indicators of anxiety were elevated (Perry, Sprock, et al., 1995). Furthermore, the EII does not correlate with doses of antipsychotic medication used to treat schizophrenia patients nor with the presence or absence of anticholinergic medication (Perry, 1993).

A majority of the work with the EII has been applied to a schizophrenia spectrum population. Among schizophrenia patients, the EII has been shown to have a stable factor structure that correlates highly (r = .98) with the original factor derived on the depressed patient sample (Perry, Viglione, & Braff, 1992). Perry et al. reported that the EII was positively correlated with a number of measures suggestive of psychotic thinking; that is, the Magical Ideation Scale (Eckblad & Chapman, 1983) and selected scales from the Minnesota Multiphasic Personality Inventory (Hathaway & McKinley, 1967). Perry and Braff (1993, 1996) repeatedly demonstrated that the EII is positively correlated with traditional ratings of positive psychotic symptoms and thought disorder as assessed by the Brief Psychiatric Rating Scale (Overall & Gorham, 1988), the Magical Ideation Scale (Eckblad & Chapman, 1983), the Global Subscale from the SAPS (Andreasen, 1984b), and negatively correlated with the alogia items from the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1984a), a measure of poverty of thinking. Perry et al. also differentiated between paranoid and nonparanoid (undifferentiated and disorganized) subtypes of schizophrenia patients using the EII. Paranoid patients are by definition more organized in their thinking and have better interpersonal and adaptive skills when compared to nonparanoid patients. As predicted, the nonparanoid patients showed higher (more impaired) scores than did the paranoid patients. This expected distinction between the paranoid and nonparanoid schizophrenic patients was not found with other Rorschach measures, such as the Schizophrenia Index from the Comprehensive System (CS; Exner, 1995). In a replication study with older schizophrenia patients, Auslander, Perry, and Jeste (2002) found that older schizophrenia patients with the nonparanoid subtype had higher EII scores, indicative of more disturbance, than those diagnosed with paranoid subtype. These findings were not attributable to differences in symptom severity, premorbid intellectual functioning or medication. The EII was also correlated with scores from the Dementia Rating Scale ( Mattis, 1973) supporting the generally accepted hypothesis that patients with the nonparanoid subtype of schizophrenia have cognitive impairment, particularly in semantic processing (Paulsen et al., 1996).

Perry, Moore, and Braff (1995) assessed differences in EII scores and other pertinent measures of psychosis among male and female schizophrenia patients. It has been reported that male patients have a more malignant form of schizophrenia with a poorer prognosis (McGlashan & Bardenstein, 1990; Seeman & Hauser, 1984); therefore, it was predicted that they would have higher scores, indicating greater impairment, on the EII. As predicted, male and female patients demonstrated similar degrees of thought disorder on pertinent subscales of the SAPS and BPRS, but male schizophrenia patients had higher EII scores than female patients. Secondarily, a relationship between EII scores and social competency was found, suggesting that greater disturbance is related to problems with social and adaptive functioning.

Most recently, the EII has been used together with several psychophysiological measures to study the relationship between thought and perceptual disturbance and information processing in schizophrenia spectrum patients (Cadenhead, Perry, & Braff, 1996; Perry & Braff, 1994; Perry, Geyer, & Braff, 1999). In each of these studies, the EII or variables from the EII were correlated with psychophysiological measures (e.g., prepulse inhibition and visual backward masking), providing further support for the EII as a sensitive measure of cognitive and perceptual disturbance. Collectively, the data from the aforementioned studies provide evidence of the EII’s incremental validity in the measurement of disturbed thought and perception and suggest that the EII has utility in schizophrenia spectrum research. The EII data also
support the extensive literature (see Holzman and colleagues’ work on the Thought Disorder Index [TDI]; Holzman et al., 1986) demonstrating the utility of Rorschach measures in the assessment of thought disorder.

The primary objective of this study is to assess thought and perceptual disturbance, as indexed by the EII, across the schizophrenia spectrum. The Rorschach protocols of nonpatients, first-degree family members of schizophrenia patients, undergraduates who scored high on psychometric scales designed to assess “psychosis proneness” (Chapman & Chapman, 1987), schizotypal personality disorder (SPD) patients, and outpatient and inpatient schizophrenia participants were collected and the EII was calculated. We hypothesized that there would be an increase in EII scores (indicating an increase in psychological disturbance) across the spectrum from nonpatients to severely disturbed schizophrenia patients.

METHOD

Participants

A total of 74 normal comparison participants, 25 undergraduates with elevated scores on either the Perceptual Aberration/Magical Ideation Scale or the Physical Anhedonia Scale (Chapman & Chapman, 1987), 40 first-degree relatives of schizophrenia patients, 43 participants diagnosed with SPD, and 132 schizophrenia patients were studied. EII data were collected as part of several ongoing studies primarily aimed at studying information processing along the schizophrenia spectrum at the University of California, San Diego Medical Center, Department of Psychiatry (UCSD; Cadenhead, Kumar, & Braff, 1996; Cadenhead, Light, Geyer, & Braff, 2000; Perry & Braff, 1996). All participants gave written consent prior to participation and a participant’s bill of rights as directed by the UCSD Human Research Protection Program.

All participants were screened for (a) a history of head injuries, (b) major medical or neurological problems, and (c) substance abuse or dependence within the past 6 months. Urine toxicology tests were performed to screen participants for current substance use. Normal comparison participants were recruited through newspaper advertisements and were excluded if they had a history of Axis I or Axis II disorders as assessed by the Structured Clinical Interview for DSM-IV (SCID–I) and the Structured Clinical Interview for DSM-IV Personality Disorders (SCID–II). We have previously established 98% interrater agreement for determining Axis I diagnoses using the SCID (Perry, Heaton et al., 2001). Additionally, any normal comparison participant who reported having a first- or second-degree relative with schizophrenia was not included in the normal comparison group.

Undergraduates were selected by screening 1,115 college students with Chapman and Chapman’s (1987) Perceptual Aberration/Magical Ideation (PerMag) Scale and the Physical Anhedonia (PhysAn) Scale. Those participants who scored two standard deviations above the mean on either of these scales were classified as “PerMag” and/or “PhysAn” (for a thorough description of this procedure, see Cadenhead, Kumar, & Braff, 1996).

Participants with SPD were recruited from outpatient facilities at UCSD and by newspaper advertisements per established methods (Cadenhead et al., 2000). All SPD participants were assessed with the SCID–I and the Structured Interview for DSM–III–R Personality Disorders (SIDP–R; Pfohl, Blum, Zimmerman, & Stangl, 1989) by a trained psychiatrist (Kristin Cadenhead).

Schizophrenia patients and their family members were recruited through inpatient and outpatient facilities at UCSD and the San Diego Alliance for the Mentally Ill. A total of 41 participants were outpatients at the time of testing, 30 were residing in a locked acute inpatient unit, and 61 were in a locked long-term inpatient treatment facility. Diagnoses of the schizophrenia participants were determined by a SCID–I interview. Family members were also assessed with the SCID–I for Axis I disorders.

Procedure

Participants were administered the Rorschach Inkblot Test according to the standard procedure of the CS (Exner, 1991) by a trained masters level clinician. Rorschach protocols were coded by raters who were blind to subject group. Previous interrater reliability (κ coefficients) ranged from .88 to .97 for the EII with these same scorers (Perry & Braff, 1994). The EII was derived from CS scores via computer, and consists of the sum of six weighted variables plus the number of responses (R). These variables are: poor perceptual accuracy (Sum FQ–), impaired reasoning and cognitive slippage, autistic logic and disorganized thought and language (WSUM6), the expression of primitive and disturbed contents that are normally censored (Critical Contents), two variables that assess disturbed thinking and perception in relationship to human representations (M– and Poor Human Experience), and a measure of intact thinking and perception in relationship to human representations (Good Human Experience). These variables are entered into the following algorithm resulting in a total EII score: .13593 (Sum FQ–) + .05023 (WSUM6) + .06823 (Critical Contents) + .20766 (M–) + .10806 (Poor Human Experiences) – .16038 (Good Human Experiences) – .0615 (R) – .04908 (Perry & Viglione, 1991). Viglione, Perry, and Meyer (in press) recently reported changes in the weights to Human Representational Variable (HRV: Good and Poor Human Experience). Entering the new HRV into the EII resulted in an insignificant change in EII scores (r = .99) and therefore for the purpose of this study the original good and poor human experience weights were used.

Participants with brief protocols, defined as fewer than 14 responses, were excluded from the analyses because of the
concern that a short record may not be interpretively valid as according to standard procedure (Exner, 1995). Eight normal comparisons, 1 undergraduate, 4 family members, 7 SPD participants, 8 schizophrenia outpatients, and 35 schizophrenia inpatients were excluded from the analysis due to brief protocols.

In addition to the Rorschach test, all participants were administered the Vocabulary Subtest of the Wechsler Adult Intelligence Scale–Revised (WAIS–R; Wechsler, 1981) to obtain an estimate of general intelligence. Age of onset of psychiatric illness was recorded for all schizophrenia patients except for 3 outpatients and 1 inpatient. Number of psychiatric hospitalizations was recorded for all SPD participants and all schizophrenia patients. Most of the schizophrenia patients, SPD participants, and students were also assessed with the SAPS (Andreason, 1984b) and the SANS (Andreasen, 1984a), with several exceptions: 8 students did not receive the SANS, 9 schizophrenia outpatients and 1 schizophrenia inpatient did not receive the SAPS or the SANS.

Statistical Analysis

All statistical analyses were performed using SPSS 9.0 statistical software. The statistical significance level for testing the main hypothesis was set at \( p < .05 \). Due to family-wise error considerations, the alpha level for other analyses was set at \( p < .01 \). Effect sizes were calculated using both Cohen’s \( d \) and \( r \) (Rosnow, Resenthal, & Rubin, 2000).

RESULTS

Demographic data for all participants are presented in Table 1. The psychometric-scale-identified students had a lower mean age than all five of the other groups, and family members of schizophrenia patients had a higher mean age than all of the other groups, omnibus \( F(5, 245) = 34.54, p < .001 \). SPD participants did not significantly differ from schizophrenia outpatients (mean difference = .48, \( p = .84 \)) or schizophrenia inpatients (mean difference = .92, \( p = .65 \)) in terms of age. Outpatient and inpatient schizophrenia participants were not significantly different from one another in age (mean difference = .45, \( p = .83 \)). Students had significantly fewer years of education than all the other groups except schizophrenia inpatients, omnibus \( F(5, 245) = 8.17, p < .001 \), and SPD participants had significantly fewer years of education than family members (mean difference = −1.28, \( p = .02 \)).

Normal comparison participants had higher WAIS–R Vocabulary scores than all of the groups, omnibus \( F(5, 245) = 7.30, p < .001 \), except family members (mean difference = 2.36, \( p = .01 \)) and schizophrenia outpatients (mean difference = .57, \( p = .54 \)). Schizophrenia outpatients had higher scores than SPD participants (mean difference = 2.92, \( p = .01 \)) and schizophrenia inpatients (mean difference = 2.64, \( p = .01 \)).

Schizophrenia inpatients had significantly higher total SAPS scores than schizophrenia outpatients, \( t(77) = 3.95, p < .001 \), Cohen’s \( d = .98 \), \( r = .41 \); SPD participants, \( t(89) = 7.55, p < .001 \), Cohen’s \( d = 1.64 \), \( r = .62 \); and students, \( t(78) = 11.67, p < .001 \), Cohen’s \( d = 2.85 \), \( r = .80 \) as well as higher to-

Table 1. Means and Standard Deviations for Demographic and Symptom Data

<table>
<thead>
<tr>
<th></th>
<th>Age(^a)</th>
<th>Sex</th>
<th>Education(^b)</th>
<th>WAIS–R Vocabulary Score</th>
<th>Age of Psychiatric Illness Onset(^a)</th>
<th>No. of Psychiatric Hospitalizations</th>
<th>Total SAPS Score</th>
<th>Total SANS Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal comparison participants(^b)</td>
<td>26.6</td>
<td>8.0</td>
<td>30</td>
<td>14.0</td>
<td>11.2</td>
<td>2.1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Family members(^c)</td>
<td>46.6</td>
<td>15.0</td>
<td>14</td>
<td>14.8</td>
<td>8.8</td>
<td>2.6</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>PerMag/PhysAn students(^d)</td>
<td>18.4</td>
<td>0.64</td>
<td>11</td>
<td>12.3</td>
<td>9.5</td>
<td>1.8</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SPD patients(^e)</td>
<td>35.8</td>
<td>10.7</td>
<td>23</td>
<td>13.5</td>
<td>7.7</td>
<td>7.3</td>
<td>0.69</td>
<td>6.6</td>
</tr>
<tr>
<td>Outpatient schizophrenia patients(^f)</td>
<td>35.3</td>
<td>8.4</td>
<td>22</td>
<td>13.5</td>
<td>10.6</td>
<td>2.9</td>
<td>24.5</td>
<td>8.2</td>
</tr>
<tr>
<td>Inpatient schizophrenia patients(^f)</td>
<td>34.9</td>
<td>7.9</td>
<td>20</td>
<td>12.3</td>
<td>8.0</td>
<td>2.4</td>
<td>20.7</td>
<td>12.1</td>
</tr>
</tbody>
</table>

Note. WAIS–R = Wechsler Adult Intelligence Scale–Revised; SAPS = Scale for the Assessment of Positive Symptoms; SANS = Scale for the Assessment of Negative Symptoms; PerMag/PhysAn = college students with elevations on the Perceptual Aberration/Magical Ideation and Physical Anhedonia Scales; SPD = schizotypal personality disorder.

\(^a\)Given in years. \(^b\)\( n = 66 \), \(^c\)\( n = 36 \), \(^d\)\( n = 24 \), \(^e\)\( n = 33 \), \(^f\)\( n = 56 \).
Inpatient schizophrenia patients & 1.21 & 1.01 & .53 & 2.03 & –1.30 & 9.94 \\
Normal comparison participants & –0.35 & –0.40 & –.45 & 0.81 & –1.81 & 2.88 \\
Family members & –0.03 & –0.08 & –.17 & 0.94 & –1.78 & 2.43 \\
PerMag/PhysAn students & 0.26 & 0.25 & .39 & 0.72 & –1.03 & 1.84 \\
SPD patients & 0.61 & 0.57 & .43 & 1.00 & –0.98 & 3.29 \\
Outpatient schizophrenia patients & 0.92 & 0.88 & .46 & 1.51 & –1.43 & 4.67 \\
Inpatient schizophrenia patients & 1.21 & 1.01 & .53 & 2.03 & –1.30 & 9.94 \\

Note. Higher EII scores indicate more pathology. EII = Ego Impairment Index; PerMag/PhysAn = college students with elevations on the Perceptual Aberration/Magical Ideation and Physical Anhedonia Scales; SPD = schizotypal personality disorder.

TABLE 2
Descriptive Statistics for EII Scores

<table>
<thead>
<tr>
<th>Samples</th>
<th>M</th>
<th>5% Trimmed M</th>
<th>Mdn</th>
<th>SD</th>
<th>Minimum Score</th>
<th>Maximum Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal comparison participants</td>
<td>–0.35</td>
<td>–0.40</td>
<td>–.45</td>
<td>0.81</td>
<td>–1.81</td>
<td>2.88</td>
</tr>
<tr>
<td>Family members</td>
<td>–0.03</td>
<td>–0.08</td>
<td>–.17</td>
<td>0.94</td>
<td>–1.78</td>
<td>2.43</td>
</tr>
<tr>
<td>PerMag/PhysAn students</td>
<td>0.26</td>
<td>0.25</td>
<td>.39</td>
<td>0.72</td>
<td>–1.03</td>
<td>1.84</td>
</tr>
<tr>
<td>SPD patients</td>
<td>0.61</td>
<td>0.57</td>
<td>.43</td>
<td>1.00</td>
<td>–0.98</td>
<td>3.29</td>
</tr>
<tr>
<td>Outpatient schizophrenia patients</td>
<td>0.92</td>
<td>0.88</td>
<td>.46</td>
<td>1.51</td>
<td>–1.43</td>
<td>4.67</td>
</tr>
<tr>
<td>Inpatient schizophrenia patients</td>
<td>1.21</td>
<td>1.01</td>
<td>.53</td>
<td>2.03</td>
<td>–1.30</td>
<td>9.94</td>
</tr>
</tbody>
</table>

FIGURE 1 Mean total Ego Impairment Index scores across the schizophrenia spectrum.

Total SANS scores than schizophrenia outpatients, t(77) = 2.78, p = .01, Cohen’s d = .68, r = .30; SPD participants, t(89) = 7.16, p < .001, Cohen’s d = 1.55, r = .60; and psychometric-scale-identified students, t(70) = 9.16, p < .001, Cohen’s d = 2.58, r = .74. SPD participants had higher SAPS, t(59) = 6.63, p < .001, Cohen’s d = 1.76, r = .65, and SANS, t(51) = 4.03, p < .001, Cohen’s d = 1.21, r = .49, scores than students.

The EII data for classification categories are displayed in Table 2 and Figure 1. A one-way analysis of variance (ANOVA) with a focused linear contrast revealed that there was a significant increase in EII scores along the schizophrenia spectrum, as the degree of pathology increased (i.e., with normal comparison participants as least pathology to schizophrenia inpatients as most pathology), F(1, 245) = 49.58, p < .001, r = .41.

Planned comparisons were run to assess for differences between specific diagnostic categories. Family members demonstrated higher EII scores than normal comparison participants. Although the difference yielded a moderate effect size, this difference failed to reach statistical significance at the .05 level, t(100) = 1.82, p = .07, Cohen’s d = .38, r = .18. Students with elevated scores on the PerMag/PhysAn scale demonstrated significantly higher EII scores than normal comparison participants, t(88) = 3.27, p = .002, Cohen’s d = .79, r = .33. Normal comparison participants had significantly lower scores than SPD participants, t(100) = 5.19, p < .001, Cohen’s d = 1.09, r = .46; schizophrenia outpatients, t(97) = 5.47, p < .001, Cohen’s d = 1.18, r = .48; and schizophrenia inpatients, t(120) = 5.75, p < .001, Cohen’s d = 1.05, r = .46.

Family members of schizophrenia patients demonstrated significantly lower EII scores than SPD participants, t(70) = 2.74, p = .008, Cohen’s d = .66, r = .31; schizophrenia outpatients, t(67) = 3.16, p = .002, Cohen’s d = .77, r = .36; and schizophrenia inpatients, t(90) = 3.43, p = .001, Cohen’s d = .74, r = .34. The PerMag/PhysAn scale students’ mean EII scores did not significantly differ from those of family members, t(58) = 1.28, p = .21, Cohen’s d = .34, r = .17; or SPD participants, t(58) = 1.44, p = .16, Cohen’s d = .39, r = .19; however, the students did have lower EII scores than schizophrenia inpatients, t(55) = 1.98, p = .05, Cohen’s d = .54, r = .26; and schizophrenia inpatients, t(78) = 2.22, p = .03, Cohen’s d = .55, r = .22. SPD participants did not significantly differ in EII scores when compared to schizophrenia outpatients, t(67) = .99, p = .32, Cohen’s d = .24, r = .12; but showed a trend toward significantly lower scores than schizophrenia inpatients, t(90) = 1.63, p = .11, Cohen’s d = .35, r = .17. The two schizophrenia groups were then compared to one another, and although participants from an inpatient setting had higher mean scores than outpatient participants, this difference did not reach statistical significance, t(87) = .70, p = .48, Cohen’s d = .16, r = .08.

Because a large number of schizophrenia patients (n = 43) were excluded due to insufficient number of responses, the difference in mean EII scores between these “low R” schizophrenia patients (R < 14) and the remainder of the schizophrenia patient sample was tested with an Independent Samples T test. Schizophrenia patients with low R had a significantly lower mean EII score (M = .33, SD = .95) than the remaining schizophrenia patient sample (M = 1.10, SD = 1.85), t(130) = –2.58, p = .01, Cohen’s d = .48, r = .22. All low R participants were then pooled with the larger sample in a second set of post hoc comparisons of total EII score among diagnostic categories. Even with these participants included, schizophrenia inpatients demonstrated significantly higher mean total EII scores when compared to normal comparison participants, t(163) = 5.71, p < .001, Cohen’s d = .90, r = .41; family members, t(129) = 3.18, p = .002, Cohen’s d = .61, r = .27; and a trend toward higher scores than PerMag/PhysAn.
students, t(114) = 1.78, p = .08, Cohen’s d = .41, r = .16. The difference between the increased schizophrenia inpatient sample and SPD participants failed to reach statistical significance, t(132) = 1.01, p = .31, Cohen’s d = .19, r = .09.

Post hoc comparisons between students with elevated scores on PerMag scale (n = 15) versus elevated scores on the PhysAn scale (n = 9) indicated that PerMag students had a trend toward significantly higher EII total scores (M = .49, SD = .71) than PhysAn students (M = .12, SD = .61), t(22) = 2.13, p = .04, Cohen’s d = .94, r = .41. When the components of the EII were examined, this difference was mostly accounted for by higher WSUM6 scores, t(22) = 2.31, p = .03, Cohen’s d = 1.02, r = .44, and Poor Human Experience scores, t(22) = 2.52, p = .02, Cohen’s d = 1.10, r = .47, for the students with elevated PerMag scale scores compared to the students with elevated PhysAn scale scores.

Correlations were run for EII scores and psychiatric illness characteristics (Table 3). There was a trend toward a negative relationship between age of onset of psychiatric illness and total EII scores (Spearman’s ρ = -.23, p = .04), indicating that the younger the participant’s onset of illness the more disturbed their thinking. In addition, there was a significant relationship between the degree of psychosis as measured by SAPS scores and total EII scores (Spearman’s ρ = .27, p = .001).

### TABLE 3

<table>
<thead>
<tr>
<th>Age of Psychiatric Illness Onseta</th>
<th>No. of Psychiatric Hospitalizationsb</th>
<th>EII Total Scorea</th>
<th>SAPS Total Scorea</th>
<th>SANS Total Scorea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Normal comparison participants</td>
<td>.25 (.12)</td>
<td>.61 (.10)</td>
<td>.42 (.15)</td>
<td>.29 (.13)</td>
</tr>
<tr>
<td>Family members</td>
<td>.23 (.13)</td>
<td>.58 (.09)</td>
<td>.65 (.07)</td>
<td>.26 (.11)</td>
</tr>
<tr>
<td>PerMag/PhysAn students</td>
<td>.26 (.20)</td>
<td>.96 (.10)</td>
<td>.53 (.14)</td>
<td>.22 (.19)</td>
</tr>
<tr>
<td>SPD patients</td>
<td>.28 (.13)</td>
<td>.94 (.13)</td>
<td>.17 (.16)</td>
<td>.33 (.19)</td>
</tr>
<tr>
<td>Outpatient schizophrenia patients</td>
<td>.33 (.14)</td>
<td>1.00 (.14)</td>
<td>1.50 (.16)</td>
<td>.32 (.17)</td>
</tr>
<tr>
<td>Inpatient schizophrenia patients</td>
<td>.37 (.18)</td>
<td>1.03 (.19)</td>
<td>1.30 (.19)</td>
<td>.37 (.18)</td>
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**Note.** EII = Ego Impairment Index; SAPS = Scale for the Assessment of Psychotic Symptoms; SANS = Scale for the Assessment of Negative Symptoms.

### DISCUSSION

In this study the EII was applied across the schizophrenia spectrum from normal comparison participants to chronic schizophrenia inpatients. In support of our hypothesis, we found high EII scores, indicative of increased pathology, in all of the schizophrenia spectrum groups when compared against normal comparison participants. As can be observed in Figure 1, the EII increased in the pathological direction across the spectrum of severity in a graduated fashion. The mean EII score for the first-degree relatives versus the normal comparison participants was not significantly different; these two groups, however, were separated by a moderate effect size and the mean EII score for the first-degree relatives was similar to previously reported EII scores for outpatients with DSM–III–R Major Depressive Disorder (Perry & Viglione, 1991). This finding supports a previous result by Shenton, Solovay, Holzman, Coleman, and Gale (1989) and Romney (1984) that first-degree relatives of schizophrenia patients demonstrate subtle disturbance in their thinking and yet appear considerably different from the clinical populations.

The examination of the variables that comprise the EII highlights one of the advantages of using this performance-based measure. The EII variables represent different aspects of disturbance including impaired perception, disorganized language, impaired reasoning, and frank cognitive slippage, as well as the expression of contents that are normally censored and not expressed. In this study, first-degree

### TABLE 4

<table>
<thead>
<tr>
<th>FQ–</th>
<th>M–</th>
<th>WSUM6</th>
<th>Critical Contents</th>
<th>Poor Human Experience</th>
<th>Good Human Experience</th>
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</table>

**Note.** For all the components except for the Good Human Experience variable, higher scores indicate more pathology. In the case of the Good Human Experience variable, lower scores indicate more pathology. EII = Ego Impairment Index; PerMag/PhysAn = college students with elevations on the Perceptual Aberration/Magical Ideation and Physical Anhedonia Scales; SPD = schizotypal personality disorder.
family members performed similar to normal comparison participants with low scores on the measure of perceptual inaccuracy and the expression of critical contents. Family members did, however, produce a higher number of poor human experience responses and fewer good human experience responses than did normal comparison participants. Furthermore, the relatives scored twice as high as the normal comparison participants on the WSUM6 variable, a measure of formal reasoning, autistic logic, and disorganized thought and language (Exner, 2001). Therefore, although the family members as a group did not appear to have frank reality testing problems, they do appear to have subtle thought disturbance problems, particularly when applied to human percepts. Elevations on WSUM6 and the Poor Human Experience variable are the signature deficits of schizophrenia patients who give approximately twice as many of these responses as any other clinical group (Exner, 1995; Perry et al., 1992).

Students who scored high on the PerMag/PhysAn scale had elevations on the perceptual inaccuracy measure (Sum FQ–) and the Poor Human Experience variable compared to normal comparison participants. These elevations are consistent with the self-reported perceptual and body image aberrations endorsed by these students. Furthermore, Chapman, Chapman, Kwapił, Eckblad, and Zinser (1994) found that students who scored high on the Perceptual Aberration Scale exceeded normal comparison participants on psychoses and psychotic-like experiences at a 10-year follow up. Thus, our data are in concert with previous findings suggesting that students with elevations on the PerMag/PhysAn scale appear similar to schizophrenia patients in terms of their perceptual and thought disorder and are at risk for future development of schizophrenia-spectrum disorders.

SPD patients demonstrated a moderately high degree of impaired formal reasoning and cognitive slippage problems and produced the greatest number of critical contents. In contrast, the schizophrenia patients had the highest scores compared to the other groups on the measures of perceptual inaccuracy, formal reasoning, and cognitive slippage. Approximately 25% of the schizophrenia patients tested produced less than 14 responses. When this group was compared against the larger group of schizophrenia patients, a significant difference in EII scores between the two groups was revealed. Although 25% of the sample failing to meet the required threshold of 14 responses is substantial, it is consistent with data previously reported by others who have assessed “brain impaired” populations with the Rorschach (Exner, Colligan, Boll, Stischer, & Hillman, 1996). Thus, this data set appears to support Exner’s (1991) suggestion that protocols of less than 14 responses significantly impact CS scores and lead to an inadequate and perhaps underrepresentation of an individual’s problem-solving abilities. There are, however, other non-CS scores (i.e., The Perseveration Scale; Perry, Potterat, Auslander, Kaplan, & Jeste, 1996) that do appear to illuminate underlying processes in low R protocols. Future research should examine these low R protocols for perseveration to help tease out scores indicative of pathology versus those scores that reflect an active avoidance of the task. Finally, the production of poor human experience responses was similar between schizophrenia and SPD patients but as a group schizophrenia patients produced few good human experience responses, a measure that has been related to positive interpersonal attributes (Burns & Viglione, 1996).

Disturbed thought and perception has long been regarded as a hallmark feature of schizophrenia spectrum disorders (Bleuler, 1950; Kraepelin, 1919). Kraepelin suggested that diagnostic subgroups could be established based on the type of thought disturbance the patient displayed. According to Bleuler, the key to understanding schizophrenia lies in the pathological nature of the patient’s thinking. Our findings support the incremental validity of the EII as a sensitive measure of thought and perceptual disturbance across the schizophrenia spectrum. In this study there were significant differences among the groups on total SAPS scores. With the EII, further analysis can be done to assess the different contributions to the overall thought disturbance score (e.g., perceptual disturbance, reasoning, etc.), thus providing a complementary assessment measure to symptom rating scales.

The EII and similar scales such as the TDI have been shown to be effective in assessing qualitative changes in thought and perceptual disturbance while demonstrating a high degree of congruence with other scales of thought disorder. Because these scales do not depend on the clinical interview for their data and because they yield sensitive information about thought disturbance independent of symptom assessments, these scales have increased utility in a variety of research contexts. Furthermore, elements of thought disorder, as demonstrated earlier, are elevated in otherwise healthy family members and when combined with other intermediate phenotypic markers, such as information processing deficits, may increase the probability of identifying the candidate genes involved in the expression of schizophrenia.

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