Multiple Dimensions of Schizotypy in First Degree Biological Relatives of Schizophrenia Patients

by Monica E. Calkins, Clayton E. Curtis, William M. Grove, and William G. Iacono

Abstract

Considerable research has been devoted to identifying individuals predisposed to schizophrenia, with much of the effort devoted to identifying the personality characteristics of the biological relatives of schizophrenia patients. Although resource-consuming interviews have yielded promising results, investigators have long sought self-report measures that index genetic risk for schizophrenia. The Schizotypal Personality Questionnaire (SPQ) is a self-report measure that assesses the nine features of DSM-defined schizotypy. The SPQ, modified to include validity scales, was administered to 135 nonpsychotic first degree relatives of schizophrenia patients and 112 healthy controls. Principal components analysis (PCA) yielded three factors that correlated highly with previously reported factors (social-interpersonal, cognitive-perceptual, and disorganization). Social-interpersonal deficits were found to best differentiate relatives from controls. Contrary to the hypothesis that schizophrenia relatives are more defensive in responding to schizotypy questionnaires, relatives were significantly less defensive than controls. The results demonstrate that a multidimensional paper-and-pencil measure can characterize schizotypal features in schizophrenia relatives, which will be useful for the further delineation of the heritable schizophrenia spectrum phenotype.

Keywords: Schizotypy, schizotypal personality questionnaire, schizophrenia, relative.

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Schizotypal traits occur at higher rates in the relatives of patients with schizophrenia than in healthy comparison subjects (Kendler and Gardner 1997) and their relatives (Maier et al. 1994). Most investigations that have detected schizotypal features in relatives or that have found an association between schizotypy and schizophrenia have relied on diagnostic interviews (Berenbaum and Fujita 1994). These family studies revealed that the relatives of schizophrenia patients exhibit increased rates of social and interpersonal disturbances (including social isolation, anxiety, or withdrawal), inappropriate or constricted affect, suspiciousness, and disorganized features such as odd speech and behavior (Siever and Gunderson 1983; Squires-Wheeler et al. 1989; Torgersen et al. 1993; Maier et al. 1994; Kendler et al. 1995; Tyrka et al. 1995). In contrast, with a few exceptions (e.g., Squires-Wheeler et al. 1989), positive symptoms such as cognitive and perceptual distortions have not typically appeared at higher rates in the relatives of patients with schizophrenia than in healthy comparison subjects (e.g., Franke et al. 1994; Kendler et al. 1996). These results suggest that personality disturbances that resemble the negative symptoms and disorganized behavior and speech of schizophrenia may be part of the constellation of deficits that mark genetic vulnerability for the disorder.

Because schizotypy interviews are time-consuming assessments that require skilled interviewers, investigators have long sought self-report measures that may serve as indexes of schizophrenia risk or propensity for psychosis. Self-report measures, however, typically have been less successful than interviews at distinguishing relatives of schizophrenia patients from healthy comparison subjects (see Kendler et al. 1996), although there are some exceptions (Katsanis et al. 1990). Several explanations for these findings have been proposed. It has been hypothesized that relatives adopt defensive response sets such that they tend to deny psychopathology when responding to self-report questions. The possibility that self-report measures may be intrinsically less able to assess crucial dimensions of schizotypy, such as signs hypothetically observable only by trained interviewers, has also been suggested (Kendler et al. 1996). In addition, most self-report measures assess just one or two dimensions of schizotypy and do not specifically target schizotypal features that family

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studies have found to be prevalent in schizophrenia relatives (Kendler et al. 1996), nor do they assess multidimensional aspects of schizotypy or the full criteria set of symptoms described in the DSM.

Such considerations led to the development of the self-report Schizotypal Personality Questionnaire (SPQ; Raine 1991) based on DSM–III–R criteria for schizotypal personality disorder (American Psychological Association 1987). The SPQ assesses each of the nine major features of schizotypal personality disorder as defined by the DSM (Raine 1991). Studies using community and college samples suggest that the SPQ has excellent psychometric properties (Raine 1991) and that high scorers exhibit deficits similar to those observed in schizophrenia (Hall and Habbits 1996; Raine et al. 1997; Daneluzzo et al. 1998). Thus, we considered the SPQ a useful instrument for the investigation of multidimensional schizotypy in the relatives of schizophrenia patients.

Several independent factor analytic examinations of community (Raine et al. 1994; Gruzelier 1996; Reynolds et al. 2000) and clinical (Vollema and Hoijtink 2000) samples have revealed that three factors underlie the SPQ and thus possibly the DSM criteria for schizotypal personality disorder: cognitive-perceptual, social-interpersonal, and disorganization. Similar three-factor solutions of interview measures of schizotypy employed with the biological relatives of schizophrenia patients have been reported (Battaglia et al. 1997; Bergman et al. 2000), but no studies to date have examined the structure of schizotypy in relatives of schizophrenia patients using the multidimensional SPQ.

Only two small sample studies have employed the SPQ with relatives. In the first investigation, Kremen et al. (1998) reported that male (n = 9), but not female (n = 31), relatives of schizophrenia patients endorsed more cognitive-perceptual schizotypal features on the SPQ than did healthy comparison subjects. The investigators reported only nonsignificant trends for increased rates of social-interpersonal schizotypal traits in relatives of schizophrenia patients and no elevations in rates of disorganization signs. Yaralian et al. (2000) examined individuals (n = 13) classified as family-history positive for schizophrenia spectrum disorders (schizophrenia and schizotypal personality disorder) on the basis of their responses to the Family History-Research Diagnostic Criteria (FH–RDC) Interview. These individuals scored significantly higher than comparison subjects on the cognitive-perceptual factor of the SPQ but were not significantly different in total SPQ, social-interpersonal factor, or disorganization scores.

The investigations of Kremen et al. (1998) and Yaralian et al. (2000) are important for their attempts to investigate self-reported DSM–III–R schizotypal features in relatives. However, as Kremen et al. (1998) indicate, their findings of significantly increased cognitive perceptual features but not increased social interpersonal or disorganized features are inconsistent with most investigations in this area that have employed interview assessments. Kremen et al. propose that the social-interpersonal factor may not have reached statistical significance in part because the sample had only a small number of male relatives; Yaralian et al. also employed a small sample of relatives. Yaralian et al. suggested that their inability to detect differences in social-interpersonal or disorganization features was unlikely to be due to defensiveness of relatives because participants endorsed other socially undesirable behaviors. However, they acknowledge the limitations inherent in inferring lack of defensiveness on these grounds.

In the present investigation, we examined SPQ performance in a large sample of first degree biological relatives of schizophrenia patients and nonpsychiatric comparison subjects. To determine whether relatives tend to deny problems or present themselves as overly virtuous, we included scales designed to assess these types of response bias. Furthermore, we assessed whether the three-factor structure of schizotypy reported in community and clinical samples using the SPQ, and in biological relatives of schizophrenia patients using interview methods, would be supported in the relatives of schizophrenia patients. Finally, we compared the internal consistency reliability of the instrument in a sample of schizophrenia relatives with that reported in community samples.

Method

First degree biological relatives (n = 135; 61 males; age in years, mean [M] = 46.5, standard deviation [SD] = 15.3) of DSM–IV diagnosed schizophrenia inpatients (n = 53; number of relatives per proband, M = 2.60, SD = 2.03, range = 1–12; n of siblings = 79, n of parents = 53, n of offspring = 3) and 112 unrelated nonpsychiatric comparison subjects (45 males; age in years, M = 34.6, SD = 13.3) participated. Axis I DSM–IV diagnostic information was obtained from interviews of the patients, relatives, and comparison subjects using the Structured Clinical Interview for DSM–IV (SCID, Modules A- E) and chart reviews. To confirm diagnostic assignments of all participants, a consensus diagnostic team composed of doctoral students and clinical psychologists reviewed SCID interviews, which were supplemented by audio recordings to clarify interviewer notes. The diagnostic team also reviewed medical chart data of relatives who had undergone psychiatric care, when available, as well as the medical charts of all patients. A reliability study performed on a group of 58 randomly selected psychiatric participants

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with various diagnoses yielded a high level ($\kappa = 0.83$) of diagnostic reliability. All diagnostic and clinical ratings were made blind to SPQ responses. Nine relatives were excluded because they had received a current or past psychotic diagnosis. Comparison subjects were recruited from family practice and other medical clinics, trade schools, and churches. They were screened and included if they had never had a DSM–IV mood disorder, psychotic symptom, substance dependence, or current substance abuse and had no history of neurological disease, systemic disease known to involve central nervous system functioning, opthalmological pathology (e.g., glaucoma or lazy eye), clinically significant head injury, or mental retardation. Potential comparison subjects were excluded if they reported that they or a first degree biological relative had ever received treatment for any psychiatric disorder. After complete description of the study to the participants, written informed consent was obtained.

All participants were administered a modified version of the SPQ (Raine 1991). To ensure that participants approached the test in a way that yielded valid information, Minnesota Multiphasic Personality Inventory–2 (MMPI–2; Butcher et al. 2001) L (lie; 15 items) and K Scale (defensiveness; 30 items) items were interspersed among the 74 SPQ items. The L Scale is designed to assess the respondents' tendency to distort their responses by claiming to have virtue not typically found among people. High scores on the L Scale ($t > 65$) suggest that respondents attempted to present themselves in an overly positive and moralistic fashion (Butcher and Williams 1992). The K Scale was empirically developed to assess the respondent's willingness to disclose personal problems; high scores ($t > 65$) are associated with a reluctance to disclose personal information and a tendency to deny problems (Butcher and Williams 1992). Seven items modeled after the Infrequency Scale of the Personality Research Form (Jackson 1984) were also merged. As implied, respondents rarely endorse items on this scale; when they do, it suggests that the respondent may have responded randomly to test items or assumed an acquiescent (yea-saying) approach to the test. When responding to the items, participants were asked to refrain from considering episodes when they were under the influence of drugs or alcohol and from periods when they were just falling asleep or awakening.

Scores for the total SPQ, the three factors, and individual scales were based on an unweighted linear combination of the SPQ items endorsed in the psychopathological direction for the scales and factors. A PCA of the SPQ items was conducted to test whether the structure reported in community samples also applied to our sample of relatives of probands with schizophrenia. MMPI–2 raw scores were converted to t-scores as with the original instrument. Finally, to assess internal consistency reliability, we computed Cronbach's alpha for the total SPQ, and each of its scales and factors.

Results

Preliminary analyses indicated that the distribution of gender was balanced between the groups; Mann-Whitney $z = -0.79$, ns. In addition, gender was found to be unrelated to total SPQ scores or to the three SPQ factors. Therefore, gender was ignored in subsequent analyses. The relatives were significantly older than comparison subjects; $t(246) = 6.47$, $p < 0.001$. Forty correlations were calculated between age and each of the nine SPQ scales, the three SPQ factor scales, and the SPQ total score for each of the two groups separately and all participants combined. None of the correlations had an absolute value larger than 0.27; only two were significant, about what would be expected by chance. Given this result, age was not considered further in the analyses.

Next, the validity scales were used to screen participants for response bias. Two relatives and three comparison subjects were excluded for endorsing more than two of the Infrequency items, indicating that they may have been responding randomly. Although 12.1 percent ($n = 15$) of the relatives and 11.0 percent ($n = 12$) of the comparison subjects had MMPI–2 L Scale t-scores greater than 65, the two groups did not differ on the L Scale; $F(1,232) = 0.30$, ns. Unexpectedly, the relatives ($M = 54.9$; $SD = 10.8$; 16.3% [$n = 20$] with $t > 65$) were significantly lower on the K Scale than the comparison subjects ($M = 58.3$; $SD = 9.6$; 22.0% [$n = 24$] with $t > 65$), $F(1,232) = 6.35$, $p < 0.02$. On the MMPI–2, few people (8% of normative sample) have a t-score above 65 (Tellegen and Ben-Porath 1992), suggesting that within the context of the SPQ, the K Scale does not operate as it does within the context of the MMPI–2, possibly because all SPQ items contain obvious psychopathological content whereas the MMPI–2 also contains items that are not face valid. Therefore, because a K Scale t-score cutoff of 65 may not be appropriate within the context of the SPQ, participants with $t > 65$ were not excluded. To investigate the possibility that defensiveness may obscure a meaningful result, analyses were run with and without participants with elevated K Scale scores ($t > 65$).

Within the relative and comparison groups separately, exploratory PCA (rotation: Promax with Kaiser normalization [$\kappa = 4$]) of the SPQ items was conducted. In both groups, PCA resolved three components (meeting eigenvalue > 1 and scree plot criteria) and accounted for 26 percent and 25 percent of the item variance in the relative and comparison group, respectively. Pearson correlations

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were computed between the factor loadings for each component and the SPQ's reported three factors (table 1). Inspection of these correlations indicated a good correspondence (i.e., strong and factor-specific correlations) between the three largest components we obtained and the established three SPQ factors.

Internal consistency reliability of the SPQ scales and factors was assessed using Cronbach's alpha. Table 2 presents the results of these analyses for the total sample, the relative group, and the comparison group. With the exception of the magical thinking subscale, the total SPQ and most of its constituent subscales and factors demonstrate adequate internal consistency values comparable to those reported in community samples (Raine et al. 1994). For each subscale, we computed the absolute difference between the alpha we obtained and that obtained by Raine et al. (1994). The average of the absolute difference for all subscales was 0.10 in our total sample, 0.05 in the relatives, and 0.11 in the comparison subjects. The magical thinking subscale yielded a very low alpha for the comparison group, which may be due to the infrequent endorsement of items on this subscale by comparison subjects (M = 0.84, SD = 2.60) or to measurement error. Excluding the magical thinking subscale, the average

Table 1. Principal components analysis resolved three components that correspond with the established three-factor model of the Schizotypal Personality Questionnaire

Principal components	Schizotypal Personality Questionnaire Factors[1]		
	Factor 1: Cognitive-perceptual	Factor 2: Social- interpersonal	Factor 3: Disorganization
Relatives (n = 124)			
Component 1	0.94	0.29	0.40
Component 2	0.58	0.89	0.53
Component 3	0.48	0.52	0.95
Comparison subjects (n = 109)			
Component 1	0.93	0.22	0.28
Component 2	0.56	0.80	0.40
Component 3	0.38	0.46	0.94

[1]Raine et al. 1994.

Table 2: Coefficient alpha for the Schizotypal Personality Questionnaire

SPQ component scale	Items (n)	Total study group (n = 233)	Relatives of schizophrenia patients (n = 124)	Healthy comparison subjects (n = 109)	Raine et al.'s samples[1] (n = 302, 220)
Factor 1: Cognitive-perceptual	33	0.76	0.85	0.67	—
Ideas of reference	9	0.70	0.70	0.72	0.71
Odd beliefs or magical thinking	7	0.20	0.61	0.09	0.78
Unusual perceptual experiences	9	0.62	0.67	0.48	0.72
Suspiciousness[2]	8	0.76	0.78	0.73	0.76
Factor 2: Social-interpersonal[2]	25	0.89	0.90	0.86	—
Excessive social anxiety	8	0.79	0.79	0.76	0.78
No close friends	9	0.76	0.77	0.69	0.71
Constricted affect	8	0.68	0.67	0.70	0.73
Factor 3: Disorganization	16	0.80	0.80	0.78	—
Odd or eccentric behavior	7	0.73	0.75	0.69	0.76
Odd speech	9	0.69	0.69	0.70	0.75
All SPQ items	74	0.89	0.92	0.85	0.91

[1]Alphas presented here are the average of the two community samples reported by Raine et al. (1994). Dashes indicate that alphas were not reported for the factor.
[2]Suspiciousness also loads on factor 2 and was included in the coefficient alphas of both factors 1 and 2.

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absolute difference in subscale alphas between our sample and Raine et al.'s (1994) sample was 0.04 for the total sample, 0.04 for the relatives, and 0.06 for the comparison subjects.

Next, we examined group differences in SPQ performance. Because some of the relatives in our sample came from the same families, the observations from our study are not independent. Thus, we conservatively adopted a p value of 0.01 as our criterion for significance. However, because of the stringency of this criterion and theoretical significance, we also report the one comparison that was significant at the 0.05 level but failed to achieve significance at the 0.01 level. Effect sizes were calculated using Glass' d [= (relative M- control M) / control SD]. The relatives (M = 17.3; SD = 11.2; range = 1–60) produced higher total SPQ scores than did the comparison subjects (M = 12.6; SD = 8.5; range = 0–42), $F(1,232) = 9.81$, $p < 0.002$, $d = 0.55$. Because past schizotypy research has indicated that relatives of schizophrenia patients tend to differ from comparison subjects in certain, but not all, schizotypal characteristics, group differences were examined for each of the SPQ factors and subscales. Figure 1 presents the personality profiles comparing the relative and comparison groups. The relatives scored significantly higher on only one of the three SPQ factors, the social-interpersonal Factor; $F(1,232) = 13.78$, $p < 0.001$, $d = 0.55$. The relatives did not score significantly higher on the cognitive-perceptual factor, $F(1,232) = 3.38$, $p = 0.08$, $d = 0.24$, or the Disorganized Factor, $F(1,232) = 1.51$, $p = 0.22$, $d = 0.17$, even at a 0.05 significance value.

The relatives scored significantly higher on three of the four social-interpersonal factor scales (social anxiety, constricted affect, and no close friends; d = 0.53, 0.36, and 0.52, respectively). They scored higher than comparison subjects on one of the four scales that make up the cognitive-perceptual factor, unusual perceptual experiences, at a level of $p < 0.05$ ($d = 0.38$), but did not significantly differ from the controls on the disorganized factor scales (odd behavior, d = 0.11; odd speech, d = 0.17).

When participants were excluded because of elevated MMPI–2 K Scale scores ($t > 65$), all of the above findings that were statistically significant remained so. We next reran the analyses excluding all relatives who had any conditions for which comparison subjects were excluded (e.g., Axis I psychopathology, medical conditions) except, of course, for psychopathology in a first degree relative. The pattern of significant and nonsignificant results with the more stringent relative sample (n = 54) remained the same, with two exceptions: The relatives endorsed significantly more items on the no close friends scale at a $p < 0.05$ level ($d = 0.40$), whereas the constricted affect scale difference was reduced to a trend ($p < 0.06$; $d = 0.32$).

Discussion

In the present investigation, schizotypal features were evidenced in a large study group of nonpsychotic individuals who differed from a comparison group by virtue of their genetic relatedness to patients with schizophrenia. The SPQ, a multidimensional self-report measure of schizotypy, demonstrated internal consistency reliability in schizophrenia relatives comparable to that reported in community samples. Consistent with the results of most interview-based assessments of schizotypy in schizophrenia relatives, social-interpersonal features best differentiated the first degree biological relatives of schizophrenia patients from healthy comparison subjects, indicating that they may be the most important schizotypal features associated with genetic vulnerability for schizophrenia. Kremen et al. (1998), who also used the SPQ, reported a trend for increased rate of social interpersonal deficits in relatives of schizophrenia patients compared with control participants, but Yaralian et al. (2000) did not find increased social interpersonal deficits in their relative group. Both groups of participants were small in comparison with the large study group employed here and may have had insufficient power to detect significant differences in this factor. In addition, Yaralian et al. (2000) point out that their ascertainment method may have affected results. Because they relied on the participant's report of familial psychopathology (through the FH–RDC Interview) to assign relative status, the authors suggest that relatives of individuals with predominantly negative schizophrenia or schizotypal symptoms may have been underrepresented in their sample, leading in turn to fewer negative schizotypal signs and symptoms in the relatives. In contrast, probands in the current investigation were ascertained by direct clinical interviews and chart reviews.

Only the social interpersonal deficit subscales consistently differentiated the relatives from comparison subjects in our study group. The only other subscale to differentiate groups was unusual perceptual features, a finding consistent with Kremen et al. (1998) and Yaralian et al. (2000). This result of increased unusual perceptual experiences in schizophrenia relatives, however, would not be expected from the results of investigations using interviews and other self-report measures and suggests that the SPQ may be a more sensitive index of these mostly untapped positive schizotypy features in schizophrenia relatives. This result is particularly salient because, unlike previous investigations, participants in our study were asked to refrain from considering episodes that could be accounted for by substance use or hypnagogic and hypnopompic hallucinations.

Caution is warranted in the interpretation of this finding, however, because the internal consistency reliability

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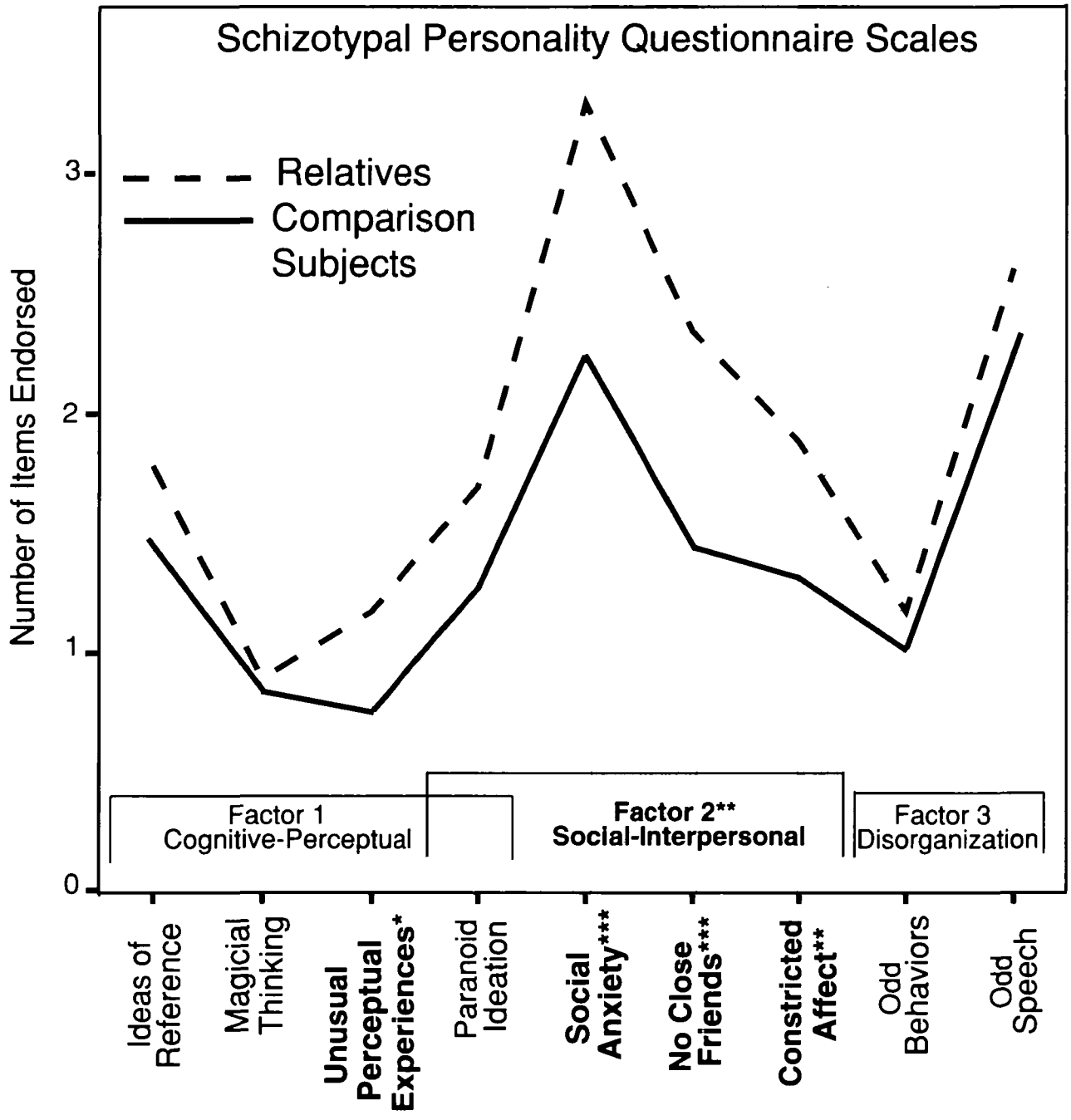
Figure 1. Mean profile for the Schizotypal Personality Questionnaire scales and factors of the relatives of schizophrenia probands and nonpsychiatric comparison subjects



Note.—Scales for which relatives scored significantly higher than comparison subjects are in bold.
$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

of this subscale was low in the comparison subjects, possibly because of the infrequent endorsement of items on this subscale. Internal consistency was not examined in the previous SPQ family studies; future investigations should include assessments of internal consistency to determine whether reduced reliability will routinely limit interpretation of this subscale. Moreover, evidence from two lines of research suggests that positive features of schizotypy exhibited by schizophrenia relatives may reflect "false schizotypal syndrome" in that they are not

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associated with genetic risk for schizophrenia (Torgersen et al. 1993). First, negative, but not positive, interview-assessed schizotypal symptoms have been reported to be associated with cognitive deficits in schizophrenia relatives similar to those reported in schizophrenia patients (Squires-Wheeler et al. 1997; Chen et al. 1998). The current results suggest that future studies with the SPQ should examine the association in relatives between SPQ factors and other putative vulnerability markers, such as eye movement dysfunction and cognitive impairment. Second, evidence from interview-based assessments suggests that negative schizotypal features are specific to the relatives of schizophrenia patients, whereas positive schizotypal features are also observed in the relatives of patients with other disorders (Torgersen et al. 1993), although this result is not ubiquitous (Coryell and Zimmerman 1989). We did not examine relatives of other psychiatric groups and thus cannot address the specificity of the observed characteristics to schizophrenia relatives.

PCA performed in the current investigation yielded three factors that correlated highly and discretely with the SPQ factors identified in community samples: social-interpersonal, cognitive-perceptual, and disorganized (Raine et al. 1994; Gruzelier 1996; Reynolds et al. 2000). Three-, four-, and seven-factor models of schizotypy symptoms assessed with other schizotypy measures have been described (Kendler et al. 1995; Bergman et al. 2000); competing factor solutions were not tested in the current investigation. However, the factor structure obtained is similar to the factor structure of measures assessing schizophrenia symptoms (for a discussion, see Vollema and van den Bosch 1995), indicating that the personality characteristics of relatives contain subclinical similarities to the symptoms of schizophrenia. Therefore, the current results provide additional evidence that investigations using multidimensional self-report measures such as the SPQ can allow for more appropriate testing of theories regarding the relationship between genetically salient symptoms of schizophrenia and schizotypy (Meehl 1962).

Relatives of schizophrenia patients did not respond more defensively to this self-report measure than did healthy comparison subjects, as assessed by MMPI–2 K Scale scores. These results are inconsistent with the often-mentioned hypothesis that other schizotypy self-report instruments have been unable to differentiate relatives from comparison subjects because of defensive responding by relatives. Other measures may have been unsuccessful because they used small groups of participants; relied on only a few, typically positive, features of schizotypy; or could not fully assess heritable aspects of schizotypy. Alternatively, relatives may exhibit defensiveness or reduced insight about particular kinds of schizotypal signs or symptoms. Relatives of schizophrenia patients in the current investigation did not evidence increased disorganization, a result consistent with the two previous investigations using the SPQ but inconsistent with several studies based on interviews and observation (e.g., Kendler et al. 1995; Squires-Wheeler et al. 1997). Raine et al. (1991) have demonstrated that disorganized signs and symptoms can be assessed with validity and reliability in community samples using the SPQ. The null results of all three SPQ studies with schizophrenia relatives that are discrepant with interview assessments, however, suggests that examinations of the comparability of observation-based and self-reported disorganization signs and symptoms in a sample of schizophrenia relatives would be warranted.

The DSM diagnostic criteria for schizotypy, and therefore the SPQ, do not include physical or social anhedonia, hypothesized components of schizotypy (Meehl 1962) that have been found to be successful at differentiating relatives and controls (Katsanis et al. 1990) via self-report measures developed by Chapman et al. (1976). Some evidence suggests that physical anhedonia is associated with the social-interpersonal factor in community samples and thus may complement the existing DSM schizotypal criteria (Gruzelier 1996). Moreover, social anhedonia has been reported to be predictive of later psychosis (Kwapil 1998). Consequently, the delineation of the full heritable schizophrenia spectrum will likely be assisted by examinations of the relationship between the SPQ and anhedonia scales in the relatives of schizophrenia patients.

The inclusion of schizotypal symptoms in the schizophrenia spectrum may add power to genetic analyses and potentially provide clues to the mode of transmission of schizophrenia (Battaglia and Torgersen 1996). Indeed, as illustrated by Matthysse and Parnas (1992), linkage studies in schizophrenia may be more powerful if, rather than using only the diagnosis of schizophrenia to identify affected cases, they instead employ characteristics that are genetically related to schizophrenia and more common in the relatives than the diagnosis of schizophrenia. Suggestive evidence supports the inclusion of schizotypal symptoms of relatives in the schizophrenia spectrum (Battaglia and Torgersen 1996). However, it remains unclear whether the inclusion of schizotypal symptoms in the spectrum enhances the power of linkage studies or adds noise to analyses (Battaglia and Torgersen 1996). Therefore, the delineation of the schizophrenia spectrum may depend on the accurate identification of specific traits that characterize the relatives of schizophrenia patients. The current results indicate that the SPQ is a promising, efficient and cost-effective tool that can help identify schizotypal symptoms most suggestive of genetic risk in family members.

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