Putatively psychosis-prone subjects 10 years later.

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Abstract:

The predictive validities of several indicators of psychosis proneness were evaluated in a 10-yr longitudinal study (N = 508). As hypothesized, high scorers on the Perceptual Aberration Scale, Magical Ideation Scale, or both (n = 182), especially those who initially reported psychoticlike experiences of at least moderate deviance, exceeded control Ss (n = 153) on psychoses (Diagnostic and Statistical Manual of Mental Disorders-III—Revised [DSM-III-R]), psychotic relatives, schizotypal symptoms, and psychoticlike experiences at follow-up. Ss who initially scored high on the Magical Ideation Scale and above the mean on the Social Anhedonia Scale were especially deviant. The Physical Anhedonia Scale and the Impulsive Nonconformity Scale were not effective predictors of psychosis proneness.

Keywords: psychosis | predictive measures | psychosis proneness | adult psychology | psychology | psychosis indicators | perceptual aberration scale | magical ideation scale

Article:

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We conducted a longitudinal study of hypothetically psychosis-prone subjects in order to validate our indicators of psychosis proneness and to establish that they measure an enduring personal characteristic. We identified hypothetically psychosis-prone subjects by assessing relevant symptoms or traits, using both paper-and-pencil screening inventories and an interview. We reinterviewed subjects 10–15 years later for a history of psychosis (revised third edition of the Diagnostic and Statistical Manual of Mental Disorders; DSM–III–R; American Psychiatric Association, 1987), as well as other indicators of psychosis proneness.

By the term psychosis proneness, we mean a predisposition or diathesis to psychosis. Like many other investigators of psychosis, we follow a diathesis–stress model. (Prominent versions of the diathesis–stress model, for the case of schizophrenia, are those offered by Meehl, 1973, 1990, 1993, and Gottesman, 1991.) We assume that psychoses, including both schizophrenia and affective psychoses, arise from the interaction between environmental stress and a predisposition or proneness. There may be separate and distinct diatheses toward schizophrenia and toward affective disorder with psychosis (Kendler & Diehl, 1993), but, if so, we were not able to differentiate those distinct diatheses in this research.

This diathesis–stress model implies that there are many people who are psychosis prone who do not decompensate into clinical psychosis (Gottesman, 1991). Evidence supporting this implication includes the fact that the concordance rates of psychotic disorders for monozygotic twins fall far short of 100%. This concordance rate is approximately 45% for schizophrenia (Gottesman, 1991) and 67% for Kraepelinian manic–depressive disorder (Bertelsen, 1979), a condition often accompanied by psychosis. Even stronger evidence is that the offspring of unaffected monozygotic twins of schizophrenics have a rate of schizophrenia comparable to that of the offspring of their schizophrenic cotwins (Gottesman & Bertelsen, 1989). Meehl (1990, 1993) estimated that only about 10% of schizotypes (his term for genetically schizophrenia-prone individuals) actually become clinically schizophrenic.

We hypothesized that our psychosis-prone subjects would have a heightened incidence of clinical psychosis at the 10-year follow-up evaluation, although we expected that the majority of the subjects would not have developed psychosis. We expected that our compensated psychosis-prone subjects would demonstrate milder and transient forms of the types of problems and symptoms reported in patients with psychosis. These problems include psychoticlike experiences, schizotypal symptoms, and poorer overall achievement and functioning. We also hypothesized that our psychosis-prone subjects would have an elevated number of relatives with psychosis because psychoses are reported to run in families. There is strong evidence of a substantial genetic component in both schizophrenia and bipolar disorder (Gottesman, 1991).

Nevertheless, some psychosis proneness may have an environmental origin. The present research does not require any assumption concerning this question.

The accurate identification of psychosis-prone individuals would facilitate study of the environmental, genetic, and other biological factors that either heighten or reduce the likelihood of psychosis-prone individuals developing clinical psychosis. It would also facilitate study of the genetic mode of transmission of the predisposition to psychoses. At present, genetic studies of psychosis proneness are handicapped by being limited primarily to relatives of overtly psychotic individuals, despite the fact that many psychotics lack identifiable psychotic relatives.

Considerable research has been done in the search for useful measure of psychosis proneness, especially schizophrenia proneness. The strategy most often used for identifying psychosis-prone individuals has been to study offspring or other family members of a schizophrenic (e.g., Erlenmeyer-Kimling & Cornblatt, 1987; Fish, 1987; Mednick, Parnas, & Schulsinger, 1987). The method of identifying psychosis-prone individuals by their traits has at least the potential of choosing a wider variety of psychosis-prone people than the genetic method. Other approaches include the use of deviant smooth-pursuit eyetracking (Holzman et al., 1988), biological measures such as monoamine oxidase (MAO) activity (Siever, 1985), and parents' communication deviance and expressed emotion (Goldstein, 1987) to identify at-risk individuals. Several investigators, like us, have attempted to identify schizophrenia-prone individuals by paper-and-pencil measures of symptoms. These inventories include Eysenck and Eysenck's (1975) Psychoticism scale from the Eysenck Personality Questionnaire, Golden and Meehl's (1979) Schizoidia Scale, Claridge and Broks's (1984) Schizotypal Personality Scale, and Raine's (1991) Schizotypal Personality Questionnaire.

Longitudinal Research Strategy for Identifying Psychosis-Prone Individuals

Our work began in the 1970s as an attempt to identify schizophrenia-prone individuals. We used the following longitudinal research strategy: (a) develop both paper-and-pencil self-report questionnaires and an interview measure of psychoticlike experiences that are believed to characterize schizophrenia-prone individuals; (b) administer questionnaires to large groups of subjects who are at or near the age range of greatest risk for schizophrenia; (c) select candidate high-risk subjects and control subjects on the basis of scores on the questionnaires; (d) evaluate the functioning of the selected subjects by interview; and (e) reevaluate the subjects' functioning at follow-up interviews.

In this article we report the results of a 10-year follow-up evaluation of a group of more than 500 such subjects. The initial stages of this research strategy have been described previously (Chapman & Chapman, 1985, 1987). At a 25-month follow up, Chapman and Chapman (1985) found that 3 high-risk subjects had become psychotic but that only 1 subject had developed schizophrenia. The other 2 subjects included one case of bipolar disorder with psychotic features and one case of delusional disorder. Because of these preliminary results as well as the

narrowing of the diagnostic criteria for schizophrenia in the DSM–III (American Psychiatric Association, 1980), we broadened the focus of the study to psychosis proneness. The primary goal of the study was to determine whether the individuals identified by our questionnaires and by our interview were indeed psychosis prone.

Preliminary Work

Screening Questionnaires for Psychosis Proneness

Members of our research team selected several symptoms or traits that are prominent in the literature on schizophrenia proneness, relying most heavily on the descriptions offered by Paul Meehl (1964) in his unpublished manual of schizotypy and by Hoch and Cattell (1959) in their descriptions of “pseudoneurotic schizophrenia,” their term for individuals who show an underlying schizophrenic process but have not yet decompensated into overt, full-blown psychosis. Separate true–false scales were developed for each of five symptomatic traits, a strategy intended to permit identification of the traits most predictive of schizophrenia.

The Revised Physical Anhedonia Scale (PhyAnh), described in Chapman, Chapman, and Raulin (1976), consists of 61 true–false items that inquire about the sensory and aesthetic pleasures of eating, touching, feeling, sex, temperature, movement, smell, sight, and sound. Although Meehl (1973) advanced physical anhedonia as a central, fundamental symptom of schizotypy, he later decided that it was less central (Meehl, 1990).

The 35-item Perceptual Aberration Scale (PerAb), described in Chapman, Chapman, and Raulin (1978), consists of 28 items designed to tap grossly schizophreniclike distortions in the perception of one's own body and 7 items for other perceptual disortions. The 30-item Magical Ideation Scale (MagicId), described by Eckblad and Chapman (1983), measures belief in forms of causation that, by conventional standards of the dominant culture, are regarded as invalid and magical. Magicld and PerAb were found to correlate .68 for male subjects (n = 2,500) and .70 for female subjects (n = 3,067; Chapman, Chapman, & Miller, 1982). Therefore, we combined the high-scoring subjects on either or both of the two scales into a single group, which we refer to as the perceptual aberration–magical ideation (Per–Mag) group.

The 51-item Impulsive Nonconformity Scale (NonCon), described by Chapman et al. (1984), was designed to tap a failure of incorporation of societal norms, a lack of empathy for the pain of others, and an unrestrained yielding to impulse and self-gratification. The 40-item Revised Social Anhedonia Scale (SocAnh; Eckblad, Chapman, Chapman, & Mishlove, 1982) measures schizoid indifference to other people, but not social anxiety (Mishlove & Chapman, 1985).

In selecting items for each scale, we followed the method of rational scale development described by Jackson (1970), including use of formal trait specifications to guide item writers. Candidate items were further screened for high item–scale correlation and for low correlation with independent measures of acquiescence and social desirability. The coefficient alpha internal

consistency reliabilities of all of these scales were in the .80s. The test–retest reliabilities ran between .75 and .85. We intermixed items from the several scales because we observed that scores on the PerAb tended to be lower if all of the items were given together without interruption by other kinds of items.

The Interview Measure of Psychoticlike Experiences

We expected that psychosis-prone subjects would demonstrate transient and milder forms of the symptoms reported by psychotic patients. Therefore, Chapman and Chapman (1980) developed an interview-based rating of psychoticlike experiences. The manual provides ratings of experiences on a continuum of deviancy from normal to severely psychotic. The manual provides scoring criteria for six broad classes of psychotic and psychoticlike experiences: (a) transmission of thoughts, (b) passivity experiences, (c) voice experiences and other auditory hallucinations, (d) thought withdrawal, (e) other personally relevant aberrant beliefs, and (f) aberrant visual experiences. Each experience is rated on an 11-point scale of deviancy. Scores of 2–5 are for psychoticlike experiences, whereas scores of 6–11 are for psychotic experiences. Scores of 1 are for normal experiences and are converted to zero for statistical analysis. For example, according to the manual, thought transmission includes experiences such as Schneiderian transmission of thoughts, that is, feeling the thoughts leave the head so that anyone in the area can hear them (score of 10), and the suspicion that one or two people who know the person well can, when physically present, read the thoughts by semimagical means (score of 4). Scoring an experience as psychotic in this system does not necessarily mean that the person is clinically psychotic in the DSM–III–R (American Psychiatric Association, 1987) sense but that the person has had the kind of experience that characterizes clinical psychosis. Although this rating scale gives scores for both psychoticlike experiences and full-blown psychotic experiences, we refer to it, for convenience of exposition, as a scale for psychoticlike experiences.

We hypothesized in advance of data collection that subjects who reported at least one experience at the initial interview that was rated at least moderately psychoticlike (score of 4 or more) would show an elevated incidence at follow up of both psychosis and other indications of psychosis proneness. We picked this cutoff on the basis of our judgment that scores of 1–3 are not sufficiently deviant to indicate serious psychopathology. In addition, we hypothesized that subjects who earned this rating and who also scored high on our paper-and-pencil questionnaires of psychosis proneness would have an especially high incidence of future psychosis and symptoms of psychosis proneness. Because of our earlier cross-sectional findings of great deviancy in the Per–Mag group, we expected that subjects who scored high on the Per–Mag and also had at least moderately psychoticlike experiences at the initial interview would show the greatest deviancy of all of our subjects.

Method

Selection of Subject Pool

College students were chosen as subjects because they are near the age of greatest risk for developing psychosis and because they are readily available in large numbers. We recognized, however, that our pool of subjects would be at lower risk for developing psychosis, especially schizophrenia, than young adults in the general population because they were functioning well enough to attend a major university and were predominately middle class. Numerous studies have indicated that good premorbid functioning is related to a reduced likelihood of developing schizophrenia, to a later age of first episode, and to a lesser severity (Cannon-Spoorr, Potkin, & Wyatt, 1982). The NIMH Epidemiological Catchment Area Study (Robins et al., 1984) reconfirmed the time-honored finding of a lower rate of schizophrenia in college-educated individuals than in less educated individuals.

Initial Interviews and Laboratory Studies

We interviewed our subjects at length soon after identifying them, using a modified version of Spitzer and Endicott's (1977) Schedule for Affective Disorders and Schizophrenia–Lifetime version (SADS–L). The modification consisted primarily of additional questions about psychoticlike and schizotypal symptoms.

At the initial assessment as well as at a preliminary 25-month follow up (Chapman & Chapman, 1987), we found that one or more of our experimental groups exceeded the control group on psychoticlike experiences, affective symptoms, schizotypal symptoms, and poor social adjustment. The Per–Mag group was especially deviant on these measures. The laboratory studies (from diverse laboratories) typically showed patterns of behavior in subjects identified by these scales that have been reported in schizophrenia, such as deviant smooth-pursuit eye movement, high scores on Rorschach indicators of thought disorder, communication deviancy, defective social skills, and aberrations on various electrophysiological measures. Miller and Yee (in press) have reviewed the relevant electrophysiological literature, and Edell (in press) has reviewed the findings of the other laboratory studies. The earlier interview findings and laboratory findings encouraged us to expect that all of these experimental groups would exceed the control group at follow-up on psychosis and on other indicators of psychosis proneness but also encouraged the hypothesis that the Per–Mag subjects would show the most deviant outcome of all of the experimental groups.

Subjects

The psychosis-proneness screening questionnaires were administered to approximately 7,800 undergraduate students enrolled in introductory psychology courses at the University of Wisconsin—Madison during the late 1970s and early 1980s. Subjects who scored at least 1.96 SDs above the mean of either the PhyAnh, PerAb, MagicId, or NonCon were invited to participate in the study. In addition, 14 subjects were chosen for the Per–Mag group on the basis of a sum of the z scores on PerAb and MagicId of 3.0 and above. The rationale was that such

subjects would score deviantly high on the symptoms measured by the two scales even though they would not score deviantly high on either one of the two scales alone. An additional group, which we call the combined-score group, consisted of subjects who did not qualify for deviancy on any one scale but earned a combined sum of the z scores of the four scales (PerAb, MagicId, NonCon, and PhyAnh) of at least 2.75. (We chose this cutoff as one that would identify subjects who are deviant but would not qualify for experimental group membership by the other criteria. About 2% of the college students, other than members of the other experimental groups, earned this high a sum of the four z scores.) We chose as control subjects individuals whose scores were lower than 0.5 SD above the mean on each of the four scales. SocAnh was not used to select subjects, although scores were obtained for all subjects on the scale. African-American and Asian subjects were not included. This was necessary because scores on our scales vary with ethnic background, and our students in the University of Wisconsin psychology classes lack sufficient minority group members to provide separate norms.

Thirty-four subjects qualified for both the Per–Mag group and Non-Con group (33 of these were reinterviewed at the 10-year follow up), whereas 2 subjects qualified for both the NonCon and PhyAnh group (one was reinterviewed). The primary group assignment of such subjects was determined by their highest z score. Table 1 shows the number of subjects in each primary group at the time of the initial testing and at the 10-year follow-up interview.

Table 1
Number of Subjects by Group at the Initial Follow-Up Interview

Group	Original group	10-Year follow-up	Refusals at follow-up	Percentage reinterviewed
Per–Mag	193	182	8	94
NonCon	74	71	2	96
PhyAnh	75	70	3	93
Combined score	33	32	1	97
Control subjects	159	153	5	96
Total	534	508	19	95

Note. Three subjects died between the initial screening and 10-year follow-up. (One Per–Mag and 1 Non-Con subject who also qualified for Per–Mag died from suicide, and 1 Per–Mag died from illness.) Four subjects completed questionnaires by mail instead of interviews. Per–Mag = the perceptual aberration–magical ideation group; NonCon = the impulsive nonconformity group; PhyAnh = the physical anhedonia group; Combined score = the group of subjects who were not deviant on any single scale but were higher on the sum of the *z* scores across the four scales.

Through planning and persistence, we succeeded, 10–15 years after initial contact, in locating and interviewing 508 of the original 534 subjects, a 95% success rate. The reinterview rate did not differ between groups. Of these 508 subjects, 468 had been seen at the 25-month follow up.

Our high success rate was achieved by securing each subject's permission 10 years earlier, together with social security number, driver's license number, and names and phone numbers of family members and close friends considered likely to know the subject's location. We also obtained assistance in locating subjects from the University of Wisconsin Alumni Office, the Social Security Administration Locator Service, the locator services of the Veterans Administration and the armed services, and the Wisconsin Department of Motor Vehicles. The subjects resided throughout the United States and on five continents. Of these 508 subjects, 506 were interviewed face to face and 2 by telephone. An additional 4 subjects (1 Per–Mag, 1 control, and 2 PhyAnh) were not interviewed but completed a brief questionnaire by mail. The questionnaire data were used for information about psychosis in the subject, psychotic relatives, and socioeconomic status (SES), but were not used to assess psychoticlike or schizotypal symptoms. In addition, 3 of our subjects died between the time of the initial testing and 10-year follow-up. One Per–Mag subject and 1 NonCon subjects who was also high on Per–Mag died from suicide, and another Per–Mag subject died of cancer. The remaining 19 subjects either were not located or refused to participate. The subjects were paid for their participation. Table 2 shows a number of characteristics of the groups at follow-up. The table gives the significance of the difference between each experimental group and the control group on each characteristic, but only when the overall test (F or χ 2) was significant. As can be seen, the groups did not differ on age, percentage married, years to follow-up, or father's social position as measured by Hollingshead's (1957) two-factor index of social position. The NonCon group exceeded the control group on the percentage of female subjects because we included some extra female NonCon subjects whom we had identified for purposes of another study. The subjects lost to attrition did not differ from the subjects reinterviewed at the 10-year follow-up on father's social position; psychoticlike experiences at the initial interview; or PerAb, MagicId, NonCon, and PhyAnh score.

Table 2
Characteristics of Each Group at Follow-Up

	Group									
	Per–Mag (n = 182)		NonCon (n = 71)		PhyAnh (n = 70)		Combined score (n = 32)		Control (n = 153)	
Characteristic	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age	30.0	1.8	30.0	1.6	29.9	1.5	29.8	0.9	30.0	1.8
Percentage female	53.3%		64.8%**		41.4%		59.4%		47.1%	
Percentage married	53.0%		40.8%		58.3%		59.4%		59.7%	
Father's social position	30.6	15.4	28.0	15.2	29.7	14.0	28.1	12.1	30.3	15.4
Years to follow-up	10.6	1.0	10.7	0.9	10.8	1.1	10.8	0.9	10.6	0.9
Subject's social position	28.2*	10.8	28.8	12.0	26.0	10.2	24.7	8.2	25.2	10.3
Global Adjustment score	68.8**	12.2	69.2**	11.2	73.6	11.1	72.8	13.0	75.0	12.3
Years of education	16.2	1.6	16.2	1.5	16.2	1.6	17.0	1.5	16.5	1.5

Note. All values are means unless designated as percentages. Per–Mag = perceptual aberration–magical ideation group; NonCon = impulsive nonconformity group; PhyAnh = physical anhedonia group; combined score = the group of subjects who were not deviant on any single scale but were higher on the sum of the z scores across the four scales.
Comparison with the control group, * $p < .05$. ** $p < .01$.

Materials

The follow-up evaluation consisted of a diagnostic interview that assessed overall functioning, psychosis and psychoticlike experiences, schizophrenia-spectrum personality disorders, mood disorders, and mental health treatment. The interview included a modified SADS–L (Spitzer & Endicott, 1977) and portions of Loranger's (1988) Personality Disorder Exam (PDE) that assess schizotypal, schizoid, and paranoid personality disorders. The SADS–L was modified to obtain additional information about psychoticlike experiences. The PDE contains questions that map onto the DSM–III–R criteria for each of the personality disorders. The questions are scored 0, 1, or 2 depending on the severity of the symptoms. The scoring produces a clinical diagnosis as well as a dimensional score (sum of scores across questions) for each personality disorder.

The interviews lasted approximately 2 hr and were typically completed in one session. The interviews, as well as the scoring and diagnosis, were conducted by clinical psychologists and advanced graduate students who had received extensive diagnostic training. The interviews were tape-recorded, and transcripts of interviews were used to help resolve the more difficult scoring decisions, including all of the scoring of psychoticlike experiences. Both the interviewers and scorers were unaware of the subjects' group membership. Reliability of ratings and diagnoses was not assessed, but diagnoses were arrived at consensually and were made according to DSM–III–R criteria. The reliability of the rating system for psychoticlike experiences was demonstrated previously (Chapman & Chapman, 1980). Family history of psychopathology was assessed during the subjects' diagnostic interview. Therefore, interviewers and raters were aware of both the subjects' clinical status and family history.

Outcome Measures

Our principal outcome measures of psychosis proneness were DSM–III–R psychosis; reports of psychotic relatives; psychoticlike experiences at follow-up interview as rated using our manual; and PDE schizoid, paranoid, and schizotypal dimensional scores at the follow-up interview. The highest scored (most deviant) psychoticlike experience at first interview was a predictor variable. We adopted psychoticlike experiences at follow-up as an indicator of an outcome of psychosis proneness only after finding that psychoticlike experiences at first interview validly predicted later clinical psychosis. We used the PDE schizotypal, paranoid, and schizoid dimensional scores at follow-up as indicators of psychosis proneness because of the widely reported finding that such symptoms are found in family members of schizophrenics (Kety, Rosenthal, Wender, & Schulsinger, 1968). In order to minimize effects of illicit drug use, subjects were instructed not to endorse experiences on the psychosis-proneness scales that they had only while using drugs. Likewise, psychoticlike experiences that subjects reported during the interview were carefully screened to ensure that they did not occur only while the subjects were under the influence of drugs.

Secondary outcome variables were two measures of overall functioning: Hollingshead's (1957) two-factor index of social position (SES) and Endicott, Spitzer, Fleiss, and Cohen's (1976) Global Adjustment Scale (GAS). SES can be viewed as a measure of achievement because it is a weighted composite of occupation and education (higher scores reflect less achievement). The GAS is a rating of overall adjustment with scores that range from psychopathological illness (lower scores) to health (higher scores). Psychosis-prone individuals are expected to have achieved lower social position and poorer overall adjustment.

Data Analysis

An analysis of variance (ANOVA) was used to compare the groups when quantitative data were analyzed. In keeping with our original hypotheses, we limited statistical analyses between pairs of groups to comparisons of each experimental group with the control group. We did not make comparisons between experimental groups. Dunnett's t was used to control for familywise error. We also computed the Brown-Forsythe (F*) statistic and the separate variance t statistic when it appeared that the variances were heterogeneous, but in no case was there a change in the significance of a result (presumably because of our large sample sizes). Therefore, we report only the conventional F and t statistics. The chi-square statistic was computed when the data were qualitative or categorical measures. Fisher's exact test was used for 2 × 2 contingency tables when the minimum expected value was less than 10. The number of subjects differed slightly among analyses because the mailed questionnaires, which were used for 4 subjects, yielded data for only some analyses.

Results

Prediction of Psychosis at 10-Year Follow-Up

Fourteen subjects reported a history of DSM–III–R psychosis at the follow-up interview. Thirteen of these experienced their first clinical psychosis during the follow-up period and 1 Per–Mag subject had developed a psychosis during adolescence but did not reveal it until the follow-up interview. Table 3 shows the group membership and diagnosis of the psychotic subjects. Each experimental group was compared with the control group on the frequency of clinical psychosis. Only the Per–Mag group differed significantly from the control group (Fisher's exact test, $p < .05$). Omitting the subject who, unknown to the investigators, had already been psychotic before the first interview would change this result to .06. (Exclusion of this subject did not, however, affect the significance level in any of our other analyses.)

Table 3
DSM–III–R Psychoses Found at 10-Year Follow-Up in Each of the Five Groups

Diagnosis	Group				
	Per–Mag (n = 182)	NonCon (n = 71)	PhyAnh (n = 70)	Combined score (n = 32)	Control (n = 153)
Schizophrenia	3	0	1	0	1
Psychosis NOS	3	0	0	0	0
Delusional disorder	1	0	0	0	0
Bipolar, psychotic	3	0	0	0	0
Major depression, psychotic	0	0	1	0	1
Total	10	0	2	0	2

Note. *DSM–III–R* = revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders*; Per–Mag = perceptual aberration–magical ideation group; NonCon = impulsive nonconformity group; PhyAnh = physical anhedonia group; combined score = the group of subjects who were not deviant on any single scale but were higher on the sum of the z scores across the four scales; NOS = not otherwise specified.

The 3 Per–Mag subjects listed in Table 3 as suffering from DSM–III–R psychosis not otherwise specified (NOS) all had developed full-fledged schizophrenic syndromes of several years' duration except for deterioration of functioning. All 3 subjects reported bizarre delusions, hallucinations, and other schizophrenic symptoms as pervasive features of everyday life. Two of them reported passivity experiences. Nevertheless, all 3 maintained responsible employment, one as an office manager, one as a health care worker, and one as a computer programmer, and none had been hospitalized for psychosis.

History of DSM–III–R substance abuse or dependence was reported by 6 of the psychotic Per–Mag subjects and by 1 each of the psychotic PhyAnh and control subjects. Two psychotic Per–Mag subjects, one diagnosed with schizophrenia and the other with bipolar disorder, were hospitalized for substance dependence. In both cases, the substance dependence treatment was subsequent to hospitalization for psychosis. A control subject diagnosed as suffering from major depression with psychotic features was hospitalized for substance dependence prior to hospitalization for psychosis.

Three additional Per–Mag subjects were sufficiently deviant in their behaviors and cognitions to warrant designation as possibly psychotic. They reported delusions and hallucinations, but their symptoms were less deviant and pervasive than the symptoms reported by the subjects diagnosed with psychosis NOS. Data for these 3 subjects are not included in Table 2 or in the analysis of data on clinical psychosis at follow-up.

Prediction of Psychosis in Relatives

The percentage of subjects in each group who reported clinical psychosis in one or more relatives of either first or second degree were Per–Mag, 15%; NonCon, 6%; PhyAnh, 9%; combined score, 6%; and control, 7%. Only the Per–Mag group differed significantly from the control group, $\chi 2$ (1, n = 335) = 5.01, $p < .05$.

Prediction of Overall Functioning

The five groups differed at follow-up on SES, $F(4, 507) = 2.82$, $p < .05$, and on GAS, $F(4, 503) = 6.73$, $p < .001$. Table 2 shows the mean values. The Per–Mag group scored more poorly than the control group on both SES, $t(507) = 2.66$, $p < .05$, and GAS, $t(503) = 4.69$, $p < .01$. The NonCon group also scored lower on GAS than the control group, $t(503) = 3.34$, $p < .01$. These findings indicate that the traits measured by these scales interfere with adjustment.

Mood Disorder

The percentage of subjects in each group who reported DSM–III–R mood disorders, with or without psychotic features, is presented in Table 4. Diagnoses were limited to subjects who reported episodes occurring since the initial assessment.

Table 4
Rates of DSM–III–R Mood Disorder at 10-Year Follow-Up

	Group				
Disorder	Per–Mag (%)	NonCon (%)	PhyAnh (%)	Combined score (%)	Control (%)
Major depression	35.2	32.4	15.7	15.6	20.3
Mania	3.8	0.0	0.0	0.0	0.0
Hypomania	4.4	4.2	2.9	6.3	1.3

Note. *DSM–III–R* = revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders*; Per–Mag = perceptual aberration–magical ideation group; NonCon = impulsive nonconformity group; PhyAnh = physical anhedonia group; combined score = the group of subjects who were not deviant on any single scale but were higher on the sum of the *z* scores across the four scales.

Ratings of the severity of manic and depressive symptoms were made at the initial and follow-up interviews. Subjects were rated from 0 (no symptoms) to 4 (recurrent severe symptoms) on both mania and depression. Two-way ANOVAs (Group × Assessment) were computed separately for depression and mania. The Group × Assessment interaction was not significant for either analysis. The groups differed on both the depression score, $F(4, 503) = 16.31$, $p < .001$, and on the mania score, $F(4, 502) = 11.35$, $p < .001$. The Per–Mag and NonCon groups both exceeded the control group on depression, $t(503) = 3.96$, $p < .01$, and $t(503) = 2.83$, $p < .05$, respectively. Only the Per–Mag group exceeded the control group on mania, $t(502) = 4.30$, $p < .01$. The depression rating decreased significantly from the initial to the follow-up evaluation, $F(1, 503) = 6.24$, $p < .05$, as did the mania rating, $F(1, 502) = 5.84$, $p < .05$.

Improvement of Prediction by Use of Initial Psychoticlike Experiences

We wanted to know whether the ratings of psychoticlike experiences at first interview could be used to improve identification of psychosis proneness among the Per–Mag subjects. (For this analysis, we included in the Per–Mag group 9 subjects whose primary group was NonCon but who also qualified for the Per–Mag group). We divided subjects into those with one or more moderately psychoticlike experiences (score of 4 or more) at the first interview and those who reported only less deviant experiences (scores below 4).

Psychosis was found in 9 of the 66 Per–Mag subjects with moderately psychoticlike experiences at the initial interview, as compared with only 1 of the 125 Per–Mag subjects with low psychoticlike experiences (Fisher's exact test, $p < .001$). Those with initial moderately psychoticlike experiences were also more deviant on follow-up psychoticlike experiences, $t(189) = 4.76$, $p < .001$, and on schizotypal dimensional score, $t(189) = 4.39$, $p < .001$. They were also poorer on GAS, $t(189) = 3.84$, $p < .001$, and on SES, $t(190) = 2.38$, $p < .05$. The two groups did not differ on reports of one or more psychotic relatives.

Psychoticlike Experiences at Follow-Up

These results support the validity of our measure of psychoticlike experiences at the first interview as an indicator of psychosis proneness. This finding supports the use of psychoticlike experiences as an outcome measure of psychosis proneness at the second interview.

We used each subject's single highest psychoticlike experience rating as a measure of deviancy. Table 5 shows the group means on that rating for the initial and follow-up interviews. The five groups differed at the follow-up interview, $F(4, 503) = 13.10$, $p < .001$, as well as the initial interview $F(4, 503) = 29.28$, $p < .001$. Scores were lower at the follow-up interview than at the initial interview, as shown by a two-way ANOVA, $F(1, 503) = 7.69$, p.01. At the follow-up interview, the Per–Mag group differed from the control group, $t(503) = 6.53$, $p < .001$, as did the NonCon group, $t(503) = 2.77$, $p < .05$. Also at the initial interview, the same two experimental groups had differed from the control groups: Per–Mag versus control, $t(503) = 10.08$, $p < .001$; NonCon versus control, $t(503) = 2.98$, $p < .05$. In order to ensure that our findings that the Per–Mag group exceeded the control group on follow-up psychoticlike experiences was not attributable to a greater number of subjects with clinical psychosis in the Per–Mag group, we reanalyzed the data with the 14 psychotic subjects omitted. The results of these analyses were substantially unchanged.

Table 5
Highest Psychoticlike Experience Rating at Initial and 10-Year Follow-Up Interviews

Interview	Group				
	Per–Mag (n = 182)	NonCon (n = 71)	PhyAnh (n = 70)	Combined score (n = 32)	Control (n = 153)
Initial Interview					
M	2.67**	1.39**	0.81	1.59	0.64
SD	2.22	1.82	1.46	2.03	1.41
10-Year follow-up					
M	1.92**	1.28*	0.46	1.06	0.48
SD	2.62	2.09	1.25	1.83	1.31

Note. Dunnett's t for comparison of each experimental group with the control group. Per–Mag = perceptual aberration–magical ideation group; NonCon = impulsive nonconformity group; PhyAnh = physical anhedonia group; combined score = the group of subjects who were not deviant on any single scale but were higher on the sum of the z scores across the four scales.
* $p < .05$. ** $p < .01$.

We also assigned each subject a score for the most deviant psychoticlike experience of each of the six types. The Per–Mag group significantly exceeded the control subjects on five of the six types of experience ($p < .01$ in each case), with the exception being thought withdrawal, which was a rare symptom in all groups. The other three experimental groups did not differ from the control group on any of these measures. These heightened psychoticlike experiences in the Per–Mag group provide additional evidence of this group's psychosis proneness.

In order to examine whether Per–Mag subjects who scored deviantly on psychoticlike experiences at the initial and follow-up interviews tended to be the same subjects, they were dichotomized at each interview according to whether their highest psychoticlike experience score was less than 4 or was 4 and above. The correlation between the two interviews was significant ($\varphi = .30$, $p < .01$).

Prediction of Schizophrenia-Spectrum Personality Disorders at Follow-Up

The PDE (Loranger, 1988) was used to assess schizotypal, schizoid, and paranoid personality disorders at follow-up. Among the nonpsychotic subjects, 3 qualified as probable or definite schizotypal personality disorder, 4 met the criteria for schizoid, and 12 met the criteria for paranoid personality disorder. None of the experimental groups differed from the control group on the rate of such diagnoses.

Ten Per–Mag subjects met the criteria for at least one of these diagnoses, although 4 of the subjects were clinically psychotic. Of the remaining 6 subjects, 2 were diagnosed with paranoid personality disorder, 3 with schizoid and paranoid personality disorders, and 1 with schizotypal personality disorder. The NonCon subjects included 1 with schizotypal personality disorder, 2 with paranoid personality disorder, and 1 with paranoid and schizoid personality disorder. The

PhyAnh subjects included 1 with paranoid personality disorder and 2 with schizoid personality disorder, in addition to 1 psychotic subject who met criteria for a personality disorder. One combined-score group subject met criteria for paranoid and schizoid personality disorders. Four control subjects met criteria for these disorders, although 2 of the subjects were psychotic. One of the remaining was diagnosed with paranoid personality disorder and 1 with paranoid, schizoid, and schizotypal disorders.

However, the PDE dimensional scores did yield differences between groups. The mean schizotypal, schizoid, and paranoid personality dimensional scores for each group, with psychotic subjects omitted, are presented in Table 6. The groups differed on schizotypal, $F(4, 489) = 8.56$, $p < .001$, and paranoid, $F(4, 489) = 4.65$, $p < .01$, dimensional score and showed a trend toward a difference on schizoid scores, $F(4, 489) = 2.15$, $p < .10$. The Per–Mag group was found to exceed the control group on schizotypal dimensional scores, $t(489) = 5.54$, $p < .01$, and on paranoid dimensional scores, $t(489) = 3.26$, $p < .01$. The NonCon group also exceeded the control group on the paranoid dimensional scores, $t(489) = 3.38$, $p < .01$, and on schizotypal dimensional scores, $t(489) = 2.69$, $p < .05$.

Table 6
Mean PDE Schizotypal, Schizoid, and Paranoid Dimensional Scores for Each Group (Psychotic Subjects Omitted)

	Group				
Dimensional score	Per–Mag (n = 172)	NonCon (n = 71)	PhyAnh (n = 68)	Combined score (n = 32)	Control (n = 151)
Schizotypal					
M	1.84**	1.39*	0.84	1.25	0.65
SD	2.35	2.28	1.21	2.27	1.27
Schizoid					
M	0.56	0.49	1.06	0.44	0.58
SD	1.24	1.00	2.01	1.08	1.35
Paranoid					
M	0.98**	1.17**	0.46	0.91	0.40
SD	1.63	2.20	1.11	2.31	1.07

Note. Dunnett's t for comparison of each experimental group with the control group. PDE = Personality Disorder Examination; Per–Mag = perceptual aberration–magical ideation group; NonCon = impulsive nonconformity group; PhyAnh = physical ahedonia group; combined score = the group of subjects who were not deviant on any single scale but were higher on the sum of the z scores across the four scales.
* $p < .05$. ** $p < .01$.

We wanted to determine the predictors of the PDE schizotypal dimensional score in the Per–Mag group because the score seems promising as an indicator of at least modest psychosis proneness. Using only the Per–Mag subjects, we performed a hierarchical regression analysis, using the

PDE schizotypal dimensional score as the dependent variable, to determine the extent of independence of our predictors. Psychoticlike experiences from the initial interview were entered first because we originally targeted it as our best predictor, followed, in order, by scores on PerAb, MagicId, NonCon, PhyAnh, SocAnh, and reports of psychotic relatives. The only significant predictors and their increments in the variance accounted for (R2) were the subjects' psychoticlike experiences from the first interview, .105; MagicId, .029; SocAnh, .034; and psychotic relatives, .028. We found it surprising that scale scores added independent variance despite their narrow range in this Per–Mag sample.

A second regression analysis was computed with the same seven independent variables but using psychoticlike experiences at follow-up as the dependent variable. The same significant predictors were found as for schizotypal symptoms and with similar increments in the variance accounted for. These increments were psychoticlike experiences at first interview, .091; MagicId, .042; SocAnh, .041; and psychotic relatives, .017.

Table 7 shows another method of considering the same information using the schizotypal dimensional score at follow-up as the dependent variable. Table 7 shows the percentage of subjects scoring 4 and above on the schizotypal dimensional score computed for subgroups defined by high or low scores on MagicId, SocAnh, and psychoticlike experiences reported at the first interview for the 191 Per–Mag subjects. (Only 14% of the entire group of 508 subjects in the study had a score this deviant on the schizotypal dimensional score.) The subjects who were most deviant on the schizotypal dimensional score at follow-up were those who scored high at the initial interview on all three of these scores (i.e., psychoticlike experiences, MagicId, and SocAnh). Among subjects who showed psychoticlike experiences at the first interview, as well as among those who did not, those who were high initially on both the MagicId and SocAnh scales showed the highest schizotypal dimensional scores at follow-up.

Table 7
Percentage of Subjects in Each Subgroup With a Schizotypal Dimensional Score Above 3

Test scores	Highest score of psychoticlike experiences: 4 or more	Highest score of psychoticlike experiences: Less than 4
Magical ideation score above 1.96		
Social anhedonia score greater than 7	60	26
Social anhedonia score of 7 or less	28	7
Magical ideation score below 1.96		
Social anhedonia score greater than 7	30	15
Social anhedonia score of 7 or less	31	15

Incidence of Psychotic Relatives in the Correctly Predicted Psychotics

One may wonder whether our indicators of psychosis proneness predict psychosis better than whether the subject has psychotic relatives. Per–Mag subjects with psychotic relatives exceeded Per–Mags without psychotic relatives on the rate of clinical psychosis in the subjects (22.2% and 2.6%, respectively, $p < .001$); on psychoticlike symptoms at follow up, $t(180) = 3.06$, $p < .01$; on schizotypal dimensional score, $t(180) = 4.26$, $p < .001$; and on GAS, $t(180) = 4.05$, $p < .001$. However, correct predictions using our indicators were not completely redundant with predictions yielded by the family history information. We examined this for psychotic relatives of either the first or second degree. Among the subjects whose psychosis was correctly predicted by the Per–Mag, 6 of the 10 reported one or more psychotic relatives. Among those predicted by moderately psychoticlike experiences, used either alone or together with the Per–Mag, 5 of 9 psychotic subjects reported having psychotic relatives. For those identified by the MagicId and SocAnh, 4 of 7 psychotic subjects reported psychotic relatives. Thus, 40%–45% of the subjects who were identified as psychosis prone and who became psychotic would not have been so identified on the basis of their having psychotic relatives.

A Search for Deviant Subgroups Within the Per–Mag Group

We examined the questionnaire scores of the Per–Mag subjects to see whether there would be a pattern that distinguishes those who became psychotic.

MagicId and PerAb subjects

Eight of the 10 Per–Mag subjects who were found clinically psychotic at follow-up initially had high scores (standard score of 1.96 or greater) on MagicId. Four had high scores on PerAb, but all 4 of these also had high scores on MagicId. Thus, MagicId appeared to predict better than PerAb, although we lacked a statistical test.

The 83 Per–Mag subjects deviant on MagicId exceeded the remaining 108 Per–Mag subjects on clinical psychosis (Fisher's exact test, $p < .05$); on psychoticlike experiences at the follwup interview, $t(189) = 3.53$, $p < .001$; and on schizotypal dimensional score, $t(189) = 2.45$, $p < .05$. They also showed a trend toward exceeding the remaining Per–Mag subjects on GAS, $t(189) = 1.82$, $p < .10$. They did not differ, however, on SES or on reports of relatives with psychosis.

Given the marked deviancy of the MagicId group at the 10-year follow-up, we wanted to determine whether significant differences between the Per–Mag group and the control group were simply due to the inclusion of the subjects who scored high on MagicId. Such was not the case. The 96 PerAb subjects whose standard scores were less than 1.96 on MagicId differed from the control subjects on the number of subjects reporting psychotic relatives, $\chi 2$ (1, $N = 249$) = 5.18, $p < .05$; on highest psychoticlike experience rating, $t(247) = 3.97$, $p < .001$; and on schizotypal dimensional score, $t(247) = 3.66$, $p < .001$. Thus, the PerAb subjects, just as the MagicId subjects, showed evidence of psychosis proneness.

MagicId subjects with social anhedonia

Seven of the 8 psychotic subjects who had high scores on MagicId also had SocAnh scores above the mean (score of 7) of the total group tested. Altogether, there were 33 subjects who scored that high on both MagicId and SocAnh. These subjects are referred to as the MagicId–SocAnh group. This group's 21% psychosis rate compares with 5% for the total Per–Mag group, 14% for those who were both high on Per–Mag and reported moderately psychoticlike experiences at the first interview, and 1.3% for the control group. The MagicId–SocAnh subjects exceeded the remaining Per–Mag subjects on highest psychoticlike experience score at the 10-year follow-up, $t(189) = 3.36$, $p < .001$. However, the groups did not differ on highest psychoticlike experience at the initial interview. The MagicId–SocAnh group also exceeded the remaining Per–Mag subjects on schizotypal dimensional score, $t(189) = 3.44$, $p < .001$; SES, $t(190) = 2.40$, $p < .05$; and GAS, $t(189) = 3.14$, $p < .01$. The groups did not differ on the number of subjects with psychotic relatives.

Although combining SocAnh with MagicId appeared to improve prediction of psychosis proneness over that obtained by MagicId alone, the use of the SocAnh scale did not enhance the predictive power of the PerAb scale. Thirty-eight subjects scored deviantly on both the PerAb and SocAnh scales. Although these subjects exceeded control subjects on the several indicators of psychosis proneness (except clinical psychosis), they did not differ from the remaining Per–Mag subjects on any of these measures.

Per–Mag subjects with higher NonCon scores

We investigated whether Per–Mag subjects who scored at least 1 SD on the NonCon Scale would be more deviant than those who did not. We had previously found in a cross-sectional study that such subjects had more deviant psychoticlike experiences and showed more cognitive defects on laboratory tasks than did other Per–Mag subjects (Chapman et al., 1984). However, in the current study, the two groups of Per–Mag subjects, that is, those with NonCon scores above and below 1.0, did not differ on clinical psychosis, highest psychoticlike experience, or schizotypal dimensional score at follow-up. Moreover, 20% of the Per–Mag subjects with low NonCon scores had a psychotic relative, compared with 6% of those with high NonCon scores, $\chi 2\ (1, N = 191) = 8.13$, $p < .01$. Thus, the high NonCon/Per–Mag subjects appear to be less genetically predisposed to psychosis than the low NonCon/Per–Mag subjects, rather than more. However, the Per–Mag subjects with the higher NonCon scores more often suffered from major depression, 29% for Per–Mag subjects with low NonCon, and 45% for those who were higher on NonCon, $\chi 2\ (1, N = 191) = 5.16$, $p < .05$.

Discussion

Validity of the Measures of Psychosis Proneness

The findings strongly support the validity of the PerAb and MagicId as indicators of psychosis proneness. As discussed earlier, we describe as “psychosis prone” not only those subjects who eventually become psychotic but also those who show symptoms (psychoticlike experiences) that have been found to be effective as statistical predictors of later psychosis. Per–Mag subjects exceeded control subjects at 10-year follow-up not only on DSM–III–R psychosis but also on psychoticlike experiences, schizotypal dimensional score, and reports of psychotic relatives. By calling individuals psychosis prone because they score high on these measures, we do not imply that they will all become psychotic. Our usage parallels that of genetics researchers (Gottesman, 1991), who refer to individuals who carry the gene for schizophrenia as schizophrenia prone even if they do not decompensate. (However, we do not make assumptions regarding the genetic or environmental origin of psychosis proneness.)

Psychoticlike experiences of at least moderate deviancy at initial interview are an excellent indicator of psychosis proneness among high scorers on the PerAb and MagicId. Individuals with such experiences were found at follow-up to be more likely to develop DSM–III–R psychosis, to report relatives with psychoses, and to exceed control subjects on the additional measures of psychosis proneness. It appears that psychoticlike experiences in late adolescence are not entirely a passing developmental phase or a transient response to experimentation with drugs and alcohol. Instead, such symptoms are often valid indicators of serious psychopathology that may develop into psychosis. On the other hand, psychoticlike experiences for the group as a whole decline with age, indicating that these symptoms are transient for many subjects.

The psychosis-prone subjects identified by these indicators often reported psychosis in relatives. Yet, the indicators clearly yielded additional information because 40%–45% of the identified psychotics did not report psychotic relatives. One cannot infer from this finding the extent of a possible genetic contribution to psychosis in these cases. These subjects might have psychotic relatives but not know it or might have known but failed to report it. Alternatively, they might have a genetic predisposition even though they have no first- or second-degree relatives with psychosis. Regardless of which alternative explanation is correct, our indicators provided increased predictive power for identifying psychosis-prone individuals.

Even though the MagicId alone yielded a higher percentage of psychotics than did the combination of MagicId and PerAb, the PerAb still had a significant relationship to psychosis proneness when used alone. The PerAb group included 4 subjects who became psychotic and differed from the control subjects on all of the other indicators of psychosis proneness.

Despite our encouraging findings, we do not know what portion of any of our groups are genuinely psychosis prone; that is, we do not know the valid positive and false-positive rates. These rate cannot be determined by the portion who actually became psychotic by the time of the 10-year follow-up. Our subjects have not yet passed through all of their age of risk. Exactly what portion of risk remains at their mean age of 30 is difficult to estimate. According to Slater and Cowie's (1971) data on mean age of first psychotic episode, 30-year-olds still have, on the average for male and female subjects combined, about 52% of their risk period remaining for schizophrenia and a much larger portion of their risk period remaining for mood psychoses. Our subjects presumably have an even greater portion of their risk remaining because, being college students, they were functioning relatively well in their late teens. Presumably, the number of psychotics in our sample will eventually be much higher than found thus far.

Schizophrenia in High-Scoring Subjects

Our scales did not successfully predict schizophrenia. The rates of schizophrenia (see Table 3) were 1.7% in the Per–Mag group, 0.7% in the control group, and 0.1% in the total sample. The rate for the control group is consistent with the NIMH Epidemiological Catchment Area Study (Regier et al., 1988; Robins et al., 1984), which reported that the lifetime prevalence of schizophrenia and schizophreniform disorder was 1.5% in the general population and 0.5% in college graduates.

Mood Psychosis in High-Scoring Subjects

Our finding that subjects whom we originally identified as hypothetically schizophrenia prone developed mood psychoses as well as schizophrenia was unexpected from the formulations of both Meehl (1964, 1973, 1990, 1993) and Hoch and Cattell (1959). The finding is not inconsistent, however, with research evidence, much of it recent, on the correlates of schizotypal symptoms. Mood disorder has been reported as elevated in the first-degree relatives of schizotypal patients (Bornstein, Klein, Mallon, & Slater, 1988; Schulz et al., 1986). Conversely,

although schizotypal symptoms are known to be elevated in the relatives of schizophrenics, they are also elevated in the off-spring of parents with mood disorders (Squires-Wheeler, Skodal, Bassett, & Erlenmeyer-Kimling, 1989; Squires-Wheeler, Skodal, Friedman, & Erlenmeyer-Kimling, 1988). Moreover, the findings of Squires-Wheeler et al. (1989) apparently cannot be attributed to atypical mood-disordered parents with schizoaffective symptoms. Although 40% of the DSM–III mood-disordered parents in this study had previously been diagnosed as DSM–II schizophrenics, the mood-disordered parents who had or had not received such a previous diagnosis had offspring with comparable rates of schizotypal symptoms (E. Squires-Wheeler, personal communication, July 6, 1993).

Findings on medication efficacy indicate that pseudoneurotic schizophrenia may have more in common with mood disorder than with schizophrenia. Klein (1967) found, in a double-blind study, that pseudoneurotic schizophrenics responded favorably to imipramine, a conventional treatment for depression, but not to chlorpromazine. Similarly, Hedberg, Houck, and Glueck (1971) found that pseudoneurotic schizophrenic patients responded better to an MAO inhibitor than to trifluoperazine.

These findings that link schizotypal symptoms to mood disorder follow reasonably from the finding that 75% of patients who qualify for schizotypal personality disorder also qualify for borderline personality disorder (Spitzer, Endicott, & Gibbon, 1979), together with the accumulating evidence of a strong link between borderline disorder and mood disorder (Akiskal et al., 1985; Gunderson & Kolb, 1978; Siever & Gunderson, 1983).

Finally, one may expect psychoticlike symptoms to presage mood disorder as well as schizophrenia because psychoticlike symptoms are reported in patients with borderline personality disorder (Siever & Gunderson, 1983), even though such symptoms are not among the diagnostic criteria of DSM–III or DSM–III–R borderline personality disorder.

The findings of Hoch, Cattell, Strahl, and Pennes (1962) may appear to be evidence contrary to this argument in that they seemed to show that pseudoneurotic schizophrenics are at risk specifically for overt schizophrenia. They reported that at longterm follow-up, 20% of their pseudoneurotic schizophrenics had become overtly schizophrenic and that half of those 20% had become chronic schizophrenics. However, the focus of their report was only on schizophrenia, and they did not even discuss the question of whether any patients developed affective disorder. Moreover, their report was from a time when the diagnosis of schizophrenia in the United States was broad. A reasonable conjecture is that many of their pseudoneurotic schizophrenics would be found, by contemporary diagnostic criteria, to have an outcome of mood psychosis.

The Unitary Psychosis Theory

The findings that our predictors predict psychosis in general rather than a particular DSM–III–R psychosis can be seen as being consistent with Crow's (1990) unitary psychosis theory and with the findings of Klosterkotter and his associates (e.g., Ebel, Gross, Klosterkotter, & Huber, 1989)

that the same “basic symptoms” are found to some extent in both schizophrenia and in patients who would qualify for “mood disorder with psychotic features” in the DSM–III–R. On the other hand, it is possible that we have simply failed to find the symptoms that differentially predict schizophrenia and mood psychosis, just as these other investigators might have failed to find differentiating features of the disorders. We are not wedded to either interpretation, and we regard as important the continued search for measures that make the differential prediction of different psychoses.

The PhyAnh does not appear to be useful for predicting either psychosis or psychosis proneness. Likewise, the combined-score group was not deviant on our follow-up measures. The NonCon did not predict psychosis at the 10-year follow-up. However, the NonCong group differed from the control group on other measures of psychosis proneness (i.e., on most deviant psychoticlike experience and on PDE paranoid and schizotypal dimensional scores). Thus, the NonCon appears to have only a modest relationship to psychosis proneness.

The subjects who were deviant on MagicId and above the mean on SocAnh had a high rate of clinical psychosis (21%) and exceeded the remaining Per–Mag subjects on psychoticlike experiences, schizotypal dimensional score, and poor overall adjustment, but not on reports of psychotic relatives. However, the extreme deviancy of this subgroup must be regarded as tentative because of the possibility that the positive findings for this subgroup capitalized on chance, as their deviancy was not hypothesized. Instead, this subgroup was selected on the basis of the same results that were used to test it. In retrospect, however, the deviancy of this subgroup makes good sense. The SocAnh asks about a trait that would be expected to increase the likelihood of psychotic decompensation. Most people rely on trusted others both to provide emotional support and to screen their ideas and perceptions for validity. Social withdrawal, which often results from schizoid indifference to other people, deprives a person of these benefits.

Cross-sectional research should be conducted to attempt to cross-validate the greater psychosis proneness of the MagicId–SocAnh subgroup than of other Per–Mag subjects. Substantial confirmation is possible without awaiting the results of an additional longitudinal study. One may seek confirming evidence, using new samples of this subgroup, from an interview measure of psychoticlike experiences and scores on laboratory tasks that are expected to identify psychosis-prone individuals.

The finding that MagicId and SocAnh used together are especially useful in identifying psychosis-prone subjects indicates that a syndrome of traits may be a more powerful predictor than a single trait. This finding does not, however, indicate that a syndrome of scores should be used at the stage of testing predictors. For example, the DSM–III–R diagnostic criteria for schizotypal personality disorder include social anxiety, which likely lacks sufficient specificity to predict either schizophrenia or consanguinity to schizophrenia. To test this hypothesis about social anxiety, one would need to examine that symptom alone.

Effects of the Context of Testing

One limitation of the PerAb is that it is transparently concerned with psychopathology. Relatives of schizophrenics who know that they are being examined because they have a psychotic family member are often defensive about admitting to psychopathology, being fearful that they will be found to be psychotic themselves. Therefore, we agree with the Katsanis, Iacono, and Beiser's (1990) suggestion that this instrument may not be useful with the family members of psychotics under those circumstances. With the benefit of hindsight, it is not surprising that the PerAb scores of first-degree relatives of psychotic patients have been found to be no higher than those of control subjects (Grove et al., 1991) or even lower than those of control subjects (Clementz, Grove, Katsanis, & Iacono, 1991; Katsanis et al., 1990). Our interview for psychoticlike experiences and the MegicId may be similarly vulnerable to defensiveness. In studies of the family members of psychotic patients, these instruments may be the most useful in designs that are less vulnerable to a subject's defensiveness. An example is the ingenious study of Lenzenweger and Loranger (1989), who gave the PerAb to nonpsychotic outpatients and found a higher rate of schizophrenia in the family members of high scorers than of low scorers.

A study by Thaker, Moran, Adami, and Cassady (1993) appears to support the greater usefulness of our scales when administered in a nonthreatening context. Subjects who had been located by newspaper advertisements, who lacked a schizophrenic family member, but who were diagnosed as having schizophrenia-spectrum personality without Axis I diagnosis, scored higher than control subjects on MagicId, PerAb, SocAnh, and NonCon. By contrast, similarly diagnosed subjects who were located by their having a schizophrenic family member did not score higher than control subjects. The investigators interpreted their findings as showing that the scales are most useful for identifying nonfamilial disorder. We believe that, in the light of Lenzenweger and Loranger's (1989) findings, their results are more likely indicative of strong effects of the context of testing.

Conclusion

Our results show that scores on the Per–Mag, as well as ratings on the interview for psychoticlike experiences, identify many psychosis-prone individuals. The data also yield the finding, to be cross-validated in future research, that subjects who score high on MagicId and somewhat high on SocAnh are especially psychosis prone.

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