

## Psychological Trauma and Schizotypal Personality Disorder

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Two studies examined the relation between psychological trauma and schizotypal symptoms. In Study 1, in which 1,510 adults completed telephone interviews, both childhood maltreatment and the experience of an injury or life-threatening event were significantly associated with schizotypal symptoms. In Study 2, in which 303 adults (oversampled for having elevated levels of schizotypal symptoms) completed extensive in-person assessments, both childhood maltreatment and meeting posttraumatic stress disorder (PTSD) Criterion A were significantly associated with schizotypal symptoms. The links between schizotypal symptoms and at least some forms of psychological trauma could not be fully accounted for by shared variance with antisocial and borderline personality disorders, absorption/dissociation, PTSD symptom severity, family history of psychotic disorder, or signs of neurodevelopmental disturbance (as indexed by minor physical anomalies and inconsistent hand use). Schizotypal symptoms were more strongly associated with childhood maltreatment among men than among women, whereas schizotypal symptoms were more strongly associated with PTSD Criterion A among women than among men. Finally, among men, the association between childhood maltreatment and schizotypal symptoms was moderated by signs of neurodevelopmental disturbance.

*Keywords:* trauma, schizotypal personality disorder, neurodevelopmental disturbance, PTSD

A large body of evidence has documented a link between psychological trauma, particularly childhood maltreatment, and a broad array of mental disorders (e.g., Kendler et al., 2000). Most research on the sequelae of psychological trauma and childhood maltreatment has focused on different forms of psychological distress and personality disorders. For example, a great deal of research has found that childhood maltreatment is associated with depressive disorder (e.g., Gibb et al., 2001) and borderline personality disorder (BPD; see review by J. G. Johnson et al., 2005). Berenbaum (1996) posited that in addition to contributing to such problems, the experience of psychological trauma can also contribute to the development of peculiar perceptions and beliefs. Accumulating evidence now supports this hypothesis (see, e.g., reviews by Morgan & Fisher, 2007; Morrison, Frame, & Larkin, 2003; Read, van Os, Morrison, & Ross, 2005), though the degree to which psychological trauma is associated with specific schizophrenia spectrum disorders, particularly schizophrenia, remains unclear (Morgan & Fisher, 2007). The present research explored

the association between psychological trauma and symptoms of schizotypal personality disorder (SPD).

In addition to research finding that a variety of psychotic and psychoticlike symptoms are associated with psychological trauma (e.g., Berenbaum, 1999; Ross & Joshi, 1992), the results of several previous studies suggest that one particular schizophrenia spectrum disorder, SPD, is associated with psychological trauma. Two studies have examined the relation between schizotypal symptoms and childhood maltreatment in community samples. In a sample of young adults, Johnson and colleagues (J. G. Johnson, Cohen, Brown, Smailes, & Bernstein, 1999; J. G. Johnson et al., 2001; J. G. Johnson, Smailes, Cohen, Brown, & Bernstein, 2000) found that documented cases of childhood maltreatment, particularly childhood neglect, were significantly associated with levels of SPD, even after adjusting statistically for age, parental education, and parental psychiatric disorders. In a sample of women between the ages of 18 and 74 years recruited from the community, Berenbaum, Valera, and Kerns (2003) found that both childhood maltreatment and a history of at least one traumatic incident were associated with elevated levels of schizotypal symptoms.

Four studies have examined the relation between schizotypal symptoms and childhood maltreatment in clinical samples. Yen et al. (2002) compared rates of trauma and childhood maltreatment among individuals with major depressive disorder and several types of personality disorders; a nonpsychiatric control group was not included. The authors found that individuals with SPD were significantly more likely than were individuals with avoidant and obsessive-compulsive personality disorders to have a history of traumatic events and to have been victims of childhood physical assault. Furthermore, individuals with SPD did not differ significantly from individuals with major depressive disorder or BPD on either of these variables, nor did they differ significantly from any of the other groups in their rate of childhood sexual abuse. In a

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sample of outpatients, all of whom had diagnoses of definite or probable personality disorder, Norden, Klein, Donaldson, Pepper, and Klein (1995) found that higher levels of schizotypal symptoms were significantly associated with higher levels of extrafamilial sexual abuse but were not associated with familial sexual abuse or with physical abuse. Ruggiero, Bernstein, and Handelsman (1999) examined the relations between personality disorders and childhood maltreatment in a sample of hospitalized male VA patients with alcohol and/or drug dependence. They divided the patients into six clusters on the basis of their patterns of scores on a childhood maltreatment questionnaire. Ruggiero et al. (1999) found that the six clusters of patients differed significantly in their mean levels of schizotypal symptoms; the highest levels of schizotypal symptoms were found among individuals in the "severe neglect," "severe sexual abuse," and "severe physical and emotional abuse" groups, whereas the lowest levels of schizotypal symptoms were found among individuals in the "minimal maltreatment" and "moderate sexual abuse" groups. Shea, Zlotnick, and Weisberg (1999) compared the personality disorder profiles of three groups of trauma victims (male combat veterans from a posttraumatic stress disorder [PTSD] clinic, adult female psychiatric inpatients who had been sexually abused, and adult female psychiatric outpatients who had been sexually abused) with each other and with the personality disorder profiles of five groups of psychiatric patients who had not been selected on the basis of having a history of trauma. They found that the personality disorder profiles of the three trauma groups resembled one another far more than they tended to resemble the profiles of the other groups of psychiatric patients. Of particular relevance to the present research is that the profiles of trauma victims included elevated rates of SPD.

Despite the consistencies in the results of the aforementioned studies, there are a variety of reasons why additional research is needed. Perhaps the most important reason additional research is warranted is that not very much is really known about the degree to which trauma is associated with schizotypal symptoms. There are four reasons for our limited knowledge. First, compared with research on psychological distress (e.g., depression) and Cluster B personality disorders, relatively little research has examined the relation between trauma and SPD. Second, the nature of the samples in the previous research prevents researchers from being very confident of an association between psychological trauma and schizotypal symptoms in the general population. Participants in four of the studies were limited to psychiatric patients. Of the two studies that were not limited to psychiatric patients, J. G. Johnson et al. (1999, 2001, 2000) included only young adults (with a mean age of 22 years), and Berenbaum et al. (2003) studied only women. A third reason for our limited knowledge is that whereas all six previous studies examined childhood physical and sexual abuse, only two studies examined childhood emotional abuse. J. G. Johnson et al. (2001) found that childhood verbal abuse was associated with elevated levels of schizotypal symptoms even after taking into account physical abuse, sexual abuse, and neglect. Although Ruggiero et al. (1999) measured emotional abuse, they did not examine it separately, so the relation between emotional abuse and schizotypal symptoms was not specifically examined in their study. Given that past research has indicated that childhood emotional abuse may play a particularly important role in the development of psychopathology (Gibb et al., 2001; Hankin, 2005),

additional research examining the potential link between childhood emotional abuse and SPD is clearly needed. Fourth, only two of the studies (Berenbaum et al., 2003; Yen et al., 2002) examined both childhood maltreatment and traumatic events in the same group of individuals, and neither study tested whether they were independently associated with schizotypal symptoms. For example, would childhood maltreatment continue to be associated with schizotypal symptoms when taking traumatic events into consideration?

Beside the need to determine the strength of the association between trauma and schizotypal symptoms, additional research is needed to explore how and why they are associated. Even if trauma and schizotypal symptoms are associated, it is important to rule out the possibility that they are associated merely because they both happen to be correlated with a third variable. In the present research, we examined whether trauma and schizotypal symptoms would continue to be associated after taking into account (a) Cluster B personality disorders and (b) biological factors previously found to be associated with SPD. Given that there is a wealth of data indicating that psychological trauma is associated with Cluster B personality disorders (e.g., Luntz & Widom, 1994; Zanarini, Gunderson, Marino, Schwartz, & Frankenburg, 1989), and SPD is associated with Cluster B personality disorders (e.g., Stuart et al., 1998), evaluating whether the association between psychological trauma and schizotypal symptoms can be accounted for by shared variance between schizotypal symptoms and Cluster B personality disorders is important. For instance, J. G. Johnson et al. (1999) found that childhood abuse and neglect were no longer significantly associated with SPD after the effects of co-occurring personality disorders were controlled for. However, J. G. Johnson et al. (1999) controlled for all other personality disorders, including the other Cluster A personality disorders, which likely share significant etiological factors with SPD. In addition, J. G. Johnson et al. (1999) did not examine traumatic events other than childhood maltreatment.

In addition to ruling out Cluster B personality disorders as the reason for trauma and schizotypal symptoms being associated, we also wished to rule out biological factors associated with schizophrenia spectrum disorders. There is abundant evidence that genetic factors contribute to schizophrenia spectrum disorders (e.g., Gottesman & Shields, 1972; Kendler & Diehl, 1993). In addition, numerous researchers (e.g., Fish, Marcus, Hans, Auerbach, & Perdue, 1992; Murray, O'Callaghan, Castle, & Lewis, 1992; Weinberger, 1987) have posited that neurodevelopmental disturbances (i.e., perturbations in the healthy development of the central nervous system) play a role in the development of schizophrenia. There is accumulating evidence that several markers of neurodevelopmental disturbance, such as elevated numbers of minor physical anomalies and inconsistent hand use, are associated with the later development of schizophrenia spectrum disorders, including SPD (e.g., Green, Satz, Gaier, Ganzell, & Kharabi, 1989; Weinstein, Diforio, Schiffman, Walker, & Bonsall, 1999). Thus, although we hypothesized that trauma would be associated with schizotypal symptoms, we also expected neurodevelopmental disturbance and family history of psychotic disorder (which is an indicator of genetic risk for schizophrenia spectrum disorders) to be associated with schizotypal symptoms. By measuring family history of psychotic disorder and signs of neurodevelopmental disturbance, we were able to test whether the association between

trauma and schizotypal symptoms would remain after taking into account biological factors previously found to be associated with SPD. This was important because of the possibility that trauma does not contribute to schizotypal symptoms, but happens to be associated with schizotypal symptoms because both the trauma and SPD are influenced by common biological factors. For example, genetic factors that contribute to schizotypal symptoms may also contribute to trauma (particularly childhood abuse and neglect). J. G. Johnson et al. (1999) found that the association between childhood maltreatment and SPD could not be accounted for by parental psychopathology (which serves as a proxy for genetic vulnerability); none of the other studies examining the relation between trauma and SPD examined this possibility. In the present research, we examined the rate of psychotic disorder among all first-degree relatives to obtain a more sensitive measure of genetic loading for psychotic disorders than had been obtained by J. G. Johnson et al. (1999). To the degree that trauma continues to be associated with schizotypal symptoms even after taking into account factors like family history of psychotic disorder and markers of neurodevelopmental disturbance, it renders less plausible the possibility that the link between trauma and schizotypal symptoms is merely an artifact of both having been influenced by shared biological factors.

In addition to examining further the strength of the association between trauma and schizotypal symptoms, as well as ruling out Cluster B personality disorders and biological vulnerability factors as being able to account for the association between trauma and schizotypal symptoms, additional research is needed to examine potential moderators and mediators of the link between trauma and schizotypal symptoms. In order to explicate the pathways to schizotypal symptoms, we also explored whether biological vulnerability factors moderate the link between trauma and schizotypal symptoms. For example, we thought it was plausible that the impact of psychological trauma on schizotypal symptoms may be particularly strong among those individuals who are biologically predisposed to develop schizophrenia spectrum disorders.

In our effort to understand the pathways to schizotypal symptoms, we also explored potential mediators of the link between trauma and schizotypal symptoms. One possibility is that psychological trauma contributes to symptoms of PTSD, which in turn increases vulnerability to schizotypal symptoms. In other words, PTSD symptomatology may serve as a mediator of the link between psychological trauma and schizotypal symptoms. A similar possibility is that absorption or dissociation serve as mediators of the link between psychological trauma and schizotypal symptoms. This seems rather plausible given that past research has found that psychological trauma is associated with absorption and dissociation (e.g., Cardena & Spiegel, 1993; McNally, Perlman, Ristuccia, & Clancy, 2006), and there is also evidence linking absorption and dissociation with peculiar perceptions and beliefs (e.g., Irwin, 2001; Pope & Kwapi, 2000; Watson, 2001). Consistent with this possibility, Berenbaum et al. (2003) found that psychological dysfunction (as indicated by PTSD symptomatology, depression, dissociation, and difficulty identifying one's feelings) was a partial mediator of the link between childhood maltreatment and schizotypal symptoms. The present study went beyond that of Berenbaum et al. (2003) by (a) including males; (b) examining lifetime PTSD in addition to current PTSD; and (c) including interview

measures of PTSD and dissociation; and (d) not limiting the examination of trauma to childhood maltreatment.

We conducted two studies to examine the relation between psychological trauma and schizotypal symptoms. In both studies, we examined men and women separately. We had two reasons for doing so. First, there is a great deal of evidence indicating that there are gender differences in schizophrenia spectrum disorders (e.g., Walker, Walder, Lewine, & Loewy, 2002). In particular, past research has consistently found that compared with women, men with schizophrenia tend to have an earlier age of onset and a worse course (e.g., Szymanski et al., 1995). Several studies have also found that women with schizophrenia have fewer structural brain abnormalities and less severe cognitive deficits than do men (e.g., Seidman et al., 1997). Furthermore, gender differences have also been found in other schizophrenia spectrum disorders. For example, Voglmaier et al. (2005) found that women with SPD had less severe cognitive deficits than did men. Gender differences have also been found in the impact of prenatal and perinatal factors (Walker et al., 2002). For example, men appear to be more adversely affected than women by obstetrical complications (Walker et al., 2002), and there is some evidence of men with schizophrenia having higher rates of obstetrical complications than women with schizophrenia (e.g., Foerster, Lewis, Owen, & Murray, 1991; but cf. Verdoux et al., 1997). In contrast, the link between maternal influenza exposure during pregnancy and schizophrenia appears to be stronger in women than in men (e.g., Murray, Jones, O'Callaghan, Takei, & Sham, 1992). These gender differences suggest that the pathways to schizophrenia spectrum disorders may differ between men and women. A second reason to examine men and women separately is that past research has found that the probability of developing PTSD (given that one has experienced a traumatic event) is greater in women than in men (Breslau et al., 1998), even after taking into account other sociodemographic factors and type of trauma. Given the evidence that there are gender differences in schizophrenia spectrum disorders, as well as gender differences in the impact of trauma, we believed it was desirable to examine men and women separately.

In the first study, we conducted telephone interviews with a very large sample of individuals who were expected to be relatively representative of the local population. The major goal of this study was to test whether the association between psychological trauma and schizotypal symptoms would be replicated in a sample that was far more representative of the general population than the samples studied in previous research. In the second study, we conducted extensive in-person assessments of a sample in which individuals with elevated schizotypal symptoms were intentionally overrepresented. The goals of the second study were to examine whether (a) psychological trauma is associated with schizotypal symptoms; (b) associations found between psychological trauma and schizotypal symptoms could be accounted for by shared variance with symptoms of antisocial personality disorder and BPD; (c) associations found between psychological trauma and schizotypal symptoms could be accounted for by shared variance with some biological vulnerability factors (i.e., family history of psychotic disorder and signs of neurodevelopmental disturbance); (d) absorption/dissociation and symptoms of PTSD mediate, partially or completely, any associations found between psychological trauma and schizotypal symptoms; and (e) associations between

psychological trauma and schizotypal symptoms would be moderated by biological vulnerability factors.

### Study 1: Telephone Survey

#### Method

#### Participants

A total of 1,510<sup>1</sup> English-speaking adults between the ages of 18 and 95 years ( $M = 44.2$ ,  $SD = 18.1$ ) completed telephone interviews concerning life experiences and symptoms of SPD. To obtain as close to a random, representative sample of the general adult population as possible, participants were selected using a random-digit dialing approach. Specifically, a list-assisted sampling procedure (that included both listed and unlisted phone numbers) was used, along with the Troldahl-Carter-Bryant method of respondent selection in each household (Bryant, 1975). Only individuals 18 years of age and older were eligible to participate. Participants did not receive any incentives for participating. There was no prescreening of prospective telephone respondents. Participants were told that the purpose of the study was to learn more about individuals' personal beliefs and life experiences. Approximately 1% of the individuals who began the interview did not complete it. The cooperation rate was 64.2%, the response rate was 45.9%, and the refusal rate was 25.6%.<sup>2</sup> Our response rate was slightly lower than that obtained in 2003 in the University of Michigan Survey of Consumer Attitudes (Curtin, Presser, & Singer, 2005), better than that obtained in the 2003 survey of alcohol, tobacco, and other drug use in Illinois (T. P. Johnson, Cho, Lerner, Pickup, & Cohen, 2004), and better than the average reported response rate in 114 random-digit dialing studies whose data were examined by Holbrook, Krosnick, and Pfent (in press).

Demographic information is presented in Table 1, along with corresponding census data for the geographic area in which the survey was conducted. As can be seen in Table 1, the participants in this sample were reasonably representative of the general population in terms of gender and race/ethnicity. However, 18- to 24-year-olds were underrepresented in the sample relative to the population where the study was completed (where the proportion of adults between the ages of 18 and 24 is quite high due to the influence of a very large university). Approximately half (55.0%) the sample had a college degree, 28.0% had some college education, 14.3% were high school or General Educational Development graduates, and 2.7% had not graduated from high school. Approximately half (46.9%) the sample was married, and an additional 29.1% were living with a romantic partner.

#### Measures

*Schizotypal personality disorder.* Symptoms of SPD were assessed using the following five of the nine subscales of the Schizotypal Personality Questionnaire (SPQ; Raine, 1991): Odd Beliefs or Magical Thinking (seven items), Ideas of Reference (nine items), Unusual Perceptual Experiences (eight<sup>3</sup> items), Suspiciousness (seven items<sup>4</sup>), No Close Friends (nine items). There were two reasons for not administering the entire SPQ. First, we wished to limit the length of the interview as a means of improving participation rates. Second, we excluded those portions of the SPQ that we thought would be least likely to provide valid, specific

Table 1  
*Study 1: Demographic Information of Participants*

Variable	Current sample	Census
Gender		
% female	52.1	49.0
Race/ethnicity		
% White, non-Hispanic	78.0	72.2
% Black, non-Hispanic	9.5	12.1
% Hispanic	2.9	3.7
% Asian or Pacific Islander	6.5	10.1
% other	3.1	1.8
Age group		
% 18–24	15.6	38.9
% 25–44	38.3	32.4
% 45+	46.1	28.7

indicators of SPD. The SPQ subscales measuring odd behavior, odd speech, and constricted affect were not administered on the basis of our view that such signs of SPD are better assessed by interviewer observation than by self-report. Evidence consistent with this view, at least with respect to the disorganization cluster of SPD criteria, were presented by Berenbaum et al. (2006). The SPQ Social Anxiety subscale was not administered because we thought that such symptoms might be as indicative of avoidant personality disorder and social phobia as they would be indicative of SPD. All SPQ items were coded true/false as is done when the SPQ is administered in paper-and-pencil format. Participants received a total SPQ score reflecting the number of items indicative of symptoms of SPD. Internal consistency of these 40 items was very good ( $\alpha = .85$ ).

*Threatening events.* In the context of being asked whether they had experienced any of 11 specific traumatic incidents (e.g., natural disaster, workplace injury), participants were asked whether

<sup>1</sup> An additional 20 individuals, for whom information concerning gender is not available, were interviewed but are not included in the present article.

<sup>2</sup> The cooperation rate is the number of completed interviews divided by the number of completed interviews plus the number of refusals. The refusal rate is the proportion of the eligible respondents who either refused to be interviewed or who did not complete an interview. The response rate is the proportion of eligible respondents who completed the interview. The American Association of Public Opinion Research's (2006) Standard Definitions provides a variety of ways of computing these rates, which depend on factors such as how to treat homes in which nobody ever answered the phone (e.g., ignore them, assume they would have had the same responding rates as other homes). We computed cooperation rate using formula number 4, refusal rate using formula number 2, and response rate using formula number 3. Cooperation, refusal, and response rates all depend on the assumptions one makes and the formula one uses. For example, the response rate in this study computed using formula number 5 was 65.1% (as opposed to 45.9% using formula number 3).

<sup>3</sup> A ninth unusual perceptual experiences item ("Do everyday things seem unusually large or small?") was initially administered as well but was dropped from the study when early data collection suggested the item was not a valid indicator of schizotypal symptoms (based on reports from interviewers and associations with other SPQ items).

<sup>4</sup> An eighth suspiciousness item ("I often feel that others have it in for me") was not administered because of its similarity to another suspiciousness item ("Do you often feel that other people have it in for you?").

they had ever had an experience in which they thought they might be killed or seriously injured. In the analyses that follow, participants were divided into those who did (46.7%) versus those who did not (53.3%) experience an injury or life-threatening event.<sup>5</sup>

*Childhood maltreatment.* Childhood maltreatment was assessed with items adapted from instruments used in previous research (Bernstein et al., 1994; Fink, Bernstein, Handelsman, Foote, & Lovejoy, 1995; Kilpatrick et al., 2000; Widom & Morris, 1997; Widom & Shepard, 1996). On the basis of the recommendations of Brewin, Andrews, and Gotlib (1993), rather than asking for global evaluations of maltreatment, the strategy used was to provide participants with descriptions of specific behavioral incidents and to ask them which, if any, of these incidents had occurred. Past research has found that participants' responses to such questions are strongly, though not nearly perfectly, associated with independent corroborations of maltreatment (Goodman et al., 2003; Widom & Morris, 1997; Widom & Shepard, 1996; Williams, 1994). Physical neglect after age 12 was not assessed because teenagers are generally able to care for themselves (e.g., feed themselves), whereas younger children often cannot. Similarly, leaving a younger child alone can be a form of neglect, whereas leaving a teenager alone is typically not a form of neglect. Sexual and emotional abuse were assessed separately for two age ranges (before age 12, and ages 12–17). It is important to assess sexual abuse separately for younger children and teenagers because sexual activity for younger children is invariably unacceptable, whereas teenagers are capable of engaging in consensual sexual activities. The assessment of physical abuse was not conducted separately for different age ranges.

*Physical abuse* occurring before the age of 18 was assessed using seven items regarding the occurrence of specific events (e.g., “beat or hit you with something hard like a stick or baseball bat”; “hurt you badly enough that you suffered some degree of injury, including cuts, bruises, burns, or other marks”). For each of these questions, participants were asked whether the event had occurred or whether they had been threatened with such an event. Responses were coded as follows: denying event occurred was coded a 0, having been threatened with the act was coded as a 0.5, and confirming that an event occurred was coded as a 1. Internal consistency for this 7-item scale was modest ( $\alpha = .68$ ). *Sexual abuse* was assessed by asking participants about seven specific sexual acts (e.g., “touch another person’s sex organs”; “have oral or anal sex with anyone”; “have attempted intercourse but without penetration”). Participants were asked which, if any, of these had occurred, or had been threatened, prior to age 12. For ages 12 through 17, participants were asked which, if any, of these events had occurred, or had been threatened, “when you did not want them to.” Responses were coded as they were for physical abuse (i.e., 0 vs. 0.5 vs. 1.0). Internal consistency for this 14-item (seven items prior to age 12, and seven items between ages 12 and 17) scale was good ( $\alpha = .81$ ). *Emotional abuse* was assessed with two questions (“How often did someone in your family shout, yell, or scream at you” and “How often did someone in your family insult or shame you”), each of which were asked for two time periods: prior to age 12, and as a teenager. Participants were asked how often, during these two age ranges, these events had occurred (1 = *never*; 4 = *often*). Internal consistency for this 4-item scale was good ( $\alpha = .85$ ). *Physical neglect* occurring before the age of 12 was assessed with eight items (e.g., “frequency of going to doctor

when sick”; “left overnight without an adult caretaker”). Participants rated how frequently each event occurred (1 = *never*, 6 = *always*). Internal consistency for this 8-item scale was modest ( $\alpha = .65$ ). Consistent with past research (e.g., Chapman et al., 2004), the different types of childhood maltreatment tended to co-occur; in our sample, the four types of childhood maltreatment were correlated between .13 and .43. A total childhood maltreatment score was computed by summing the four types of childhood maltreatment scores, after first standardizing them (because they were scored using different scales).

### Survey Administration

The telephone survey was carried out by the University of Illinois Survey Research Laboratory, which had extensive experience carrying out a broad range of telephone surveys. The telephone survey questions were administered by trained interviewers. The interviewers had all received extensive general training in interview techniques (including issues related to confidentiality and the establishment of rapport) and had worked successfully on at least one prior telephone survey. The interviewers received additional training specific to this study (provided in part by Howard Berenbaum) in which they were trained in how to handle the sensitive questions included in the protocol; they also completed mock interviews prior to calling potential participants.

Participants were first asked about SPD, then about traumatic events, and finally about childhood maltreatment. Interviewers read the survey questions aloud and were able to provide clarification about the questions if participants asked. Interviewers did not ask follow-up questions. Before beginning the interview, interviewers assured participants that all of their answers would remain confidential. Immediately prior to asking participants about traumatic events and childhood maltreatment, interviewers let participants know that they were about to ask questions about events that might be very stressful or disturbing and reminded them of the confidentiality of their answers.

### Results

We began by examining whether men and women differed in their histories of childhood maltreatment, whether they had experienced a life-/injury-threatening event, and their levels of schizotypal symptoms. As can be seen in Table 2, men and women did not differ appreciably in their total childhood maltreatment scores. However, they did differ in the kinds of maltreatment they experienced—women experienced more sexual abuse than men, whereas men experienced more physical neglect and physical abuse than women. Also, women were more likely than were men

<sup>5</sup> Because so many participants did not experience an injury- or a life-threatening event, a continuous score representing the number of such events would have been quite skewed, and so we analyzed the data using a dichotomous score. The correlation between the dichotomous and continuous scores was quite strong ( $r = .80, p < .01$ ). When the data were analyzed using the continuous score, the pattern of results was identical, though the association between schizotypal symptoms and the continuous score was slightly stronger than was the association between schizotypal symptoms and the dichotomous score.

Table 2  
Study 1: Comparisons of Men and Women

Variable	Men		Women		Statistic	Effect size
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Physical abuse	1.3	1.5	0.8	1.2	$t(1483) = 7.41^{**}$	$d = 0.38$
Sexual abuse	0.4	1.3	0.9	1.8	$t(1472) = 5.66^{**}$	$d = 0.30$
Emotional abuse	8.8	2.8	9.1	3.3	$t(1495) = 1.43$	$d = 0.07$
Physical neglect	12.2	4.8	11.2	4.3	$t(1386) = 4.02^{**}$	$d = 0.22$
Total maltreatment	0.19	2.5	-0.07	2.7	$t(1335) = 1.87$	$d = 0.10$
Life-Injury-threatening Event (%)	51.7		57.8		Fisher's exact $p < .01^{**}$	$\phi = .10$
Schizotypal symptoms	8.7	5.9	9.0	6.3	$t(1444) = 0.98$	$d = 0.05$

\*\* $p < .01$ .

to experience a life-/injury-threatening event. Men and women did not differ appreciably in their levels of schizotypal symptoms.

We next examined whether childhood maltreatment was associated with schizotypal symptoms. As can be seen in Table 3, regardless of gender, higher levels of schizotypal symptoms were associated with higher levels of all forms of childhood maltreatment. To examine the degree to which different forms of childhood maltreatment were associated with schizotypal symptoms when taking the remaining forms of childhood maltreatment into account, we conducted multiple regression analyses, entering all four forms of childhood maltreatment into the prediction equation simultaneously. As can be seen in Table 3, when other forms of maltreatment were taken into consideration, sexual abuse was no longer associated with schizotypal symptoms among either men or women, and physical abuse was no longer associated with schizotypal symptoms among women and was only very weakly associated with schizotypal symptoms among men.

Because of the very wide range of ages among the participants, we explored the possibility that age might moderate the links between childhood maltreatment and schizotypal symptoms. There were two reasons why one might expect this to be the case: (a) Older individuals may have forgotten about having been maltreated, and (b) social norms concerning maltreatment may have changed over time, which could have influenced the impact of maltreatment. We conducted hierarchical multiple regression analyses predicting schizotypal symptoms entering age and maltreatment on the first step and the Age  $\times$  Maltreatment interaction in

the second step. We examined each specific form of maltreatment as well as total maltreatment. Among women, there was no evidence of age moderating the links between maltreatment and schizotypal symptoms. Among men, age significantly moderated the link between neglect and schizotypal symptoms,  $\Delta F(1, 643) = 4.09, p < .05, \Delta R^2 = .006$ , the relation between neglect and schizotypal symptoms became stronger as age increased. Among men, age did not moderate the links between schizotypal symptoms and the other maltreatment scores. As a second means of addressing this issue, the data were reanalyzed after excluding the 69.2% of participants who were more than 30 years old. After excluding these individuals, maltreatment continued to be associated with schizotypal symptoms. After excluding women older than age 30, the correlation between schizotypal symptoms and total maltreatment increased slightly (from  $r = .32$  to  $r = .35, p < .01$ ). After excluding men older than age 30, the correlation between schizotypal symptoms and total maltreatment decreased slightly (from  $r = .35$  to  $r = .28, p < .01$ ).

As hypothesized, individuals who had experienced a life- or an injury-threatening event had significantly higher levels of schizotypal symptoms than did individuals who did not experience such an event, men:  $t(684) = 4.41, p < .01, d = 0.34$ ; women:  $t(750) = 4.79, p < .01, d = 0.35$ . We next entered both the total childhood maltreatment and the history of life-/injury-threatening event variables into a multiple regression analysis in order to examine whether they were associated independently with schizotypal symptoms. For both men and women, both childhood maltreat-

Table 3  
Study 1: The Relations, Computed in Terms of Correlations and Betas, Between Schizotypal Symptoms and Childhood Maltreatment (Weighted<sup>a</sup> in Parentheses)

Variable	Males		Females	
	<i>r</i>	$\beta^b$	<i>r</i>	$\beta^b$
Physical abuse	.21** (.17**)	.09* (.03)	.24** (.15**)	.06 (.01)
Sexual abuse	.12** (.14**)	.04 (.08*)	.17** (.15**)	.07 (.10*)
Emotional abuse	.31** (.31**)	.23** (.26**)	.25** (.20**)	.15** (.14**)
Physical neglect	.25** (.21**)	.19** (.14**)	.25** (.23**)	.20** (.19**)
Total maltreatment	.35** (.32**)	—	.32** (.27**)	—

Note. Dashes indicate data were not applicable. <sup>a</sup>Weighted by age group and race/ethnicity. <sup>b</sup>On the basis of regression analysis simultaneously entering all four specific forms of maltreatment.

\* $p < .05$ . \*\* $p < .01$ .

ment (men:  $\beta = .33, p < .01$ ; women:  $\beta = .29, p < .01$ ) and a history of life-/injury-threatening experience (men:  $\beta = .11, p < .01$ ; women:  $\beta = .11, p < .01$ ) contributed independently to the prediction of schizotypal symptoms.

In our final set of analyses, we examined whether trauma/childhood maltreatment was associated with schizotypal symptoms while weighting cases on the basis of the degree to which the participant's race/ethnicity and age group were under- or overrepresented in the sample relative to the population from which individuals were sampled. So, for example, because African Americans were slightly underrepresented in the sample and non-Hispanic European Americans were slightly overrepresented, the cases of African American participants were weighted more heavily, and the cases of non-Hispanic European Americans were weighted less heavily. Cases were not weighted by gender because the data were analyzed separately by gender. The results of these analyses examining the relations between childhood maltreatment and schizotypal symptoms are presented in Table 3 (within the parentheses). When weighting cases, there remained substantial evidence of childhood maltreatment and schizotypal symptoms being associated, though the associations tended to be slightly weaker. When weighting cases and taking all forms of maltreatment into consideration simultaneously, the association between schizotypal symptoms and physical abuse became somewhat weaker (and no longer statistically significant), whereas the association between schizotypal symptoms and sexual abuse became somewhat stronger (and became statistically significant). As in the unweighted analyses, physical neglect and emotional abuse were most strongly associated with schizotypal symptoms. When weighting cases, individuals who had experienced a life- or an injury-threatening event continued to have higher levels of schizotypal symptoms than individuals who had not experienced such an event; in fact, when weighting cases, the effect sizes increased slightly ( $d = 0.38$  among men, and  $d = 0.46$  among women).

## Study 2: In-Person Assessment

### Method

#### Participants

The participants were 303<sup>6</sup> adults (53.1% female) between the ages of 18 and 89 years ( $M = 43.2, SD = 17.6$ ). Of those who reported their ethnicity<sup>7</sup> (98.7%), the sample was mostly European American (78.9%), with 9.4% African American, 5.4% Asian American/Asian, 2.7% Latino/a, 1.7% biracial, 1.3% Native American, and 0.7% "other." Approximately half (53.8%) the sample had a college degree, 33.8% had some college education, 11.0% had a high school degree, and 1.4% had not graduated from high school. Close to half (40.4%) the sample was married, and an additional 10.1% were living with a romantic partner.

These individuals were participating in a large project examining pathways to disturbed emotions, perceptions, and beliefs (e.g., Berenbaum et al., 2006). We intentionally oversampled individuals with high levels of peculiar perceptions and beliefs in two ways. First, 214 of the participants in the present study had participated in Study 1. As data were collected in Study 1, we invited to participate in Study 2 those individuals who (a) had indicated they could be contacted to participate in an additional research project

and who either (b) had scores in the highest decile on the SPQ Odd Beliefs subscale, No Close Friends subscale, or total score; or (c) were randomly selected from among the remaining participants. Second, the remaining 89 participants were recruited by placing advertisements in newspapers and public locations seeking individuals who reported signs of SPD. For example, we placed advertisements in the local newspaper seeking research participants who do things that others would find odd or eccentric, who believe in things that others would find peculiar or odd, and who rarely need friends to confide in.

#### Instruments

*Schizotypal, antisocial, and BPDs.* We assessed these three personality disorders using the corresponding modules of the Personality Disorder Interview-IV (PDI-IV; Widiger, Mangine, Corbitt, Ellis, & Thomas, 1995). In this semistructured interview, participants are asked a series of questions (e.g., "Have you experienced any odd coincidences?"). These questions are followed up as needed for clarification, with the trained interviewers making dimensional ratings of each *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (*DSM-IV*; American Psychiatric Association, 1994) diagnostic criterion (0 = absent; 1 = sub-threshold<sup>8</sup>; 2 = present; 3 = severe) for each of these personality disorders. Interviewers were trained by Thomas Widiger, the lead developer of the PDI-IV. A second trained member of the research team listened to recorded PDI-IV interviews and independently rated the same criteria. When raters disagreed about whether a criterion was above or below threshold, or disagreed by more than one point, the research team discussed the case and resolved the disagreement by consensus. Other disagreements (e.g., one rater assigned a score of 2, and the second rater assigned a score of 3) were resolved by using the mean of the two raters. Dimensional schizotypal, antisocial personality disorder, and BPD scores were computed by summing across the scores for each diagnostic criterion for each disorder. Interrater reliability of the total schizotypal, antisocial personality disorder, and BPD scores, measured using the intraclass correlation coefficient, treating raters as random effects and the mean of the raters as the unit of reliability, were .91, .94, and .92, respectively.

As expected, a large portion (36.7%) of the sample was at or above threshold for the SPD odd beliefs criterion, and many more (31.0%) were rated as having subthreshold levels. Similarly, many

<sup>6</sup> In addition to the 303 participants we report on, an additional 15 individuals began participating but were excluded from analyses because they either (a) met criteria for Criterion A of schizophrenia ( $n = 7$ ) as determined using the psychotic disorders module of the SCID, (b) did not complete the protocol ( $n = 6$ ); (c) had English language skills that questioned the validity of their answers ( $n = 1$ ), or (d) appeared to be fabricating responses ( $n = 1$ ).

<sup>7</sup> Because it was not the goal of Study 2 to obtain a sample representative of the general population, as it had been in Study 1, we did not conduct analyses similar to those conducted in Study 1 in which we weighted cases on the basis of the degree to which the participant's race/ethnicity and age group were under- or overrepresented in the sample relative to the general population.

<sup>8</sup> In consultation with Thomas Widiger, we changed the original PDI-IV 3-point rating scale (absent, present, severe) to a 4-point scale by adding a subthreshold point to the continuum.

participants (23.2%) were at or above threshold for the SPD unusual perceptual experiences criterion, and many more (25.4%) were rated as having subthreshold levels. Thus, more than half the sample exhibited at least some signs of odd beliefs, and more than half the sample exhibited at least some signs of unusual perceptions. In fact, only 29.0% of the sample did not exhibit any signs of either odd beliefs or unusual perceptions. Although many individuals exhibited some signs of SPD, very few (2.4%) met full diagnostic criteria (i.e., were at or above threshold for five or more diagnostic criteria). Similarly, very few individuals met full diagnostic criteria for BPD (2.6%), and relatively few met full diagnostic criteria (ignoring the conduct disorder criterion) for antisocial personality disorder (8.3%).

*Childhood maltreatment.* Childhood physical, sexual, and emotional abuse (by family members and nonfamily members), as well as physical neglect, were assessed via interview by trained female graduate students. Prior to beginning the childhood maltreatment interview, participants were reminded that only members of the research team would have access to their responses. In addition, prior to asking about childhood sexual abuse, the interviewers presented the participants with information that was intended to make them less inclined to withhold information about their childhood sexual experiences. Specifically, participants were told them that it is not rare for individuals to have sexual experiences as children, that some of these experiences are with relatives and family members, and that some of these experiences are quite painful, whereas others are not. The interviewers were blind to the participant's level of SPD symptoms.

The childhood *physical abuse* interview was a modified/expanded version of the Self-Report of Childhood Abuse Physical (Widom & Shepard, 1996), which addressed whether and to what extent specific types of physically abusive incidents/outcomes occurred. Participants were asked about a variety of physically abusive incidents/outcomes (e.g., "beat or hit you with something hard like a stick or baseball bat"; "intentionally burn you"; "hurt you badly enough so that you needed a doctor or other medical treatment"). These questions were followed up, as needed, by asking about the perpetrator(s), how often such incidents/outcomes occurred, and the ages at which they occurred. Childhood *sexual abuse* was measured using an interview procedure that followed the same approach described by Finkelhor (1979), Russell (1983), and Widom and Morris (1997). Participants were asked about a variety of sexual acts (e.g., "another person showing his or her sex organs to you"; "you fondling another person in a sexual way"; "oral or anal sex"; "intercourse"). These questions were followed up, as needed, by asking about the perpetrator(s), how often such incidents/outcomes occurred, the ages at which they occurred, whether (in the case of fondling and touching) the person was unclothed, and whether there were explicit threats to comply with the wishes of the perpetrator. Participants were told that for sexual experiences that occurred starting at age 12, we were interested only in unwanted sexual experiences. Childhood *emotional abuse* was assessed using the relevant portion of the Childhood Trauma Interview (Bernstein et al., 1994; Fink et al., 1995). Participants were asked about a variety of emotionally abusive actions (e.g., "Did anyone ever call you stupid or ugly or bad, or say that you couldn't do anything right"; "Did anyone say or do things that made you feel ashamed or embarrassed"; "What about ignoring you or giving you the silent treatment"). These questions were

followed up, as needed, by asking about the perpetrator(s), what had been said or done, how often such incidents/outcomes occurred, and the ages at which they occurred. *Physical neglect* was also assessed using the relevant portion of the Childhood Trauma Interview. Participants were asked about a variety of conditions (e.g., "not having enough food to eat"; "not being taken to the doctor when ill"; "left overnight without an adult caretaker"), how often they occurred, and the ages at which they occurred.

The interviewer rated the global severity (0 = absent; 6 = torturous) of these four types of childhood maltreatment during three different periods: before age 6, ages 6–11, and ages 12–17 (except for physical neglect, which was not rated for ages 12–17 because individuals in this age range require less parental supervision and are better able to care for themselves). These ratings were based on the interviewer's judgment of the severity of the acts that were described rather than on the participants' own judgment of their severity or on the participants' descriptions of the impact of the maltreatment. Maltreatment tended to be relatively consistent across age; correlations between age groups were .68–.96. Therefore, the maltreatment scores were averaged across age ranges to provide one physical abuse, one sexual abuse, one emotional abuse, and one physical neglect score for each participant. Using the interviewers' notes, a research assistant, blind to all other scores, rated the same four types of maltreatment across the three age ranges for each participant. Interrater reliability, measured using the intraclass correlation coefficient, treating raters as random effects and the mean of the raters as the unit of reliability, ranged between .88 and .91. The four scores from the interviewer were averaged with the four scores from the second rater to provide one physical abuse, one sexual abuse, one emotional abuse, and one physical neglect score for each participant. Consistent with past research (e.g., Chapman et al., 2004), the different types of childhood maltreatment tended to co-occur; in our sample, the four types of childhood maltreatment were correlated between .35 and .64. Therefore, a single total childhood maltreatment score was computed, summing across the four types of maltreatment.

*Threatening events.* Threatening events were operationalized as the individual having met *DSM-IV* PTSD Criterion A. To meet Criterion A, the individual must have experienced an event that was (a) life threatening or that had produced serious injury or threat to the physical integrity of the individual or another person; and (b) produced an emotional reaction of intense fear, helplessness, or horror during and/or after the event. Interviewers administered the Life Events Checklist (Gray, Litz, Hsu, & Lombardo, 2004), a self-report checklist that measures exposure to potentially traumatic life events, to determine whether participants had experienced any events that might meet the first part of Criterion A. This was followed up with additional questions concerning emotional responses to the events, as needed. Specifically, individuals who met this first part of Criterion A were interviewed using the relevant portion of the Clinician-Administered PTSD Scale (CAPS; Blake et al., 1995; Weathers, Keane, & Davidson, 2001; Weathers, Ruscio, & Keane, 1999) to assess their emotional reactions during and after each trauma. Participants were divided into those who did meet PTSD Criterion A ( $n = 106$ ) and those who did not meet PTSD Criterion A ( $n = 197$ ).

*PTSD.* For those participants who met PTSD Criterion A, PTSD symptomatology was assessed using the CAPS (Blake et al., 1995; Weathers et al., 2001, 1999). The CAPS is a structured



interview that assesses the frequency (ranging from 0 [*never*] to 4 [*daily or almost every day*]) and intensity (ranging from 0 [*none*] to 4 [*extreme*]) of the 17 PTSD symptoms included in the *DSM-IV*. Interviewers were trained by Frank Weathers, one of the developers of the CAPS. Total current and lifetime PTSD severity scores were computed by summing the frequency and intensity scores across the 17 CAPS symptom items (Weathers et al., 2001). A second trained member of the research team listened to recorded CAPS interviews and independently rated the same criteria. If raters disagreed about whether a criterion met the diagnostic threshold, then the research team would discuss the case and arrive at a consensus decision. If raters agreed about whether the criterion met the diagnostic threshold, but disagreed about the severity (e.g., moderate intensity of symptoms vs. extreme intensity of symptoms), then the mean of the two raters served as the final score. Interrater reliability of the total current and lifetime PTSD scores, measured using the intraclass correlation coefficient, treating raters as random effects and the mean of the raters as the unit of reliability, were both .99. For the analyses using PTSD scores, individuals who did not meet PTSD Criterion A were assigned PTSD scores of zero. Of those individuals who met PTSD Criterion A, 64% met full diagnostic criteria for lifetime PTSD, and 5% met full diagnostic criteria for current PTSD.

**Absorption and dissociation.** On the basis of the work of some researchers arguing that a distinction can be made between non-pathological absorption and pathological dissociation (e.g., Waller & Ross, 1997), instruments that might be considered measurements of each of them were administered. Absorption was measured using two questionnaires. The 7-item Imagination subscale of the Dissociative Processes Scale (DPS; Harrison & Watson, 1992) assesses individual differences in absorption, imaginativeness, and fantasizing (e.g., "I daydream a lot", "I have a very active imagination"). Individuals rated each item on the DPS on a 5-point scale ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). Internal consistency for this scale in the present sample was .89. The 8-item Absorption subscale of the Curious Experiences Survey (CES; Goldberg, 1999) assesses the tendency to devote a great deal of attention/mental concentration to experiences (e.g., "Had the experience of remembering a past event so vividly that it felt like I was reliving the event"; "Found that I was able to ignore pain"). Individuals rated each item on the CES on a 5-point scale ranging from 1 (*this never happens to me*) to 5 (*this almost always happens to me*). Internal consistency for this scale in the present sample was .74. Imagination and Absorption scores were strongly correlated (among men:  $r = .65, p < .01$ ; among women:  $r = .57, p < .01$ ). A single non-pathological absorption composite score was computed by summing across standardized Imagination and Absorption scores.

Pathological dissociation was also measured in two different ways. First, dissociative disturbances were assessed using the Structured Clinical Interview for *DSM-IV* Dissociative Disorders-Revised (SCID-D; Steinberg, 1994). A dichotomous dissociative disorder score (present vs. absent) was created, distinguishing the 43 participants who were rated as exhibiting at least some signs of dissociative disturbance from the remaining participants who were rated as not exhibiting any signs of dissociative disturbance. Second, pathological dissociation was measured using the eight items of the DES-T subscale (Waller & Ross, 1997); these items (all taken from the Dissociative Experiences Scale; DES) measure

amnesia, derealization, and depersonalization. The likelihood of participants being members of the pathological dissociation taxon was estimated using the algorithm presented in Waller and Ross (1997). As expected, the distribution of the likelihood scores was bimodal; the vast majority of participants had likelihood scores less than .11 and were considered to not belong to the pathological dissociation taxon, and 13 participants had likelihood scores between .70 and 1.0 and were considered to belong to the pathological dissociation taxon. Therefore, a dichotomous pathological dissociation taxon score (present vs. absent) was created. Whether individuals were rated as exhibiting signs of dissociative disturbance was associated with whether they were in the pathological dissociation taxon (among men:  $\phi = .15, p < .09$ ; among women:  $\phi = .30, p < .01$ ). Participants were given a single pathological dissociation composite score of zero, one, or two on the basis of whether they showed signs of pathological dissociation on the SCID-D and/or on the DES-T.

**Family history of psychotic disorder.** The lifetime prevalence of psychotic disorders in participants' first-degree (i.e., parents, siblings, and children) biological relatives was examined. Psychotic disorders were coded according to a modified set of scoring rules based on the Family History Research Diagnostic Criteria (FH-RDC; Andreasen, Endicott, Spitzer, & Winokur, 1977). The FH-RDC lists a set of related criteria for diagnoses of both chronic schizophrenia and schizoaffective disorder. Similar to the FH-RDC's scoring rules for these disorders, for a family member to receive a psychotic disorder diagnosis in the present study, the presence of psychotic symptoms (e.g., delusions, hallucinations) must have been present and must have led to significant impairment. Because not all relatives had passed through the full age of risk, and some had not even entered the age of risk, bezugsziffern (BZ) for the age-corrected prevalence or morbid risk of psychotic disorders in biological first-degree relatives were calculated using the Weinberg abridged method (Slater & Cowie, 1971); the risk period for psychotic disorders was 18–39 years (e.g., Klein, Taylor, Dickstein, & Harding, 1988).

**Neurodevelopmental disturbance.** Minor physical anomalies (MPAs) and inconsistent hand use served as indicators of neurodevelopmental disturbance.<sup>9</sup> To assess MPAs, morphology of six specific body regions (head, eyes, mouth, ears, hands, and feet) were examined using the original 18 items from the Waldrop and Halverson (1971) scale, supplemented with four additional items from the ear and mouth regions (ear lobe size, anterior ear helix shape, palatal ridges behind upper teeth, and bifid/clefted tongue) in order to improve coverage of MPAs in these regions. Assessment of MPAs was performed by graduate research assistants who had undergone systematic training in the administration of the scale. Most items were scored as either absent (0) or present (1). In accordance with recent scoring modifications (i.e., Ismail, Cantor-Graae, & McNeil, 1998), specific items (e.g., fine hair) were weighted (and thus were scored 0–2). Head circumference was scored using published norms (Eichorn & Bayley, 1962). Distance between tear ducts was scored using the sample mean and standard

<sup>9</sup> We also measured dermatoglyphic asymmetries. However, because our measure of dermatoglyphic asymmetries was not associated with any of the other variables examined in this study, we have chosen not to include it in the present article.

Table 4  
Study 2: Comparisons of Men and Women

Variable	Men		Women		Statistic	Effect size
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Physical abuse	0.9	1.0	0.9	0.9	$t(299) = 0.23$	$d = 0.03$
Sexual abuse	0.5	0.9	0.6	0.8	$t(299) = 0.70$	$d = 0.08$
Emotional abuse	1.0	1.0	1.2	1.1	$t(299) = 2.25^*$	$d = 0.26$
Physical neglect	0.5	0.9	0.6	1.0	$t(298) = 0.29$	$d = 0.03$
Total maltreatment	2.9	2.9	3.2	2.9	$t(299) = 1.03$	$d = 0.12$
PTSD Criterion A (%)		25.3		44.0	Fisher's exact $p < .01^{**}$	$\phi = .20$
Minor physical anomalies	4.8	3.0	4.0	2.8	$t(284) = 2.72^*$	$d = 0.28$
Dermatoglyphic asymmetries	10.8	6.8	10.1	5.5	$t(260) = 0.91$	$d = .11$
Inconsistent hand use (%)		20.3		12.7	Fisher's exact $p = .08$	$\phi = .10$
Family history of psychotic disorder	0.04	0.15	0.03	0.08	$t(288) = 1.36$	$d = 0.08$
Schizotypal symptoms	3.3	3.1	3.8	3.3	$t(301) = 1.41$	$d = 0.16$

\*  $p < .05$ . \*\*  $p < .01$ .

deviation. For both head circumference and distance between tear ducts, participants with scores more than 1.5 standard deviations above the mean were coded as having an MPA on these items. Individual item scores were summed to yield a total MPA score. The "number of (ear) asymmetries" item from the original Waldrop scale was not included in final calculations due to problems that arose in assessing and scoring this item. Participants with missing data for three or more of these items were excluded from final analyses.

Inconsistent hand use was measured using the Hand Preference Demonstration Test (HPDT; Soper et al., 1986). The test consists of eight items that are intended to assess participants' hand preferences over a wide range of activities. For example, participants were asked to pick up a spoon (placed directly in front of them), and the experimenter recorded which hand the participant used. This 8-item task was administered three times over two different days. Following Green, Satz, Smith, and Nelson (1989), participants were divided into those who used different hands on two<sup>10</sup> or more occasions ( $n = 48$ ) and those who used different hands one time at most ( $n = 247$ ); we refer to the former group as the high-hand use inconsistency group.

### Procedure

One experimenter assessed (a) SPD, (b) family history of psychotic disorder, (c) the SCID-D, (d) the assessment of MPAs, and (e) two of the three HPDT trials. At a second session, a second experimenter assessed (a) antisocial personality disorders and BPDs, (b) childhood maltreatment and history of psychological trauma, (c) PTSD, and (d) the third HPDT trial. Both of these experimenters were blind to questionnaire scores.

## Results

### Descriptive Statistics

We began by examining whether men and women differed in any of the variables examined. As can be seen in Table 4, the gender differences tended to be rather small. Compared with

women, men tended to have more MPAs. Compared with men, women had higher levels of emotional abuse and were more likely to meet PTSD Criterion A.

### Harmful/Traumatic Life Experiences and Schizotypal Symptoms

As can be seen in Table 5, among both men and women, higher levels of schizotypal symptoms were associated with higher levels of childhood maltreatment. Unlike Study 1, in Study 2 there were significant gender differences in how schizotypal symptoms were associated with childhood maltreatment. Specifically, schizotypal symptoms were significantly more strongly associated with total childhood maltreatment among men than among women ( $z = 2.24$ ,  $p < .05$ ), with gender differences in correlations being particularly strong for physical abuse ( $z = 2.44$ ,  $p < .05$ ). To examine the degree to which different forms of childhood maltreatment were associated with schizotypal symptoms when taking the remaining forms of childhood maltreatment into account, we conducted multiple regression analyses, entering all four forms of childhood maltreatment into the prediction equation simultaneously. As can be seen in Table 6, when other forms of maltreatment were taken into consideration, only emotional abuse continued to be significantly associated with schizotypal symptoms.

As in Study 1, because of the very wide range of ages among the participants, we explored the possibility that age might moderate the links between childhood maltreatment and schizotypal symptoms. We conducted hierarchical multiple regression analyses predicting schizotypal symptoms, entering age and maltreatment on the first step and the Age  $\times$  Maltreatment interaction in the second step. We examined each specific form of maltreatment as well as total maltreatment. There was no evidence of age moderating the

<sup>10</sup> We chose to use the liberal cutoff of two rather than the more conservative cutoff of three, also used by Green et al. (1989), because relatively few (5.4%) individuals exhibited such high rates of hand use inconsistency.

Table 5

Study 2: Correlations Among Schizotypal Symptoms, Harmful/Traumatic Experiences, PTSD, Absorption, and Dissociation

Variable	1	2	3	4	5	6	7
1. Schizotypal personality disorder	—	.25**	.30**	.38**	.35**	.47**	.37**
2. Total childhood maltreatment	.47**	—	.27**	.33**	.28**	.22**	.16*
3. PTSD Criterion A	.19*	.34**	—	.49**	.84**	.18*	.22**
4. Current PTSD	.36**	.41**	.50**	—	.64**	.32**	.31**
5. Lifetime PTSD	.29**	.51**	.86**	.66**	—	.32**	.30**
6. Absorption	.41**	.24**	.23**	.18*	.21*	—	.45**
7. Dissociation	.23**	.34**	.20*	.19*	.26**	.24**	—

Note. Correlations for women appear above the diagonal; correlations for men appear below the diagonal. PTSD = posttraumatic stress disorder. \* $p < .05$ . \*\* $p < .01$ .

links between maltreatment and schizotypal symptoms among women. Among men, age significantly moderated the link between schizotypal symptoms and both neglect,  $\Delta F(1, 136) = 4.76, p < .05, \Delta R^2 = .03$ , and sexual abuse,  $\Delta F(1, 137) = 4.54, p < .05, \Delta R^2 = .03$ . In contrast to Study 1, in Study 2 the relation between schizotypal symptoms and both neglect and sexual abuse became weaker as age increased. Among men, age did not moderate the links between schizotypal symptoms and the other maltreatment scores. As a second means of addressing this issue, the data were reanalyzed after excluding the 66.6% of participants who were more than 30 years old. After excluding these individuals, maltreatment continued to be associated with schizotypal symptoms. After excluding women older than age 30, the correlation between schizotypal symptoms and total maltreatment declined slightly (from  $r = .30$  to  $r = .25, p < .05$ ). After excluding men older than age 30, the correlation between schizotypal symptoms and total maltreatment increased slightly (from  $r = .47$  to  $r = .55, p < .01$ ).

As hypothesized, individuals who met PTSD Criterion A had significantly higher levels of schizotypal symptoms than did individuals who did not meet PTSD Criterion A, men:  $t(140) = 2.29, p < .05, d = 0.42$ ; women:  $t(159) = 3.95, p < .01, d = 0.62$ . We next examined whether childhood maltreatment and meeting PTSD Criterion A were associated independently with schizotypal symptoms. To do so, we entered both the total childhood maltreatment and the PTSD Criterion A variables into a multiple regression analysis predicting schizotypal symptoms. For men, childhood maltreatment ( $\beta = .46, p < .01$ ) contributed independently

to the prediction of schizotypal symptoms, whereas PTSD Criterion A did not ( $\beta = .04, ns$ ). In contrast, for women, both childhood maltreatment ( $\beta = .19, p < .05$ ) and meeting PTSD Criterion A ( $\beta = .23, p < .01$ ) contributed independently to the prediction of schizotypal symptoms.

#### Can Antisocial Personality Disorders and BPDs Account for the Association Between Harmful/Traumatic Life Experiences and Schizotypal Symptoms?

As expected, schizotypal symptoms were significantly associated with symptoms of both antisocial personality disorder (among men,  $r = .40, p < .01$ ; among women,  $r = .33, p < .01$ ) and BPD (among men,  $r = .56, p < .01$ ; among women,  $r = .40, p < .01$ ). Also as expected, childhood maltreatment was associated with both antisocial personality disorder (among men,  $r = .52, p < .01$ ; among women,  $r = .30, p < .01$ ) and BPD (among men,  $r = .57, p < .01$ ; among women,  $r = .44, p < .01$ ). Though the associations were not as strong, a history of meeting PTSD Criterion A was also significantly associated with both antisocial personality disorder (among men,  $r = .27, p < .01$ ; among women,  $r = .18, p < .05$ ) and BPD (among men,  $r = .38, p < .01$ ; among women,  $r = .26, p < .01$ ). Therefore, in our next set of analyses, we examined whether the associations between schizotypal symptoms and harmful/traumatic life experiences could be completely accounted for by shared variance with antisocial personality disorders and BPDs. Somewhat different patterns emerged for men and women. Among men, when removing shared variance with both antisocial personality disorders and BPDs, schizotypal symptoms continued to be significantly associated with childhood maltreatment ( $r = .22, p < .01$ ) but not with PTSD Criterion A ( $r = -.03$ ). In contrast, among women, when removing shared variance with both antisocial personality disorders and BPDs, schizotypal symptoms continued to be significantly associated with PTSD Criterion A ( $r = .20, p < .05$ ) but not with childhood maltreatment ( $r = .09$ ).

#### Can Biological Vulnerability Factors Account for the Association Between Harmful/Traumatic Life Experiences and Schizotypal Symptoms?

Having found that schizotypal symptoms were associated with harmful/traumatic life experiences (i.e., childhood maltreatment and a history of a life event meeting PTSD Criterion A), we

Table 6

Study 2: Relations (Correlations and Betas) Between Schizotypal Symptoms and Childhood Maltreatment

Variable	Males		Females	
	$r$	$\beta^a$	$r$	$\beta^a$
Physical abuse	.37**	.13	.11	-.16
Sexual abuse	.31**	.10	.19*	.14
Emotional abuse	.44**	.28**	.30**	.33**
Physical neglect	.34**	.08	.15*	.03
Total maltreatment	.47**	—	.30**	—

Note. Dashes indicate data were not applicable.

<sup>a</sup>Based on regression analysis simultaneously entering all four specific forms of maltreatment.

\* $p < .05$ . \*\* $p < .01$ .

Table 7  
*Study 2: Correlations Among Schizotypal Symptoms, Harmful/Traumatic Experiences, Family History of Psychotic Disorder, and Signs of Neurodevelopmental Disturbance*

Variable	1	2	3	4	5	6
1. Schizotypal personality disorder	—	.25**	.30**	.29**	.18*	-.02
2. Total childhood maltreatment	.47**	—	.27**	.19*	.16*	.04
3. PTSD Criterion A	.19*	.34**	—	.17*	.12	.11
4. Family history of psychotic disorder	.17*	.17*	.19*	—	.01	-.01
5. Inconsistent hand use	.14	.18*	-.004	-.03	—	.15
6. Minor physical anomalies	.19*	.11	.17*	-.06	.17*	—

Note. Correlations for women appear above the diagonal; correlations for men appear below the diagonal. PTSD = posttraumatic stress disorder.  
 \* $p < .05$ . \*\* $p < .01$ .

proceeded to explore anticipated biological contributors to schizotypal symptoms. As can be seen in Table 7, among both men and women, higher levels of schizotypal symptoms were associated with higher rates of family history of psychotic disorders. There was also evidence of schizotypal symptoms being associated with signs of neurodevelopmental disturbance, specifically with MPAs among men and with inconsistent hand use among women.

As can be seen in Table 7, there was clear evidence of harmful/traumatic life experiences being associated with family history of psychotic disorders and also some evidence of such experiences being associated (albeit less consistently) with signs of neurodevelopmental disturbance. We therefore computed partial correlations to test whether harmful/traumatic life experiences would continue to be associated with schizotypal symptoms after removing shared variance with family history of psychotic disorders, inconsistent hand use, and MPAs. Among men, after removing shared variance with all three of these factors, schizotypal symptoms continued to be associated with total childhood maltreatment ( $r = .28, p < .01$ ) but not with PTSD Criterion A ( $r = .06, ns$ ). In contrast, among women, even after removing shared variance with all three of these factors, schizotypal symptoms continued to be associated with both total childhood maltreatment ( $r = .19, p < .05$ ) and PTSD Criterion A ( $r = .26, p < .01$ ).

*Mediators of the Links Between Harmful/Traumatic Life Experiences and Schizotypal Symptoms*

We next explored four potential mediators of the link between schizotypal symptoms and harmful/traumatic experiences (i.e., childhood maltreatment and a history of a life event meeting PTSD Criterion A): (a) lifetime PTSD symptomatology, (b) current PTSD symptomatology, (c) absorption, and (d) dissociation. The correlations among these variables are presented in Table 5. We tested mediation effects using the Sobel test (Baron & Kenny, 1986; Sobel, 1982). The results of the tests of mediation are presented in Table 8. Also presented in Table 8 are the remaining contributions of the trauma/maltreatment predictors when the mediator was also included in the regression equation. The Sobel test columns in Table 8 indicate whether the potential mediator (listed in the Mediator column) was a statistically significant mediator of the link between the form of trauma/maltreatment (listed in the leftmost column of the table) and schizotypal symptoms. The Remaining contribution columns present the beta weights (and statistical significance thereof) linking the form of trauma/maltreatment with schizotypal symptoms after taking the potential mediator into account. In those cases in which there is evidence of significant mediation, and the remaining contribution (beta) is not

Table 8  
*Study 2: Tests of the Potentially Mediating Roles of Absorption, Dissociation, and PTSD*

Trauma/child maltreatment	Mediator	Men		Women	
		Sobel test (z) <sup>a</sup>	Remaining contribution (β) <sup>b</sup>	Sobel test (z) <sup>a</sup>	Remaining contribution (β) <sup>b</sup>
PTSD Criterion A	Absorption	2.40*	.10	2.19*	.20**
PTSD Criterion A	Dissociation	1.65†	.13	2.38*	.23**
PTSD Criterion A	Lifetime PTSD	3.07**	-.24	2.55*	-.02
PTSD Criterion A	Current PTSD	3.32**	.03	3.16**	.15†
Childhood maltreatment	Absorption	2.39*	.39**	2.62**	.15*
Childhood maltreatment	Dissociation	0.94	.43**	1.84†	.19*
Childhood maltreatment	Lifetime PTSD	0.79	.43**	2.43*	.20*
Childhood maltreatment	Current PTSD	2.29*	.39**	2.96**	.16*

Note. PTSD = posttraumatic stress disorder. <sup>a</sup>The Sobel test is used to examine whether there is evidence of statistically significant mediation. <sup>b</sup>The remaining contribution tests whether the form of trauma/childhood maltreatment continues to predict schizotypal symptoms even after taking into account the mediator.  
 † $p < .10$ . \* $p < .05$ . \*\* $p < .01$ .

statistically significant, mediation can be said to be complete. In contrast, in those cases in which there is evidence of significant mediation and the remaining contribution (beta) is statistically significant, it is considered to be only partial mediation.

For both men and women, absorption/dissociation and PTSD symptoms consistently mediated the link between PTSD Criterion A and schizotypal symptoms. Absorption/dissociation and PTSD symptoms also tended to mediate the link between childhood maltreatment and schizotypal symptoms, though dissociation and lifetime PTSD were not significant mediators for men. For both men and women, childhood maltreatment continued to be significantly associated with schizotypal symptoms even after taking into account absorption/dissociation and PTSD. In contrast, after taking into account absorption/dissociation and PTSD symptoms, PTSD Criterion A was no longer significantly associated with schizotypal symptoms among men. Among women, PTSD Criterion A continued to be significantly associated with schizotypal symptoms after taking into account absorption and dissociation, and there was a trend for PTSD Criterion A to be associated with schizotypal symptoms after taking into account current PTSD symptoms; the link between PTSD Criterion A and schizotypal symptoms was eliminated when lifetime PTSD symptoms were taken into account.

#### *Biological Moderators of the Links Between Harmful/Traumatic Life Experiences and Schizotypal Symptoms*

Finally, we explored whether the associations between schizotypal symptoms and harmful/traumatic life experiences (i.e., childhood maltreatment and a history of a life event meeting PTSD Criterion A) were moderated by biological vulnerability factors (i.e., family history of psychotic disorder and signs of neurodevelopmental disturbance). We conducted hierarchical multiple regression analyses (using centered variables) to predict schizotypal symptoms. In each such analysis, a harmful/traumatic life experience variable and a biological vulnerability factor were entered in the first step, and the interaction between the life experience and biological factor was entered in the second step. There was some evidence of the association between harmful/traumatic life experiences and schizotypal symptoms being significantly moderated by neurodevelopmental disturbance, though only among men. In contrast to neurodevelopmental disturbance, there was no evidence of family history of psychotic disorder moderating the association between schizotypal symptoms and harmful/traumatic life experiences.

Among men (but not women), the interaction between childhood maltreatment and hand use inconsistency improved the prediction of schizotypal symptoms,  $\Delta F(1, 134) = 4.07, p < .05, \Delta R^2 = .02$ . As noted by several researchers (e.g., Champoux & Peters, 1987; McClelland & Judd, 1993), the change in  $R^2$  due to moderation effects are typically quite small, and changes as low as .01 are usually considered important. Among men with inconsistent hand use, the correlation between childhood maltreatment and schizotypal symptoms was .67 ( $p < .01$ ), whereas among men with consistent hand use, the correlation between childhood maltreatment and schizotypal symptoms was .41 ( $p < .01$ ).

#### *Discussion*

##### *The Relations Between Harmful/Traumatic Life Experiences and Schizotypal Symptoms*

The results of the present research provide support for the hypothesis that psychological trauma is associated with elevated levels of SPD and are consistent with those obtained in previous research (e.g., Berenbaum et al., 2003). The results of Study 1 indicate that the results of previous research linking psychological trauma with schizotypal symptoms were not artifacts of atypical samples of participants. The results of Study 1 also provide an estimate of the strength of the associations in the general population between harmful/traumatic life experiences and schizotypal symptoms. On the basis of the conventions provided by Cohen (1988), the association between total childhood maltreatment and schizotypal symptoms was of medium magnitude, and the association between a life- or an injury-threatening event and schizotypal symptoms was between small and medium magnitude. Despite our attempt to obtain accurate estimates of the strength of the associations between trauma and schizotypal symptoms in the general population, our estimates should be interpreted with caution for several reasons. First, it was not possible to obtain a truly random sample of the population in Study 1 because (a) at the time of the study, approximately 9% of U. S. households did not have "land line" telephones (approximately 2.5% did not have any telephone service, and approximately 6.5% had only wireless service; Piekarski, 2005); this may be the reason that the proportion of younger adults, who are especially likely to have cell phones rather than land lines, was much lower than that found in the general population; and (b) participation was voluntary, not all potential participants agreed to participate, and it is undoubtedly the case that who chooses to participate is not random. Second, some participants may have intentionally or unintentionally provided inaccurate information concerning their experiences of trauma. Third, because both trauma histories and schizotypal symptoms were measured with self-report, the strength of the associations may have been inflated due to common method variance. Thus, although we believe that the strength of the associations found in Study 1 are likely to be more accurate estimates of population parameters than found in most conventional studies that do not attempt to sample individuals randomly from the general population, as was the case in Study 2 and previous research examining the link between trauma and schizotypal symptoms, we recognize that they may be biased for a variety of reasons.

In both studies, we found evidence of all facets of childhood maltreatment being associated with schizotypal symptoms, though in Study 2, the association with physical abuse among women was not statistically significant. Of the different facets of maltreatment, emotional abuse was most strongly associated with schizotypal symptoms. In fact, in both studies, for both men and women, emotional abuse continued to be associated with schizotypal symptoms even after taking the other types of maltreatment into account. This finding is consistent with that of J. G. Johnson et al. (2001), who found that verbal abuse was associated with schizotypal symptoms even after taking into account physical abuse, sexual abuse, and neglect. In Study 1, physical neglect was more strongly associated with schizotypal symptoms than were physical and sexual abuse (though some of these differences were quite small), and was the only form of maltreatment besides emotional

abuse to be significantly associated with schizotypal symptoms among both men and women when taking all other forms of maltreatment into account. In Study 2, although physical neglect was associated with schizotypal symptoms (particularly among men), the association was no longer significant after taking all other forms of maltreatment into account. Our findings concerning neglect are consistent with those of both Berenbaum, Valera, and Kerns (2003) and J. G. Johnson et al. (1999, 2000), who found that neglect was most strongly associated with schizotypal symptoms. Thus, the present research suggests that of the different forms of childhood maltreatment, physical neglect may be particularly strongly associated with schizotypal symptoms but that emotional abuse appears to be the form of maltreatment that is most strongly associated with schizotypal symptoms.

In addition to childhood maltreatment, we found that traumatic events were also associated with schizotypal symptoms. Elevated levels of schizotypal symptoms were associated with having experienced a life- or an injury-threatening event (Study 1) and with having met PTSD Criterion A (Study 2). Among women, childhood maltreatment and traumatic events were associated independently with schizotypal symptoms in both studies. In contrast, among men, childhood maltreatment and traumatic events were associated independently with schizotypal symptoms in Study 1 but not in Study 2. In Study 2, among men, schizotypal symptoms were associated with childhood maltreatment even when taking into consideration PTSD Criterion A, but not with PTSD Criterion A when taking into account childhood maltreatment. Because past research had not examined this issue, additional research is needed to determine whether and why childhood maltreatment and traumatic events are associated independently with schizotypal symptoms among men.

The results of Study 2 render less plausible two artifactual explanations for the association between harmful/traumatic life experiences and schizotypal symptoms. First, we found evidence of schizotypal symptoms continuing to be associated with harmful/traumatic experiences even after removing shared variance with both antisocial personality disorders and BPDs (though the particular type of experience that continued to be associated with schizotypal symptoms varied by gender). Second, we found evidence of schizotypal symptoms continuing to be associated with harmful/traumatic experiences even after removing shared variance with both family history of psychotic disorders and signs of neurodevelopmental disturbance (though, again, the particular type of experience that continued to be associated with schizotypal symptoms varied by gender). We cannot definitively rule out the possibility that the association between schizotypal symptoms and harmful/traumatic experiences is due to both being caused by genetic factors for two reasons. First, some individuals may have been unable or unwilling to provide accurate information concerning family history of psychotic disorders. Second, family history of psychotic disorders, even when perfectly accurate, provides only an estimate of genetic vulnerability because not all genetic vulnerability is expressed.

#### *Mediators and Moderators*

We found evidence consistent with the hypothesis that absorption, dissociation, and PTSD symptoms partially mediate the links between harmful/traumatic experiences and schizotypal symp-

oms. These findings are important for two reasons. First, the finding that they did not completely mediate all of the links indicates that schizotypal symptoms are not merely reflections of other personality and psychopathological outcomes of harmful/traumatic experiences. Second, these findings begin to explicate the manner in which harmful/traumatic experiences get translated into elevated schizotypal symptoms. Given the correlational nature of the present research, however, we cannot be certain that absorption, dissociation, and PTSD symptoms actually play roles in the development of schizotypal symptoms. Only future longitudinal research can directly test such possibilities. We also believe it will be important for future research to examine other potential mediators. For example, as discussed further below, future research should explore other potential mediators such as disturbances in the hypothalamic-pituitary-adrenal axis.

It is undoubtedly the case that the impact on schizotypal symptoms of harmful/traumatic experiences, even of the same magnitude, will vary across individuals. In Study 2, we explored whether biological vulnerability factors for schizophrenia spectrum disorders moderated the links between harmful/traumatic experiences and schizotypal symptoms. We found evidence of neurodevelopmental disturbance moderating the links between childhood maltreatment and schizotypal symptoms, though only among men. In contrast, there was no evidence of the links being moderated by family history of psychotic disorder. We believe it will be extremely important for future research to explore other potential moderators. Although our search for moderators focused on biological vulnerability factors associated with schizophrenia spectrum disorders, there is no reason why the search for moderators should be limited to either (a) biological factors or (b) factors directly associated with risk for schizophrenia spectrum disorders. For example, it seems quite plausible that factors such as culture and family support influence the response to harmful/traumatic experiences and hence the pathways to schizotypal symptoms.

#### *Gender*

The results of the present research revealed both similarities and differences between men and women. The most important similarity was that harmful/traumatic experiences were associated with schizotypal symptoms among both men and women. Gender differences emerged in terms of how different types of harmful/traumatic experiences were associated with schizotypal symptoms. In Study 2, schizotypal symptoms were more strongly associated with childhood maltreatment among men than among women, whereas schizotypal symptoms were more strongly associated with PTSD Criterion A among women than among men. Furthermore, to the degree that PTSD Criterion A was associated with schizotypal symptoms among men, the link was completely mediated by absorption, dissociation, and PTSD symptoms (whereas among women, these factors were only partial mediators of the link between PTSD Criterion A and schizotypal symptoms).

Although schizotypal symptoms were associated with family history of psychotic disorder among both men and women, gender differences emerged in terms of the associations between schizotypal symptoms and signs of neurodevelopmental disturbance. Among women, only inconsistent hand use was associated with schizotypal symptoms. In contrast, among men, MPAs were significantly correlated with schizotypal symptoms, and inconsistent

hand use interacted with childhood maltreatment to predict schizotypal symptoms. Although the results of the present research are consistent with the results of much previous research in suggesting that there may be gender differences in the pathways to schizophrenia spectrum disorders (e.g., Walker et al., 2002), a great deal of additional research is clearly needed.

#### *Additional Limitations and Future Directions*

It should be noted that the results of Study 2 cannot be considered an entirely independent replication of Study 1 because the majority of participants in Study 2 had also participated in Study 1. Another limitation of the present research was that we were not able to obtain independent corroboration of participants' own reports of harmful/traumatic life experiences. As a result, we cannot rule out the possibility that some participants may have fabricated or exaggerated their reports. On the basis of the results of past research (e.g., Goodman et al., 2003; Widom & Morris, 1997; Widom & Shepard, 1996; Williams, 1994), there is also reason to suspect that some individuals underreported their experiences of harmful/traumatic experiences. Furthermore, we recognize that some researchers may be reluctant to trust the reports of harmful/traumatic life experiences of individuals with elevated levels of schizotypal symptoms, perhaps suspecting that such individuals are particularly likely to fabricate harmful/traumatic experiences. There are several reasons we are reasonably confident that our measures of harmful/traumatic life experiences are, for the most part, valid. First, we used methods that have been found in the past to provide accurate estimates of harmful/traumatic experiences. For example, we did not simply ask participants whether they had been sexually abused as children, but instead asked about specific behavioral acts that might have taken place. Second, we are reassured by the consistencies between our results and those of J. G. Johnson et al. (1999, 2001, 2000), who relied on documented cases of childhood maltreatment. Third, in a review of the literature, Brewin et al. (1993) concluded that "there is little reason to link psychiatric status with less reliable or less valid recall of early experiences" (p. 82). Fourth, we excluded from Study 2 individuals who met diagnostic Criterion A of schizophrenia; thus, the reports of maltreatment/trauma cannot be attributed to florid psychosis. Fifth, if reports of harmful/traumatic experiences were being driven by elevated levels of schizotypal symptoms, why would such symptoms be more likely to lead individuals to report physical neglect inaccurately than to lead them to report physical and sexual abuse inaccurately; if anything, we would have expected more false reports of physical and sexual abuse than false reports of physical neglect. Finally, past research has often failed to find evidence of elevated rates of childhood maltreatment among individuals with schizophrenia (e.g., Brown & Anderson, 1991; Pribor & Dinwiddie, 1992; Stein, Golding, Siegel, Burnam, & Sorenson, 1988)—if, as such research suggests, individuals with schizophrenia are not particularly prone to fabricate or exaggerate reports of maltreatment, then why expect individuals with elevated levels of schizotypal symptoms to do so? Despite our confidence in the relative veracity of participants' own reports of harmful/traumatic life experiences, we recognize that it will be desirable for future research to obtain independent corroboration of participants' reports. In fact, prospective longitudinal research would be

ideal, though it will unfortunately not be practical for many investigators to be able to carry out such research.

In the present research, participants exhibited a wide range of schizotypal symptoms. Although quite a few participants exhibited odd beliefs and unusual perceptual experiences, relatively few individuals met full diagnostic criteria for SPD. Despite this, levels of schizotypal symptoms were associated with both family history of psychotic disorders and signs of neurodevelopmental disturbance, as would be expected if SPD, as we measured it in our sample, were tapping genuine schizophrenia spectrum psychopathology. Nonetheless, it will be important for future research to examine whether the findings of the present research will replicate in clinical samples with larger proportions of individuals with more severe levels of schizotypal symptoms.

We believe the focus of future research should be on elucidating the mechanisms whereby psychological trauma contributes to schizotypal symptoms. There are two avenues that we think will be particularly worthwhile pursuing. First, there is growing evidence of harmful/traumatic experiences influencing a range of neurobiological outcomes (e.g., De Bellis, Hooper, & Sapia, 2005; Gunnar, 2007; Southwick, Rasmusson, Barron, & Arnsten, 2005; Yehuda, 2006). For example, childhood abuse, as well as traumatic events leading to PTSD, have been found to be associated with disturbances in neurotransmitter systems, the hypothalamic-pituitary-adrenal axis, and both structural and functional brain changes (e.g., Bremner et al., 2003; De Bellis et al., 1994; Hull, 2002; Southwick et al., 1997). Given the extensive theorizing and research linking such neurobiological factors with schizophrenia spectrum disorders (e.g., Walker, Kestler, Bollini, & Hochman, 2004), it seems quite plausible that disruptions in neurobiological systems mediate the links between harmful/traumatic experiences and schizotypal symptoms.

The second avenue we recommend for researchers who wish to understand the link between harmful/traumatic experiences and schizotypal symptoms concerns the possibility that peculiar perceptions and beliefs may play a role in helping individuals cope with, or make sense of, their own experiences. Consistent with this hypothesis, Boden and Berenbaum (2004) found that when community residents were asked about their peculiar beliefs, they typically reported that their beliefs were important to them, had a positive impact on their lives, and served to clarify their understanding of themselves and their world. Thus, even though we believe it is critical to explore how the biological sequelae of harmful/traumatic experiences may contribute to peculiar perceptions and beliefs, we believe it is also important to explore how individuals' perceptions and beliefs may reflect attempts to cope with such experiences. Given that some people's experiences, such as being maltreated by one's parents, violate most people's expectations of how the world ought to work, perhaps it should not be surprising that individuals who survive such experiences are prone to develop perceptions and beliefs that are considered outside of the mainstream.

Our final recommendation for future research is to not think of the development of schizotypal symptoms in terms of a single type of cause (e.g., biological or psychological). The results of the present research, as well as research by other investigators (e.g., Walker, Sabuwalla, & Huot, 2004), indicate that the development of schizophrenia spectrum symptoms is probably best understood as resulting from the additive and sometimes interactive contribu-

tions of a host of factors that gradually unfold over an extended period of time. It is quite possible that the pathways to schizotypal symptoms are far more complex than even suggested by the results of the present research. For example, although we treated harmful traumatic experiences as being distinct from biological factors, there are reasons to think that this is an artificial simplification of reality. Specifically, past research has found that genetic factors can contribute to the likelihood of experiencing significant stressors (e.g., Kendler, Neale, Kessler, Heath, & Eaves, 1993). Thus, researchers wishing to develop models of the development of schizotypal symptoms must ultimately take into account complex factors such as gene–environment correlations (e.g., Rutter et al., 1997).

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