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Perceived threat mediates the relationship between psychosis proneness and aggressive behavior

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Abstract

Psychotic symptoms are associated with aggressive tendencies, but this relationship is both complex and imperfect. In contrast to psychotic disorders, little is known about aggressive behavior and sub-clinical psychotic symptoms (e.g., “psychosis proneness”), which are relatively common in the general population. Threat/control-override (TCO), which is the propensity to overestimate the likelihood that an outside agent will (1) inflict harm (threat) or (2) control one’s behaviors (control-override), has been associated with aggression in both psychiatric and community samples. The purpose of this study was to determine if psychosis proneness is related to aggression, and if one or both aspects of TCO mediate this relationship. We hypothesized that the propensity to overestimate threat would mediate this relationship, but control-override would not. Sixty men and sixty women (mean age = 20.00 years, *sd* = 3.00) with no history of psychotic disorder completed measures assessing psychosis proneness, threat control/override, aggressive history, aggressive ideation, and aggressive behavior. Three structural equation models were tested: (1) Threat and control-override modeled as separate mediating variables, (2) TCO as a unitary mediating latent construct, and (3) TCO considered as part of a psychosis-proneness latent variable. Results indicated that psychosis proneness is positively related to aggression and that the best model fit was obtained when threat and control-override were modeled as separate variables, with mediation through threat alone. The utility of TCO for explaining the relation between psychosis spectrum symptoms and aggression is discussed.

Keywords

Aggression; Psychosis-proneness; Threat; Control-override; Mediation

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1. Introduction

Psychotic symptoms have long been thought to be associated with aggressive tendencies, and this impression has influenced public perception, clinicians, and policy makers (Monahan, 1992). A recent meta-analysis concluded that psychosis is associated with a 49 percent or greater increase in the probability of aggression (Douglas et al., 2009). However, the relationship between psychosis and aggression is complex and imperfect. For example, future violence may be mediated by features associated with schizophrenia (rather than schizophrenia *per se*) such as heightened sensitivity to perceived threat (Elbogen and Johnson, 2009).

Formal psychotic disorders such as schizophrenia, schizoaffective disorder, and delusional disorder, have low base rates in the population, with a lifetime prevalence rates ranging from 0.5–1.5% (Kessler et al., 2005). In contrast, sub-clinical psychotic-like experiences are much more common (Kessler et al., 2005; Mojtabai, 2006) with four-week prevalence rates in young adults ranging from 3.2% to 32.3% (Rössler et al., 2007). Importantly, these experiences can be observed in the absence of any formal psychotic disorder diagnosis (Kessler et al., 2005).

Researchers have identified several trait-like sub-clinical psychotic experiences that are risk factors for the development of a psychotic disorder (Barkus et al., 2006; Chapman et al., 1994). These “psychosis proneness” experiences include perceptual aberrations (Chapman et al., 1994), magical ideation (Gooding et al., 2005), and social anhedonia (Kwapil, 1998). All have been shown to predict psychotic symptoms and schizophrenia-spectrum disorders in longitudinal studies. For example, of 335 individuals tracked for 10 years, those who scored highest on scales designed to assess perceptual aberrations and magical thinking were more likely to develop a schizophrenia-spectrum disorder compared to individuals who scored low on these two scales (Chapman et al., 1994). Social anhedonia may be an even more robust predictor of future psychosis. Specifically, 24% of college students scoring about two standard deviations above the mean on a measure of social anhedonia developed a schizophrenia spectrum disorder at 10 year follow-up, compared to 1% of controls (Kwapil, 1998).

Given the association between psychotic disorders and aggression, it is reasonable to posit that psychosis-proneness may also be a risk factor for aggressive behavior. However, almost no research has examined the relationship between sub-clinical psychotic symptoms and aggressive behavior, and none has examined the relationship between psychosis proneness specifically and aggression. With respect to sub-clinical psychotic symptoms generally, one study reported an association between “psychotic-like experiences” and aggression in a non-institutionalized community sample (Mojtabai, 2006), but another study found no relationship between schizotypal personality traits and aggression (Berman et al., 1998). Hence, the evidence for a relationship between sub-clinical psychotic-like symptoms and aggression is lacking, and the relationship between psychosis proneness *per se* and aggression is not yet known.

Because psychosis does not inevitably lead to aggression, researchers have tried to identify variables related to psychosis that may help to explain this relationship. A constellation of personality traits related to psychosis called threat/control-override (TCO) (Link and Stueve, 1994) has received empirical support as a potential explanatory variable for the psychosis-aggression link and has some grounding in general theories of aggressive behavior. The idea behind TCO is that only psychotic-like experiences that lead someone to fear personal harm (threat) while blocking internal constraints against violence (control-override) precipitate aggression (Link and Stueve, 1994). Accordingly, heightened perceived threat of harm in

combination with the perception that one's thought processes are being controlled by outside forces would be expected to be associated with the expression of aggression, whereas non-threatening visual hallucinations or delusions of grandeur would not (Link and Stueve, 1994). Link and colleagues invoked the notion of "rationality-within-irrationality" to explain TCO's relationship to aggression as (Link and Stueve, 1994). This is the idea that aggression may be perceived as a logical response when an individual is predisposed to misinterpret environmental events as highly threatening or as an effort to control one's behavior.

Early studies assessed TCO using three items from the Psychiatric Epidemiology Research Interview (PERI) (Dohrenwend et al., 1980; Shrout et al., 1988) which is a screening instrument for psychiatric symptoms and violent/illegal behavior. Although TCO includes both threat and control-override, TCO has generally been treated statistically as a single variable in most, but not all (Link et al., 1998; Stompe et al., 2004; Teasdale et al., 2006), studies. A modest but consistent relationship between TCO experiences and aggression has been found in retrospective studies (Link et al., 1999; Stompe et al., 2004; Stueve and Link, 1998). For example, the presence of TCO symptoms conferred twice the risk of violence compared to non-TCO delusions and hallucinations in patients with schizophrenia (Swanson et al., 1996). Moreover, the presence of any TCO symptom is associated with five to ten times likelihood of violence during a six-month follow-up period (Hodgins et al., 2003). An association between TCO and aggression has been found in both men and women (Stueve and Link, 1998), cross-culturally in the United States, Israel, and Austria (Link and Stueve, 1994; Stompe et al., 2004; Stueve and Link, 1998), and using different items to measure TCO (Swanson et al., 1996). The relation has also been observed for both interview (Link et al., 1999; Link and Stueve, 1994; Link et al., 1998; Mojtabai, 2006; Skeem et al., 2006; Swanson et al., 1996) and self-ratings (McNeil et al., 2003) of TCO symptoms, and in both patient (Hodgins et al., 2003; Link and Stueve, 1994; Stompe et al., 2004) and non-patient community (Link and Stueve, 1994; Mojtabai, 2006; Swanson et al., 1996) samples. The latter finding suggests that TCO is a general risk factor for aggression, even for individuals who do not have a diagnosable mental disorder.

Several prospective studies of TCO and aggression have been conducted. Prospectively, TCO has been associated with aggression in psychiatric patients discharged into the community (Hodgins et al., 2003), particularly in men (Teasdale et al., 2006). However, two other prospective studies found no link between TCO and aggression (Appelbaum et al., 2000; Skeem et al., 2006). The latter null findings may be due in part to the inherent difficulty of predicting future aggressive acts.

Because TCO has generally been treated as a single variable combining threat and control-override, little research has been conducted to determine whether the association between TCO and aggression reflects the combination of threat and control-override, or whether one or the other is more strongly associated with aggression. However, the TCO literature to date provides qualified evidence that threat may be more strongly associated with aggression compared to control-override. Among the three studies that have examined threat and control-override independently (Link et al., 1998; Stompe et al., 2004; Teasdale et al., 2006), all three have found a positive association between threat and aggression. Only one study, however, found an association between control-override by itself and aggression (Link et al., 1998). This pattern of findings is not unexpected given that perceived threat or provocation is one of the most replicated and robust predictors of aggression overall (Bettencourt et al., 2006).

To be clear about the distinction between psychosis proneness and TCO, psychosis proneness represents a cluster of personality traits that are stable and indicative of a heightened risk (diathesis) for developing psychosis. In contrast, TCO represents

experiences that might be considered either psychotic or psychotic-like. Moreover, although psychosis is related to TCO, and TCO is in turn related to aggression, TCO has not yet been directly examined as a mediating variable in this relationship. If psychosis proneness is related to aggression, it is also reasonable to propose that this association would be mediated by TCO. Further, whether the threat or control-override aspects of TCO, or both, serve as mediators is an important question. Indeed, individual differences in threat perception have been unequivocally linked to aggression, but there is no empirical evidence outside the psychosis literature that we know of to support the notion that the belief or perception that an outside agent is influencing one's thoughts is associated with aggression. For these reasons, a systematic investigation of the separate and combined roles of threat and control-override as mediators of the psychosis proneness-aggression association is warranted.

In summary, the relationship between psychosis proneness and aggressive behavior is not yet known. Confirming a relation between psychosis proneness and aggression would be important because many more individuals are at-risk for psychotic disorders than are actually diagnosed. Indeed, sub-clinical psychotic symptoms in children have been associated with both later aggression and later development of psychosis (Arseneault et al., 2003). Furthermore, in contrast to formal psychotic disorders, it is not yet known whether psychosis proneness is associated with TCO experiences. However, because TCO symptoms have been associated with aggressive behavior in both patient and non-patient samples it is reasonable to propose that psychosis proneness is also related to TCO and that TCO mediates the relationship between psychosis-proneness and aggression primarily through threat perception. Therefore, the purpose of this study is to (1) determine whether psychosis proneness is related to aggressive behavior in young adults with no history of active psychosis, and (2) test whether threat symptoms, override symptoms, or both explain this relationship. Three structural equation models were tested: (1) Threat and control-override modeled as separate mediating variables for the expected psychosis-proneness and aggression relationship (our proposed model), (2) TCO modeled as a unitary mediating latent construct (comparison model 1), and (3) TCO considered as part of a psychosis-proneness latent variable (comparison model 2).

2. Methods

2.1 Participants

Volunteers ($N = 159$) for a study on "personality and motor-skills" were recruited from undergraduate psychology classes and screened for medical or psychiatric problems using a health questionnaire. Current mood disorder, a life-history of any psychotic disorder, or current use of any psychiatric medication (based on self-report) were exclusionary criteria. Thirty-nine volunteers were excluded from the final sample for the following reasons: 1) fifteen for technical problems with the aggression task (see below); 2) three for current use of psychotropic medication; 3) nine for evidence of random responding on the Chapman scales; 4) three for visual/motor impairment affecting performance on the aggression task; 5) five did not complete the study or provided substantial incomplete data; 6) one had previous experience with the aggression task; and 7) three had more than one of these problem. Thus, the final sample consisted of 120 participants (60 men and 60 women). Excluded individuals did not significantly differ from included participants on any of the study variables (all $ps > .05$). Self-identified racial composition of the final sample was 51% Caucasian, 46% African American, 3% Hispanic, and less than 1% "other." The average age of participants was 20.0 ($sd = 3.0$) years old. Median current household income for the sample was between \$10,000 and \$20,000 per year (range under \$10,000 to over \$100,000 per year). The majority of our sample (96.7%) had never been married. The procedures and consent processes used in this study were approved by the Institutional Review Board for the Protection of Human Subjects at the University of Southern Mississippi.

2.2 Psychosis proneness measures

Psychosis proneness was assessed along three dimensions: perceptual aberration, magical ideation, and social anhedonia. Descriptive statistics for the measures are presented in Table 1. Using the 1.96 standard deviation cut-off for identifying risk for developing schizophrenia spectrum disorder (Kwapil, 1998), 11 individuals (almost 10% of our sample) would qualify as high scorers on one or more of the psychosis proneness scales (see below).

2.2.1 The Perceptual Aberration Scale (PAS) (Chapman et al., 1978)—The PAS consists of 35 true-false items assessing hallucination-like experiences relating to distorted perceptions, primarily distorted bodily perceptions. Items from this scale include, “I have felt that my head or limbs were somehow not my own” and “Parts of my body occasionally seem dead or unreal.” Individuals diagnosed with schizophrenia produce higher scores on the PAS compared to both healthy controls and non-psychotic psychiatric controls (Chapman et al., 1978). The PAS also predicts familial psychosis, schizotypal symptoms, and psychotic-like experiences at 10-year follow-up (Chapman et al., 1994). Internal consistency for this scale is good in both college students ($\alpha = 0.88$) and patients with a psychotic disorder ($\alpha = 0.90$) (Chapman et al., 1978). In our sample α was 0.76.

2.2.2 The Magical Ideation Scale (MIS) (Eckblad and Chapman, 1983)—The MIS consists of 30 true-false items relating to “magical” or illogical thinking, such as belief in astrology or psychic phenomena, and ideas of reference (e.g., “I have felt that there were messages for me in the way things were arranged, like in a store window”). On its face, the MIS appears to assess sub-clinical types of delusional thinking. MIS scores tend to be highly correlated with PAS scores ($r = 0.68$ to 0.70), which is not surprising given that both reflect subclinical manifestations of positive psychotic symptoms. High scores on these scales predict later psychosis, a schizophrenia spectrum disorder diagnosis, and a greater number of psychotic-like experiences (Chapman et al., 1994; Gooding et al., 2005). Internal consistency for the MIS is good, with alphas > 0.80 (Eckblad and Chapman, 1983). Alpha for our sample was 0.77.

2.2.3 The Revised Social Anhedonia Scale (RSAS) (Mishlove and Chapman, 1985)—The RSAS is a 40-item true-false scale measuring “schizoid indifference to other people, but not social anxiety” (Chapman et al., 1994, *p.* 172). The RSAS has been shown to identify individuals with poor social adjustment, and high scores on the RSAS are associated with more psychotic-like experiences (Mishlove and Chapman, 1985). The RSAS improves the prediction of later schizophrenia spectrum disorders when combined with other Chapman scales, such as the Magical Ideation Scale (Kwapil et al., 1997). Alphas ranging from 0.79 to 0.84 in different samples have been reported for the RSAS (Collins et al., 2005). Alpha for our sample was 0.87.

2.3 Threat/Control-Override

Threat/control-override was assessed by self-ratings on the following three questions adapted from the Psychiatric Epidemiological Research Interview (PERI) (Dohrenwend et al., 1980): (1) How often have you felt that your mind was dominated by forces beyond your control?; (2) How often have you felt that thoughts were put into your head that were not your own?; and (3) How often have you felt that there were people who wished to do you harm? Response options ranged from “Never” (0) to “Always” (4). The first two questions relate to control-override experiences, the last question relates to threat experiences. An example of a non-TCO item from the PERI would be “How often have you heard things that other people say they can’t hear?” Note that non-TCO items were not used in this study. The PERI is a widely used measure of psychiatric symptoms with good psychometric characteristics (Dohrenwend et al., 1980), and these items and scaling have been used in lay-

(Link et al., 1998) and self-ratings of TCO (McNiel et al., 2003). In our sample, 61.7% of participants reported at least one threat experience; 26.7% reported at least one control-override experience.

2.4 Aggression Measures

Aggression has been defined as behavior that is intended to harm another individual against their will (Bettencourt et al., 2006). Aggression was assessed in three ways in this study: (1) Self-reported aggressive history, (2) self-reported aggressive tendencies, and (3) aggressive behavior observed in the laboratory using a well-established aggression task.

2.4.1 Life History: The Life History of Aggression (LHA), Aggression subscale (Coccaro et al., 1997)—The Aggression scale of the LHA was used to assess frequency and severity of aggression since adolescence. The LHA Aggression scale consists of five items (angry outbursts, physical fighting, verbal aggression, assaults, and aggression toward objects), with six response options indicating how many times the participant has engaged in the specified behavior ranging from “never happened” (0) to “happened so many times I couldn’t give a number” (5). The LHA has good internal consistency ($\alpha = 0.87$), and test-retest reliability, $r > 0.80$ (Coccaro et al., 1997). For our sample alpha was 0.78. Scores on the LHA Aggression scale are positively correlated with aggressive behavior observed in the laboratory, as well as biologic variables theoretically associated with aggressive behavior (Berman et al., 2009; Coccaro et al., 1996). Men scored higher than women on this measure, $t_{(118)} = 4.38, p < 0.001$ (see Table 1 for descriptive statistics).

2.4.2 Aggressive Disposition: The Buss-Perry Aggression Questionnaire (BPAQ) (Buss and Perry, 1992)—The BPAQ is a 29-item scale which measures aggressive feelings and tendencies. The items use a 5-point Likert-type scale with options ranging from “Extremely unlike me” to “Extremely like me.” Higher scores indicate greater self-perceived aggressiveness. In addition to a total scale score, the BPAQ has four factor analytically derived subscales: Physical aggression, verbal aggression, anger, and hostility. Test-retest reliability and internal consistency for the physical aggression subscale is good, 0.80 and 0.85, respectively (Buss and Perry, 1992). Alpha for our sample was 0.82. Evidence for the validity of both the BPAQ subscales and the total scale score is supported by the association between self-ratings on the BPAQ and peer-ratings of aggressive tendencies (Buss and Perry, 1992). Thus, the physical aggression subscale score was used for this study as an index of aggressive disposition. Men scored higher than women on this measure, $t_{(118)} = 4.35, p < 0.001$.

2.4.3 Aggressive Behavior: The Taylor Reaction-time Task (TRT) (Taylor, 1967)—The TRT is a well-validated laboratory task designed to assess physical aggression. Over forty years of research has provided evidence for the task’s validity and robustness to various modifications (Anderson and Bushman, 1997; Giancola and Chermack, 1998). In the TRT, the participant competes against an increasingly provocative fictitious opponent in a reaction time game during which electric shock is administered and received. Before each reaction time trial, the participant (and ostensibly the opponent) selects a shock from 0 through 10 or 20 by pressing one of 12 keys on a computer keyboard, and the person (participant or opponent) who has the slower reaction time on that trial receives the shock set by the other person before the trial. The faster person does not receive a shock, but sees the shock level the other person set on a computer monitor with an array labeled 0 through 10 and 20. The 10 shock is equivalent to a pain threshold determined before the task. The 9 shock is set at 95% of this maximum, 8 at 90%, 7 at 85%, and so forth. The 20 shock purportedly corresponds to “a severe shock” twice the intensity of a 10. For the 0 response,

no shock is administered. This non-aggressive response option is included to increase the ecological validity of the task but is rarely used.

The TRT consists of 28 reaction time trials with provocation by the opponent increasing to simulate a real-world aggressive encounter and to elicit aggressive responding by the participant. The frequency of wins and losses for the participant (50%) is pre-programmed by the experimenter and computer-controlled. The opponent selects one 20 shock toward the end of the sequence to elicit counter-aggression. The participant “wins” this trial, so the 20 shock is not received by the participant. Extreme (20) shocks are recoded as 11 to minimize the effects of outliers on mean shock (the behavioral index of aggression of interest) before data analysis. During the TRT, the participant is led to believe (via audiotapes of a same-sex confederate) that they are interacting with an opponent of the same gender. Men chose higher shocks on average than women, $t_{(118)} = 2.53, p < 0.05$.

2.5 Procedures

After providing informed consent, participants completed the tasks in a modified counterbalanced order, with half the participants completing the questionnaires then the TRT, and the other half completing the tasks in the reverse order. This was done to control for potential order effects. Results of a recent meta-analysis indicated that gender does not moderate the relation between psychosis and aggression (Douglas et al., 2009) and TCO in some cases seems to predict aggression in both men and women (Stueve and Link, 1998). However, men tend to be more aggressive overall than women in both field (Stueve and Link, 1998) and laboratory (Eagly and Steffen, 1986) studies. Hence, equal numbers of men and women were recruited to determine if gender differences exist in the models tested. Descriptive statistics for all measures are presented in Table 1.

2.6. Data analysis

The hypotheses were tested using three structural equation models. In our proposed model, the three Chapman scales were used as indicators of the Psychosis Proneness latent variable. The two control-override items from the PERI were used as indicators for the Control-Override latent variable, and the threat item from the PERI was used as a single indicator of the latent variable for threat. As a conservative approximation, reliability for threat (0.49) was estimated using the alpha for the three items measuring threat/control-override. Three measures were used as indicators of the Aggression latent variable: The LHA aggression subscale, the physical aggression scale score on the Buss-Perry Aggression Questionnaire, and mean shock selection on the Taylor Reaction-time Task.

Data analyses took place in the following steps with significance testing at the alpha 0.05 level. First, correlation coefficients among the variables were examined. Second, the measurement model for the proposed model was tested to ensure that all indicator variables had adequate loadings onto the proposed constructs. Third, the proposed model was tested structurally, followed by testing of the two mediators (threat and control-override). This was done to determine whether the paths in the model reflected the hypothesized relationships among the constructs. Fourth, two alternative models were tested and compared with the proposed model. The latter two comparison models were designed to test, respectively: 1) threat/control-override as a single mediator; and 2) threat/control-override as additional indicators of psychosis proneness to determine if TCO are better considered additional aspects of psychosis proneness. The analyses were conducted using *Mplus*, version 5.21 (Muthén and Muthén, 2007).

3. Results

3.1 Bivariate Relations

As can be seen in Table 2, the three indicators of psychosis proneness were significantly correlated with each other. The three aggression measures were also significantly correlated. Except for the relation between the Perceptual Aberrations Scale (PAS) and the Taylor Reaction-time Task (TRT), the three psychosis proneness scales were significantly related to all aggression measures. The three threat/control-override (TCO) items were significantly correlated. The relationships between the psychosis proneness scales and the TCO items varied as a function of the psychosis proneness scales, with PAS being correlated with all three TCO items, the Magical Ideations Scale (MIS) with two TCO items, and Revised Social Anhedonia Scale (RSAS) with one TCO item. The threat TCO item correlated significantly with two of the three aggression measures, as did one of the control-override items (thought control). The second control-override item (thought insertion) did not correlate with any measure of aggression.

3.2 Proposed Model

The proposed model is shown in Figure 1. Because the indicators for the aggression latent variable were on materially different scales, the Life History of Aggression scale and Buss Perry Aggression Questionnaire scores were rescaled, and divided by 2 and 4 respectively, so that their variances were in a similar range (L. Muthén, personal communication, March 26, 2010). The first step was to test the measurement model where all latent variables are correlated with each other. The proposed measurement model showed good fit, $\chi^2_{(22)} = 20.56$, $p = 0.55$, CFI = 1.00, TLI = 1.00, and RMSEA = 0.000 with 90% CI: 0.000 – 0.071. All factor loadings were significant at $p < 0.01$ (Table 3) and factor correlations are presented in Table 4. These results suggest that the indicator variables adequately reflect the latent variables in the model. Because there were gender differences in our aggression measures, we tested for any effects of gender on the fit of the measurement model by comparing two models using the chi-square difference test. In one model the factor loadings were free to vary for each gender; in the other the factor loadings were constrained to be equal across both genders. Both models fit the data well (unconstrained model $\chi^2_{(48)} = 44.71$, $p = 0.57$, TLI = 1.00, CFI = 1.00, RMSEA = 0.000, 90% CI: 0.000 to 0.075; constrained model $\chi^2_{(57)} = 52.44$, $p = 0.65$, TLI = 1.00, CFI = 1.00, RMSEA = 0.000, 90% CI: 0.000 to 0.068). The chi-square values for these models were not significantly different suggesting that gender does not significantly affect model fit in the measurement model. Overall, the model fit and path indices of the measurement model suggest that the indicator variables adequately tap into the proposed latent variables.

Before proceeding to the proposed structural model, the direct relationship between Psychosis Proneness and Aggression (e.g., with no mediators in the model) was tested and found to be significant ($\beta = 0.47$, $p < 0.001$) with good model fit, $\chi^2_{(8)} = 7.83$, $p = .45$, TLI = 1.00, CFI = 1.00, RMSEA = 0.000, 90% CI: 0.000 to 0.106. The fit of the proposed structural model was tested next (see Figure 1). The standard errors of measurement in the structural models were estimated using bias-corrected bootstrapping with 5000 draws (Preacher and Hayes, 2008). The bootstrap procedure helps address issues associated with moderate sample sizes (Yung and Bentler, 1996). In the proposed model, the relationship between Psychosis Proneness and Aggression is mediated through two separate and distinct variables, Threat and Control-override. The model thus includes a direct path from Psychosis Proneness to Aggression and two indirect paths from Psychosis Proneness to Aggression, one through Threat and one through Control-override. Following the procedure for testing multiple mediators described in Preacher and Hayes (2008), both the indirect paths and the direct path from Psychosis Proneness to Aggression were left free to vary

simultaneously (Preacher and Hayes, 2008). A significant effect of psychosis proneness on aggression is not necessary for mediation to take place (Preacher and Hayes, 2008). This test of mediation differs from that laid out in Baron and Kenny in that the direct effect is not controlled statistically, and need not be substantially smaller than the indirect path in order to demonstrate mediation (Baron and Kenny, 1986).

The overall model fit of the structural model was good, $\chi^2_{(23)} = 22.21$, $p = 0.51$, TLI = 1.00, CFI = 1.00, RMSEA = 0.000, 90% CI: 0.000 to 0.072. Mediation by Threat and/or Control-override was determined by examining the direct and specific indirect effects of Psychosis Proneness on Aggression. As can be seen in Figure 1, the standardized direct effect of psychosis proneness on aggression was not significant with the mediators in the model. The specific standardized indirect effect of Psychosis Proneness on Aggression through Threat ($\beta = .22$, $p < 0.05$), however, was significant, indicating that threat does mediate the relation between psychosis proneness and aggression. The indirect effect of Psychosis Proneness on Aggression through Control-override ($\beta = -.02$) was not significant. These results indicate that control-override does not mediate the relation between psychosis proneness and aggression.

3.3 Comparison Model 1

We next tested a model in which the three TCO symptoms were treated as indicators of a single latent Threat/Control-override (TCO) variable (Figure 2). The fit for the measurement model, where the variables were all correlated, was adequate, $\chi^2_{(24)} = 35.77$, $p = 0.06$, TLI = 0.92, CFI = 0.95, and RMSEA = 0.064, 90% CI 0.000 to 0.105. All factor loadings were significant at $p < 0.01$. We also tested for gender differences and the chi-square values for these models were not significantly different suggesting that gender does not significantly affect model fit in the measurement model.

The structural model and the measurement model are equivalent, so the fit statistics are the same. In the structural model, the direct path from TCO to Aggression was not significant. In addition, the indirect effect of Psychosis Proneness on Aggression through TCO ($\beta = .14$) was also not significant, suggesting that no mediation took place through the overall TCO variable.

3.4 Comparison Model 2

Finally, we tested a model in which threat and control-override items were used as indicators of the Psychosis Proneness latent variable (Figure 3). The fit for the measurement model, where the latent variables were correlated, was poor, $\chi^2_{(26)} = 48.63$, $p < 0.05$, TLI = 0.86, CFI = 0.90, and RMSEA = 0.085, 90% CI 0.047 to 0.112. All factor loadings were significant at $p < 0.01$. We also tested for gender differences, and the chi-square values for these models were not significantly different suggesting that gender does not significantly affect model fit in the measurement model.

The structural model and the measurement model are equivalent, so the fit statistics are the same. In the structural model, the direct path from Psychosis Proneness to Aggression was significant (see Figure 3).

3.5 Proposed versus Comparison Models

Fit statistics for the proposed and comparison models are presented in Table 5. As can be seen in the table, using either the change in chi-square test, or the change in CFI > 0.01 (Cheung and Rensvold, 2002), the fit for both comparison models was significantly worse than the proposed model. The RMSEA also increases materially in the comparison models.

These results provide evidence to support the notion that the proposed model that treats threat and control-override as separate latent variables provides a better fit for the data.

4. Discussion

The purpose of this study was to examine (using multiple measures and a series of structural equation models) whether psychosis proneness is related to aggression, and whether the relationship is mediated by threat experiences, control-override experiences, or both. As we predicted, psychosis proneness is associated with aggressive behavior. All psychosis proneness and aggression measures except for the PAS and laboratory aggression were correlated, and this one non-significant effect was in the expected direction. Furthermore, the overall direct effect of the latent variable Psychosis Proneness on Aggression was significant and in the positive direction. This finding indicates that the relationship between psychosis and aggression extends beyond clinically diagnosed psychosis or active psychotic symptoms, and that people who are predisposed to psychosis, even if they may never go on to develop a psychotic disorder, are at higher risk for being aggressive. The relationship between psychosis proneness and aggression is not trivial. Many more individuals are at risk for a psychotic disorder than will actually go on to develop one (Link et al., 1992; van Os et al., 2001). When one considers that psychosis proneness and sub-clinical psychotic-like experiences are more prevalent than diagnosed psychotic disorders, it becomes clear that sub-clinical manifestations of psychosis are a reliable and important indicator of aggressive acts in the general population. However, because aggression is multi-determined, psychosis proneness is one among many dispositional variables that are associated with aggression. Future research should therefore investigate whether variables such as aggressive ideation or anger moderate the relationship between psychosis proneness and aggression.

We were also interested in whether threat and control-override, either separately or combined, explain the relationship between psychosis proneness and aggression. Overall, a model treating threat and control-override as separate latent variables produced better fit statistics than a model treating TCO as a single latent variable. Indeed, we found that TCO considered as a single variable was not related to aggression, and does not mediate the relation between psychosis proneness and aggression. It appears that for psychosis proneness, treating threat and control-override as distinct variables provided a better model for our data. As predicted, when threat and control-override were considered separately, threat was associated with both psychosis proneness and aggression and mediated the relation between the two, but control-override did not mediate this relation. The association between perceived threat and aggression is worthwhile to consider. In contrast to control-override, threat or actual provocation is one of the most replicated antecedents of aggression (Bettencourt et al., 2006; Chermack et al., 1997). The underlying biologic correlates of response to threat have long been of interest to researchers, and recent research has demonstrated that response to threat may be under neurobiologic control (Berman et al., 2009). Determining the neurobiologic pathways for threat-related aggression in the presence of psychotic experiences would therefore be worthy of future study. Alternatively, cognitive factors may be responsible for the relationship between psychosis, threat perception, and aggression. For example, research has suggested that psychotic individuals have impaired theory of mind (e.g., the ability to understand the thoughts, feelings, and motivations of others), and this deficit has been associated with paranoia (Bentall and Taylor, 2006). Examining cognitive processing in psychosis-related aggression should therefore be addressed in future studies.

The lack of mediation by control-override is not likely due to a low base rate of these experiences in our sample. Although more bizarre than threat experiences, control-override experiences were still reported by 26.7% of our sample, which is consistent with other

estimates of psychotic-like symptoms in the general population (Rössler et al., 2007; van Os et al., 2001) and previous TCO studies. Control-override experiences were reported by 16.8% and 18.5% of Link et al.'s (1998) non-institutionalized community sample and 1% of the sample was rated by a psychiatrist to have a control-override delusion. In contrast to our findings, Link et al. (1998) reported an association between these control-override experiences and aggression. Future research may help determine if these conflicting results are due to study differences in psychiatric assessment, samples used, or how aggression was measured.

In sum, our results suggest that psychosis proneness, or the diathesis for later psychotic disorder, is associated with increased aggressive behavior. Furthermore, this relationship is at least partially mediated through the threat experiences, such that psychosis proneness is associated with a greater tendency to feel threatened, which in turn is associated a greater tendency to act out aggressively. These results are consistent with the robust literature on the role of provocation (real or perceived) in eliciting aggressive behavior. The results also call into question the notion of "rationality within irrationality" in regards to the psychosis and aggression link, particularly with regard to control-override experiences. It is not clear that this theory alone can explain why threat experiences lead to aggression and it clearly is not sufficient to explain why control-override experiences lead to aggression, if they do at all. Perhaps the relationship between control-override and aggression depends on the presence of other factors, such as impairments in executive functioning or cognitive disorganization. Our results also suggest that threat and control-override are distinct concepts. This is not surprising given that on their face threat and control-override items reflect apparently very different types of experiences. It is also reasonable to suspect that these experiences may be mediated through different neural pathways, although this is a question for future research.

Several aspects of the measurement models bear discussion. For comparison model 1, the factor loading of Threat onto the latent variable TCO is larger than some other factor loadings in the model (for example, Social Anhedonia on Psychosis Proneness). However, the inclusion of Social Anhedonia with Psychosis Proneness is supported on theoretical grounds. Specifically, social anhedonia represents a negative symptom of psychosis and is a robust predictor of later psychotic experiences and schizophrenia spectrum disorder despite its comparatively lower correlation with the positive symptom indicators of psychosis proneness (Chapman et al., 1994; Gooding et al., 2005). Similarly, we believe that aggressive behavior observed in the laboratory adequately reflected the aggression latent variable despite its relatively low loading. The somewhat lower loading is not unexpected given that the other two measures are self-ratings of trait aggression. Furthermore, an extensive body of literature supports the validity of laboratory-based aggression paradigms (viz a viz associations with self-reported aggression and with separate but related constructs; Anderson and Bushman, 1997). In contrast, threat and control-override are on the face very different types of experience and there is a dearth of research showing that these experiences should be treated as a single variable or index, though they have often been treated as such in previous studies. Overall, we found a model treating threat and control-override as separate but correlated latent variables to be the most tenable. Furthermore, this model also worked equally well for both men and women.

Despite the use of college students as participants, this study had several strengths compared to previous studies of psychotic-like symptoms in non-patient samples and aggression, including (1) The use of measures for psychosis proneness that are well-validated for non-clinical populations, (2) the use of both prospective behavioral and retrospective self-report measures of aggression, and (3) the application of structural equation modeling (SEM) to test mediation.

Several limitations of the study bear mentioning. First, although we used a multi-modal assessment and structural equation models to examine the associations and mechanisms of interest, due to the fact that our study employed a cross-sectional design we are not able to demonstrate mediation in the causal sense. Specifically, we are not able to show with our data the temporal relations among the variables to support causal inferences. Our model is based on previous research showing that psychosis proneness predicts an increase in psychotic-like experiences and that psychotic-like experiences are associated with aggression. Future longitudinal research is needed to answer questions about causality.

The small number of items used to assess control-override is a second limitation of this study. Unfortunately, researchers have not yet developed any *a priori* measure specifically intended to assess TCO. Instead, previous research on TCO has relied on a small number of questions that have been drawn from screener measures. The development of a longer measure of threat and control-override symptoms with good psychometric properties would be beneficial to the research in this area.

Another limitation of this study is the lack of assessment of non-TCO psychotic-like experiences for comparison. Most previous researchers have found that TCO experiences are associated with aggression whereas other, non-TCO, psychotic-like experiences are not (Link and Stueve, 1994), but see Mojtabai (2006). The inclusion of a scale for this type of experience would have made an interesting comparison in testing our argument that threat is the mechanism through which psychosis proneness has its effect on aggression.

Finally, there is considerable research to suggest that psychosis proneness and subclinical manifestations of psychosis (i.e., “psychotic-like”) experiences are not uncommon in the population. However, integrating research studies that use different terminology to describe these similar concepts is tricky at best. There is a need for clarity in the literature as to how these concepts are operationally defined and assessed if the results of these studies are to be meaningfully integrated. With regard to this study, we consider psychosis proneness to represent a personality trait, reflecting a certain “style” of perceiving and understanding the world. As previous researchers have noted, this trait is associated with increased likelihood of having certain psychotic and sub-clinical psychotic-like experiences that are distinct from psychosis proneness.

This study has implications for the prevention of aggressive behaviors associated with sub-clinical psychotic symptoms, as well as aggressive tendencies exhibited by the minority of individuals who go on to develop a psychotic disorder. It has been suggested that violence by individuals with a psychotic disorder could be prevented by monitoring early signs of psychotic symptoms and treating concurrent aggressive behaviors before the onset of psychosis (Arseneault et al., 2003). Therefore both psychosis proneness and threat perception may be important factors to assess when doing violence risk assessments. In addition, early interventions for psychosis should also include components that reduce the expression of aggressive behaviors, especially in response to perceived threat.

Although the main purpose of our study was to examine the relationship between psychosis proneness and aggression, the results raise interesting questions about what role control-override symptoms actually play in aggression in clinical populations. Of course, caution should be taken when generalizing beyond the current sample. However, future research might use similar techniques (i.e., structural equation modeling) to better understand these relationships in a clinical sample. Additionally, factor analyses have suggested at least 3 independent dimensions of psychotic symptoms: positive, negative, and disorganized (Andreasen et al., 1995). Our scales assessed positive- and negative-like traits, but not disorganized traits. It would be informative to look at this variable in a community sample

as well in relation to aggression. Finally, it is important to emphasize that although psychosis is a risk-factor for aggressive behavior, caution should be taken not to overgeneralize the findings to all people who are psychotic or showing signs of prodromal psychosis. Clearly, most individuals with these symptoms are not aggressive, and the relative risk conveyed by psychosis may be lower than that of other, more common, factors, such as male gender and substance abuse (Monahan, 1992; Swanson et al., 1990).

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References

- Anderson CA, Bushman BJ. External validity of 'trivial' experiments: The case of laboratory aggression. *Review of General Psychology* 1997;1:19–41.
- Andreasen NC, Arndt S, Alliger R, Miller D. Symptoms of schizophrenia: Methods, meanings, and mechanisms. *Archives of General Psychiatry* 1995;52:341–351. [PubMed: 7726714]
- Appelbaum PS, Robbins PC, Monahan J. Violence and delusions: Data from the MacArthur Violence Risk Assessment Study. *American Journal of Psychiatry* 2000;157:566–572. [PubMed: 10739415]
- Arseneault L, Cannon M, Murray R, Poulton R, Caspi A, Moffitt TE. Childhood origins of violent behaviour in adults with schizophreniform disorder. *British Journal of Psychiatry* 2003;183:520–525. [PubMed: 14645023]
- Barkus E, Stirling J, Hopkins R, Lewis S. The presence of neurological soft signs along the psychosis proneness continuum. *Schizophrenia Bulletin* 2006;32:573–577. [PubMed: 16407574]
- Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology* 1986;51:1173–1182. [PubMed: 3806354]
- Bentall RP, Taylor JL. Psychological processes and paranoia: Implications for forensic behavioural science. *Behavioral Sciences & the Law* 2006;24:277–294. [PubMed: 16773623]
- Berman ME, Fallon AE, Coccaro EF. The relationship between personality psychopathology and aggressive behavior in research volunteers. *Journal of Abnormal Psychology* 1998;107:651–658. [PubMed: 9830252]
- Berman ME, McCloskey MS, Fanning JR, Schumacher JA, Coccaro EF. Serotonin augmentation reduces response to attack in aggressive individuals. *Psychological Science* 2009;20:714–720. [PubMed: 19422623]
- Bettencourt BA, Talley A, Benjamin AJ, Valentine J. Personality and aggressive behavior under provoking and neutral conditions: A meta-analytic review. *Psychological Bulletin* 2006;132:751–777. [PubMed: 16910753]
- Buss AH, Perry M. The Aggression Questionnaire. *Journal of Personality and Social Psychology* 1992;63:452–459. [PubMed: 1403624]
- Chapman LJ, Chapman JP, Kwapil TR, Eckblad M, Zinser MC. Putatively psychosis-prone subjects 10 years later. *Journal of Abnormal Psychology* 1994;103:171–183. [PubMed: 8040487]
- Chapman LJ, Chapman JP, Raulin ML. Body-image aberration in schizophrenia. *Journal of Abnormal Psychology* 1978;87:399–407. [PubMed: 681612]
- Chermack ST, Berman M, Taylor SP. Effects of provocation on emotions and aggression in males. *Aggressive Behavior* 1997;23:1–10.
- Cheung GW, Rensvold RB. Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling* 2002;9:233–255.
- Coccaro EF, Berman ME, Kavoussi RJ. Assessment of life-history of aggression: Development and psychometric characteristics. *Psychiatry Research* 1997;73:147–157. [PubMed: 9481806]

- Coccaro EF, Berman ME, Kavoussi RJ, Hauger RL. Relationship of prolactin response to d-fenfluramine to behavioral and questionnaire assessments of aggression in personality-disordered men. *Biological Psychiatry* 1996;40:157–164. [PubMed: 8830948]
- Collins LM, Blanchard JJ, Biondo KM. Behavioral signs of schizoidia and schizotypy in social anhedonics. *Schizophrenia Research* 2005;78:309–322. [PubMed: 15950438]
- Dohrenwend BP, Shrout PE, Egri G, Mendelsohn FS. Nonspecific psychological distress and other dimensions of psychopathology. *Archives of General Psychiatry* 1980;37:1229–1236. [PubMed: 7436685]
- Douglas KS, Guy LS, Hart SD. Psychosis as a risk factor for violence to others: A meta-analysis. *Psychological Bulletin* 2009;135:679–706. [PubMed: 19702378]
- Eagly AH, Steffen VJ. Gender and aggressive behavior: A meta-analytic review of the social psychological literature. *Psychological Bulletin* 1986;100:309–330. [PubMed: 3797558]
- Eckblad M, Chapman LJ. Magical ideation as an indicator of schizotypy. *Journal of Consulting and Clinical Psychology* 1983;51:215–225. [PubMed: 6841765]
- Elbogen EB, Johnson SC. The intricate link between violence and mental disorder: Results from the national epidemiologic survey on alcohol and related conditions. *Archives of General Psychiatry* 2009;66:152–161. [PubMed: 19188537]
- Giancola PR, Chermack ST. Construct validity of laboratory aggression paradigms: A response to Tedeschi and Quigley (1996). *Aggression and Violent Behavior* 1998;3:237–253.
- Gooding DC, Tallent KA, Matts CW. Clinical status of at-risk individuals 5 years later: Further validation of the psychometric high-risk strategy. *Journal of Abnormal Psychology* 2005;114:170–175. [PubMed: 15709824]
- Hodgins S, Hiscoke UL, Freese R. The antecedents of aggressive behavior among men with schizophrenia: A prospective investigation of patients in community treatment. *Behavioral Sciences & the Law* 2003;21:523–546. [PubMed: 12898506]
- Kessler RC, Birnbaum H, Demler O, Falloon IRH, Gagnon E, Guyer M, Howes MJ, Kendler KS, Shi L, Walters E, Wu EQ. The prevalence and correlates of nonaffective psychosis in the National Comorbidity Survey Replication (NCS-R). *Biological Psychiatry* 2005;58:668–676. [PubMed: 16023620]
- Kwapil TR. Social anhedonia as a predictor of the development of schizophrenia- spectrum disorders. *Journal of Abnormal Psychology* 1998;107:558–565. [PubMed: 9830243]
- Kwapil TR, Miller MB, Zinser MC, Chapman J, Chapman LJ. Magical ideation and social anhedonia as predictors of psychosis proneness: A partial replication. *Journal of Abnormal Psychology* 1997;106:491–495. [PubMed: 9241953]
- Link BG, Andrews H, Cullen FT. The violent and illegal behavior of mental patients reconsidered. *American Sociological Review* 1992;57:275–292.
- Link BG, Monahan J, Stueve A, Cullen FT. Real in their consequences: A sociological approach to understanding the association between psychotic symptoms and violence. *American Sociological Review* 1999;64:316–332.
- Link, BG.; Stueve, A. Psychotic symptoms and the violent/illegal behavior of mental patients compared to community controls. In: Monahan, J.; Steadman, HJ., editors. *Violence and mental disorder: Developments in risk assessment*. University of Chicago Press; Chicago, IL: 1994. p. 137-159.
- Link BG, Stueve A, Phelan J. Psychotic symptoms and violent behaviors: Probing the components of 'threat/control-override' symptoms. *Social Psychiatry and Psychiatric Epidemiology* 1998;33:S55–S60. [PubMed: 9857780]
- McNiel DE, Eisner JP, Binder ReL. The relationship between aggressive attributional style and violence by psychiatric patients. *Journal of Consulting and Clinical Psychology* 2003;71:399–403. [PubMed: 12699034]
- Mishlove M, Chapman LJ. Social anhedonia in the prediction of psychosis proneness. *Journal of Abnormal Psychology* 1985;94:384–396. [PubMed: 4031235]
- Mojtabai R. Psychotic-like experiences and interpersonal violence in the general population. *Social Psychiatry and Psychiatric Epidemiology* 2006;41:183–190. [PubMed: 16467952]

- Monahan J. Mental disorder and violent behavior: Perceptions and evidence. *American Psychologist* 1992;47:511–521. [PubMed: 1595982]
- Muthén, BO.; Muthén, LK. *Mplus user's guide*. 5. 2007.
- Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods* 2008;40:879–891. [PubMed: 18697684]
- Rössler W, Riecher-Rössler A, Angst J, Murray R, Gamma A, Eich D, van Os J, Gross VA. Psychotic experiences in the general population: a twenty-year prospective community study. *Schizophrenia Research* 2007;92:1–14. [PubMed: 17363221]
- Shrout PE, Lyons M, Dohrenwend BP, Skodol AE, Solomon M, Kass F. Changing time frames on symptom inventories: Effects on the Psychiatric Epidemiology Research Interview. *Journal of Consulting and Clinical Psychology* 1988;56:267–272. [PubMed: 3372834]
- Skeem JL, Schubert C, Odgers C, Mulvey EP, Gardner W, Lidz C. Psychiatric symptoms and community violence among high-risk patients: A test of the relationship at the weekly level. *Journal of Consulting and Clinical Psychology* 2006;74:967–979. [PubMed: 17032100]
- Stompe T, Ortwein-Swoboda G, Schanda H. Schizophrenia, delusional symptoms, and violence: The threat/control-override concept reexamined. *Schizophrenia Bulletin* 2004;30:31–44. [PubMed: 15176760]
- Stueve A, Link BG. Gender differences in the relationship between mental illness and violence: Evidence from a community-based epidemiological study in Israel. *Social Psychiatry and Psychiatric Epidemiology* 1998;33:S61–SS67. [PubMed: 9857781]
- Swanson JW, Borum R, Swartz MS, Monahan J. Psychotic symptoms and disorders and the risk of violent behaviour in the community. *Criminal Behaviour and Mental Health* 1996;6:309–329.
- Swanson JW, Holzer CE, Ganju VK, Jono RT. Violence and psychiatric disorder in the community: Evidence from the Epidemiologic Catchment Area surveys. *Hospital & Community Psychiatry* 1990;41:761–770. [PubMed: 2142118]
- Taylor SP. Aggressive behavior and physiological arousal as a function of provocation and the tendency to inhibit aggression. *Journal of Personality* 1967;35:297–310. [PubMed: 6059850]
- Teasdale B, Silver E, Monahan J. Gender, threat/control-override delusions and violence. *Law and Human Behavior* 2006;30:649–658. [PubMed: 16967327]
- van Os J, Hanssen M, Bijl RV, Vollebergh W. Prevalence of psychotic disorder and community level of psychotic symptoms: An urban-rural comparison. *Archives of General Psychiatry* 2001;58:663–668. [PubMed: 11448373]
- Yung, Y-F.; Bentler, PM. Bootstrapping techniques in analysis of mean structure and covariance structures. In: Marcoulides, GA.; Schumacker, RE., editors. *Advanced structural equation modeling: Issues and techniques*. Erlbaum; Mahwah, NJ: 1996. p. 195-226.

Figure 1.
Proposed model testing threat and control-override as separate mediational paths.

Note: * $p < 0.05$, ** $p < 0.01$

Figure 2.
Comparison model 1 testing threat/control-override as a single mediator.

Note: * $p < 0.05$, ** $p < 0.01$

Figure 3. Comparison model 3 testing threat and control-override as additional indicators of psychosis proneness.

Table 1

Means, standard deviations, and ranges for men, women, and overall.

Measure	Men			Women			Overall		
	Mean	sd	Range	Mean	sd	Range	Mean	sd	Range
PAS	4.3	3.2	0–15	3.2	3.4	0–20	3.8	3.3	0–20
MIS	7.3	4.3	0–18	7.3	4.6	1–20	7.3	4.4	0–20
RSAS	11.3	7.4	1–34	9.1	5.7	1–26	10.2	6.7	0–34
TRT	6.0	2.5	0–11	4.9	2.2	0–11	5.4	2.4	0–11
BPAQ	23.7	7.1	11–37	18.7	5.6	10–34	21.2	6.8	10–37
LHA	9.9	4.7	2–21	6.3	4.1	0–17	8.1	4.8	0–21
TCO 1	0.3	0.8	1–4	0.2	0.5	1–3	0.2	0.7	1–4
TCO 2	0.5	0.9	1–5	0.5	0.9	1–4	0.5	0.9	1–5
TOC 3	1.4	1.3	1–5	1.1	1.1	1–5	1.2	1.2	1–5

PAS = Perceptual Aberration Scale, MIS = Magical Ideation Scale, RSAS = Revised Social Anhedonia Scale, TRT = Taylor Reaction-time Task mean shock, BPAQ = Buss Perry Aggression Questionnaire physical aggression subscale, LHA = Life History of Aggression, TCO 1 = Thought Control, TCO 2 = Thought Insertion, TCO 3 = Threat (see methods section). *Note.* $n = 60$ men and $n = 60$ women.

Table 2

Variance-covariance (correlation coefficient) matrix

	PAS	MIS	RSAS	TRT	BPAQ	LHA	TCO 1	TCO 2	TCO 3
PAS	11.02	(0.66**)	(0.29**)	(0.18)	(0.32**)	(0.32**)	(0.27**)	(0.26**)	(0.30**)
MIS	9.60	19.09	(0.30**)	(0.20*)	(0.27**)	(0.21*)	(0.18)	(0.30**)	(0.37**)
RSAS	6.35	8.77	44.13	(0.22*)	(0.22*)	(0.20*)	(0.11)	(0.18)	(0.29**)
TRT	1.39	2.04	3.55	5.72	(0.21*)	(0.20*)	(0.04)	(-0.01)	(0.16)
BPAQ	1.81	1.99	2.48	0.86	2.90	(0.63**)	(0.22*)	(0.10)	(0.35**)
LHA	2.55	2.20	3.19	1.11	2.54	5.62	(0.20*)	(0.05)	(0.33**)
TCO1	0.58	0.51	0.50	0.06	0.25	0.31	0.43	(0.46**)	(0.24**)
TCO 2	0.80	1.18	1.06	-0.01	0.15	0.11	0.28	0.83	(0.22*)
TCO 3	1.18	1.93	2.26	0.45	0.71	0.94	0.19	0.24	1.41

PAS = Perceptual Aberration Scale, MIS = Magical Ideation Scale, RSAS = Revised Social Anhedonia Scale, TRT = Taylor Reaction-time Task mean shock, BPAQ = Buss Perry Aggression Questionnaire physical aggression subscale, LHA = Life History of Aggression, TCO 1 = Thought Control, TCO 2 = Thought Insertion, TCO 3 = Threat (see methods section).

Note:

*
 $p < .05$,

**
 $p < .01$.

Variances are displayed on the diagonal (in bold). Correlations are above the diagonal (in parentheses) and covariances are below the diagonal.

Table 3

Factor loadings for the measurement model (Proposed model)

Indicator	Psychosis Proneness	Aggression	Control-Override	Threat.
PAS	0.81			
MIS	0.80			
RSAS	0.39			
TRT		0.27		
BPAQ		0.82		
LHA		0.77		
TCO 1			0.65	
TCO 2			0.72	
TCO 3				0.81

PAS = Perceptual Aberration Scale, MIS = Magical Ideation Scale, RSAS = Revised Social Anhedonia Scale, TRT = Taylor Reaction-time Task mean shock, BPAQ = Buss Perry Aggression Questionnaire physical aggression subscale, LHA = Life History of Aggression, TCO 1 = Thought Control, TCO 2 = Thought Insertion, TCO 3 = Threat (see methods section). *Note:* All loadings significant at $p < 0.01$. There are 22 df for the measurement model.

Table 4

Factor correlations for the measurement model (Proposed model)

Factor	Psychosis Proneness	Aggression	Control-Override
Aggression	0.47**		
Control-Override	0.47**	0.24	
Threat	0.53**	0.54**	0.41**

*Note:**
 $p < 0.05$,**
 $p < 0.01$.

Table 5

Model fit statistics for the proposed and comparison models

	Chi-square	df	TLI	CFI	RMSEA
Proposed ^a	22.21	23	1.00	1.00	0.000
Comparison 1 ^b	35.77	24	0.92	0.95	0.064
Change ^c	13.56	1	-0.08	-0.05	0.064
Comparison 2 ^d	48.63	26	0.86	0.90	0.085
Change ^e	26.42	3	-0.14	-0.10	0.085

^a = Proposed model. Threat and control-override are treated as separate mediators.

^b = Comparison model 1. Threat/control-override is treated as a single mediator.

^c = Comparison model 1 minus proposed model.

^d = Comparison model 2. Threat and control-override are additional indicators of psychosis proneness. No mediators in the model.

^e = Comparison model 2 minus proposed model.