The Relation of Schizotypy and Aberrant Salience to Social Cognition as Assessed Through Responses to Video-Taped Interpersonal Interactions: A Cross-Sectional Study

by

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ABSTRACT

Although social cognitive deficits are considered a hallmark trait of schizophrenia, research on schizotypy and social cognition is inconsistent. The present study examines the associations among schizotypy, aberrant salience, and social cognition. Schizotypy and aberrant salience were assessed continuously using the Schizotypal Personality Questionnaire Brief Revised (SPQ-BR) and the Aberrant Salience Inventory (ASI). Social cognition was examined using The Awareness of Social Inference Test (TASIT), an audio-visual paradigm that taps into multiple domains of social cognition. Data from 849 undergraduate students was analyzed. Results indicated that schizotypy overall was not associated with social cognitive deficits. However, when schizotypy was analyzed dimensionally, positive schizotypy was associated with social cognitive impairments. Further, aberrant salience was revealed to be consistently associated with social cognitive impairments, except when positive schizotypy was included in the model. This suggests the possibility that positive schizotypy could mediate the association between aberrant salience and social cognition. Overall, this study highlights the importance of focusing on positive schizotypy and aberrant salience in future investigations of social cognitive difficulties in psychosis.

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INTRODUCTION

1. Social cognition

Social cognition describes a variety of cognitive processes related to perceiving, recognizing, processing, understanding, and responding to social interactions and situations (Penn et al., 1997; Adolphs, 2009; Cowan et al., 2019). This conceptualization suggests a need for the ability to quickly understand, process, and react to social stimuli in order to successfully engage in social interactions. Schizophrenia-spectrum disorders (e.g. schizophrenia, schizoaffective disorder, "cluster A" personality disorders including schizotypal personality disorder), by definition constitute abnormalities in social and cognitive processing. Therefore, it is perhaps unsurprising that individuals who experience psychotic symptomology show impairments in social cognition, a process that is necessary for successful social interactions (Penn et al., 2008). Impaired social abilities negatively impact one's ability to maintain relationships and engage in social situations (McDonald et al., 2006). As such, social cognitive deficits greatly impact social, work, and community functioning, as well as independent living (Couture et al., 2006; Fett et al., 2011**).**

Although social cognitive deficits are considered a hallmark trait of schizophrenia, the research on schizotypy- a sub-clinical metric of psychosis proneness- and social cognition is inconsistent (van Os & Reininghaus, 2016; Cowan et al., 2019). There are several factors that may contribute to the inconsistent findings regarding relations between schizotypy and social cognition. First, social cognition is a broad

umbrella term for a variety of more specific domains. Because of this, there is lack of consensus among researchers regarding a) the definition of social cognition and b) how to measure it. In fact, these disparities are so profound, that they led to the initiation of the Social Cognition Psychometric Evaluation (SCOPE) study (Pinkham et al., 2014). The purpose of this study was to create a taskforce of social cognition experts (namely the "RAND panel") with the explicit goals of developing a consensus of the categories/domains of social cognition and identifying the best existing measures of social cognition (Pinkham et al., 2014). The RAND panelists deliberated and agreed upon five domains of social cognition: social perception, theory of mind, attributional style, self-awareness, and emotion processing (Cowan et al., 2019; Healey et al., 2016; Pinkham et al., 2014). This domain specificity is critical, because research has shown that deficits in social cognition in individuals with schizophrenia-spectrum disorders are domain-specific (Couture et al., 2006; Cowan et al., 2019; Green et al., 2015). Thus, an impairment in one domain of social cognition does not necessarily translate to impairments in all domains; conversely, if a domain remains intact, deficits may exist in others.

Another contributing factor to the inconsistent findings regarding relations between schizotypy and social cognition involves the measurement properties of social cognition tasks. Although RAND panelists recommend the "best" existing tasks from over 100 nominated measures (Pinkham et al., 2014), several of the most popular measures have questionable ecological validity. Specifically, these measures lack real-

world depictions of socialization, often asking participants to read a passage and answer questions or to analyze static, outdated photos that do not represent the dynamic audio-visual nature of real social interactions. For example, the Reading the Mind in the Eyes Test (Baron-Cohen et al., 2001) asks participants to infer the mental state of others using black-and-white photos cropped to only show the eye region of a person's face. Again, this measure lacks the animated nature of true socialization; there are no non-verbal cues, voice inflection, or action-reaction processes. This brings into question both the ecological and construct validity of these tasks, which may contribute to the conflicting results across studies.

2. Schizotypy

Though there has been a substantial increase in research on schizophrenia-spectrum disorders and social cognition over the past several decades, much remains unknown (Green et al., 2008). Schizophrenia research is particularly difficult due to obstacles in population access and heterogeneity in symptomatology, which is often confounded by effects of comorbid psychiatric disorders and medication (Barrantes-Vidal et al., 2015; Szoke et al., 2014). Fortunately, schizophrenia-spectrum disorders exist on a continuum, wherein psychosis can be studied as it exists both clinically and sub-clinically (Fleming et al., 2012; Szoke et al., 2014; van Os et al., 2009; Chapman & Chapman, 1980). Sub-clinical psychosis is also referred to as schizotypy, which can be thought of as a latent liability for "psychosis-proneness" or schizophrenia (Lenzenweger, 2015; van Os & Reininghaus, 2016). Because schizotypy and schizophrenia possess the same

phenotypic expression in varying degrees of severity, they can be assessed as related constructs (Raine, 2006; Chapman & Chapman, 1980). As such, it is important to understand schizotypy not only for its own sake, but also because it provides a unique opportunity to further our understanding of psychotic disorders, which can aid in prevention and treatment efforts and lessen its social and economic burden (Raine, 2006). Although this approach has promise, not much is known about the association between sub-clinical psychosis and social cognition (van Os & Reininghaus, 2016; Cowan et al., 2019).

3. Psychosis and social cognition

Although research suggests that it is possible for an individual to experience psychotic symptoms in the absence of full-blown psychosis, schizotypes still experience dysfunction. At the same time, results of studies on schizophrenia and schizotypy do not always perfectly mirror one another. In regards to theory of mind (ToM),- a key subdomain of social cognition described as the ability to infer others' mental states- research thus far has found reliable ToM deficits in people with schizophrenia (Bora et al., 2009; Chung et al., 2014; Savla et al., 2013; Sprong et al., 2007; Bora & Pantellis, 2016; Bliksted et al., 2014; Green et al., 2015; Sarfati et al., 1997). Researchers have consistently posited that schizophrenia is closely related to impaired ToM (Corcoran et al., 1995; Hardy-Baylé, 1994; Frith, 1992) and the results from two meta-analyses estimate the effect size of ToM deficits in schizophrenia to be approximately Cohen's d= 1.0 (Bora et al., 2009; Savla et al., 2013).

However, research on ToM and schizotypy is less consistent (Cowan et al., 2019). For example, in a college sample of 52 persons high in schizotypy and 42 persons low in schizotypy, Jahshan and Sergi (2007) did not find an association between high schizotypy and impaired ToM relative to those low in schizotypy. This null finding was corroborated by Deptula and Bedwell in their 2015 paper investigating schizotypy, autobiographical memory, and ToM, in which higher schizotypy scores related to better performance rather than poorer performance on a ToM measure (Deptula & Bedwell, 2015). Conversely, a recent meta-analysis analyzed several studies that showed that individuals with first-episode psychosis have ToM deficits compared to healthy controls, and that these impairments closely mirror deficits found in schizophrenia (Healey et al., 2016). Similarly, in a more recent meta-analysis of theory of mind and schizotypy, a small negative association between schizotypy and theory of mind was found; the association was more significant in studies that used extreme-group designs (which categorizes individuals into dichotomous groups based on either very high or very low schizotypy scores) compared to those that did not utilize this study design (Bora, 2020).

Researchers noted that disparate results are likely the result of divergent ideas concerning the factor structure of social cognition and/or inconsistent—and perhaps not ecologically valid—measures of social cognition across studies (Morrison et al., 2013; Healey et al., 2016). There was also heterogeneity in measures of schizotypy and study design (e.g. extreme-group design vs continuous variable design) (Bora, 2020). Further, it is important to note that within the Bora (2020) meta-analysis, more than half of the 24

studies did not find an association between theory of mind and global schizotypy, nor did they suggest a specific association between the dimensions of schizotypy and ToM (Bora, 2020).

A similar pattern of results has been found within the emotion processing subdomain of social cognition and schizophrenia and schizotypy, respectively. Research on emotion processing and schizophrenia is extensive and relatively consistent, wherein people with schizophrenia demonstrate persistent impaired emotion processing (Hoekert, 2009; Li et al., 2010; Savla et al., 2013). However, individuals with schizotypy show more varied patterns. Several studies have found that schizotypes exhibit impaired emotion recognition (Abbot & Green 2013; van't Wout et al., 2005; Brown & Cohen, 2010; Lee et al., 2015; Williams et al., 2007; Poreh et al., 1994; Mikhailova et al., 1996), but others have not been able to replicate these results (Jahshan & Sergi, 2007; Toomey & Schuldberg, 1995; Waldeck & Miller, 2000). A review by Phillips and Seidman (2008) noted that schizotypal groups (e.g., individuals at high-risk for schizophrenia) demonstrated similar patterns of emotional processing impairments as those with schizophrenia, but to a less severe extent.

Overall, mixed results in the literature regarding ToM, emotion processing, and schizotypy can be attributed to a multitude of factors. First, differing conceptualizations of social cognition coupled with differences in measurement have often been cited as a major factor of differing findings in the psychosis and social cognition literature (Pinkham et al., 2014). Second, differential profiles of symptomatology, severity of

impairment, and/or confounding comorbid mental health disorders can lead to differing patterns of social cognitive deficits in individuals with schizotypy. For example, common psychological adjustment difficulties, including anxiety and depression, are highly comorbid with psychosis, but not every study controls for these factors (Lewandowski et al., 2006;). Additionally, as mentioned before, it seems that social cognitive deficits may be domain-specific (Couture et al., 2006; Cowan et al., 2019). Therefore, it is possible that specific social cognition domains could wax and wane in unique patterns along the psychosis spectrum, so while several components may be impaired others could be intact at any given time (Cowan et al., 2019).

Another factor to consider is the relation between schizotypy and general neurocognitive deficits. Evidence from several studies suggests that social cognition and basic neurocognition, though related, are distinct from one another (Allen et al., 2007; Pinkham & Penn, 2006; Fett et al., 2011). In fact, some studies have shown that schizotypes perform normally on basic neurocognitive measures, though as cognitive load increased, schizotypes trended toward poorer performance (Aguirre et al., 2008; Chun et al., 2013; Cohen et al., 2012). In fact, Jahshan and Sergi (2007) found no difference in verbal secondary memory or executive functioning performance between high and low schizotypes. This indicates that social cognition should be examined as a distinct construct from basic neurocognitive functioning as it relates to schizotypy.

4. Aberrant salience

The inconsistent findings regarding relations between schizotypy and social cognition suggest the possibility of a third variable that may better explain the association between these two constructs. However, very few (if any) researchers have adopted a mechanistic approach to analyzing associations between social cognitive deficits and schizotypy. To bridge this gap, the present study investigated aberrant salience, a construct that has long been associated with psychosis, suggesting that individuals with schizotypy have a tendency to overattribute importance to otherwise innocuous stimuli. Salience processing is central to understanding the dimensional symptomatology of psychosis (Maher, 1974; Kapur, 2003). A longstanding hypothesis posits that delusions and hallucinations are a direct result of the undue importance that people with psychosis place on otherwise innocuous stimuli- a process known as aberrant salience (Kapur, 2003). As a result, distorted attributions and internal representations occur, causing cognitive-perceptual abnormalities.

Some researchers have even suggested that aberrant salience is an indicator of psychosis proneness (Cicero et al., 2010). Aberrant salience has also been proposed as the underlying mechanism of the propensity toward abnormal perceptual experiences in general populations (Kapur, 2003; van Os et al., 2001; Chun et al., 2020). Interestingly, salience processing has been increasingly linked to the negative dimension of schizotypy in recent years. Deficits in motivation, self-awareness, and emotion recognition, coupled with anhedonia and apathy may be associated with failures of learning, attention, and adaptive salience responses. (Cowan et al., 2019; Jensen et al., 2008; Roiser et al., 2009;

Waltz et al., 2007). Despite showing deficits in emotion recognition (Seghers et al., 2011)—which is often viewed as a negative symptom of schizotypy— schizotypes demonstrate an increased attention to emotional stimuli, a trait linked to the positive dimension of schizotypy (Kerns, 2005). Thus, although some research suggests that positive symptoms may heighten salience, other research argues that negative symptoms may dampen stimuli salience (Kapur, 2003; Haselgrove et al., 2016). Of note, in a study by Roiser and colleagues (2009), there was no difference between schizophrenics and healthy controls on measures of aberrant salience; however, patients with delusions demonstrated significantly higher aberrant salience than those without. The same study also found associations between negative symptoms and aberrant salience, suggesting a common, underlying impairment in psychosis may be the inability to distinguish between important and unimportant stimuli (Roiser et al., 2009).

Thus, positive schizotypy may be a manifestation by which innocuous stimuli are processed as overly important, whereas negative schizotypy may be the manifestation by which insufficient salience is given to important stimuli (Chun et al., 2019). With this in mind, aberrant salience may a) be a better indicator of social cognitive deficits than schizotypy and/or b) play an important role in better understanding the association between schizotypy and social cognition.

5. Aberrant salience and social cognition

If aberrant salience is at least in part the driving mechanism of psychotic symptomatology, it follows that impaired salience processing could affect the processes

necessary to engage in successful social interactions. Impaired social cognition is present throughout all stages of psychosis development, even during premorbid and prodromal phases during which schizotypal traits may be nascent (Amminger et al., 2012; Corcoran et al., 2015). Aberrant salience hinders an individual's ability to allocate proper attention to relevant stimuli, thereby affecting proper information processing required for social cognitive functioning. In fact, there is evidence that aberrant salience impairs emotion recognition, a key construct of social cognition (Comparelli et al., 2020). However, there is a dearth of research on these topics and more investigation is necessary to understand associations among schizotypy, aberrant salience, and social cognition.

6. Present study

Taking these factors into consideration, the current study a) assesses multiple domains of social cognition, b) utilizes an ecologically valid measure of social cognition, and c) includes aberrant salience in the investigation of relations between schizotypy and social cognition. Specifically, this study employed The Awareness of Social Inference Test (TASIT; McDonald et al., 2003), a relatively new measures that taps into multiple domains of social cognition, namely emotion processing and theory of mind (ToM). TASIT utilizes an audio-visual paradigm that depicts naturalistic interactions affording improved ecological validity relative to many existing measures. Accordingly, we assessed schizotypy and aberrant salience and their relation to emotion processing and ToM specifically. We hypothesized that those with higher schizotypy- analyzed both overall and dimensionally- would show impaired social cognition relative to those with

lower schizotypy. Similarly, we hypothesized that those with higher aberrant salience would demonstrate impaired social cognition. Lastly, considering the possibility that aberrant salience is a factor may affect psychosis symptoms, we hypothesized that aberrant salience would interact with schizotypy such that higher levels of aberrant salience combined with higher levels of schizotypy would be associated with the greatest impairment of social cognition.

Method

Participants

Participants were 955 undergraduate students from a large southwestern university in the United States. Student participants were enrolled in a Psychology 101 course in Spring 2021 and recruited via the department's research participation website. To protect participants' privacy, no discernible or intentionally identifying information was linked to the online survey. At the end of the survey, participants were directed to another link where they could fill in their contact information in order to receive credit necessary to pass the course and/or to obtain optional extra credit. This additional questionnaire could not be linked to any survey information or responses. All participants gave informed consent. Participation was voluntary and anonymous. Precautions were taken to ensure one response per participant. This study was approved by the University Institutional Review Board.

Measures

Schizotypy

The Schizotypal Personality Questionnaire Brief Revised was used to measure schizotypy (SPQ-BR; Cohen et al., 2010). This measure employs a 5-point Likert scale with options ranging from *"Strongly Disagree"* to *"Strongly Agree"* in responding to questions such as, "*Do you sometimes feel that other people are watching you?"* or "*I am an odd, unusual person."* In addition to being a reliable and valid measure of schizotypy, the SPQ-BR has a more sensitive response format than the SPQ Brief and is significantly shorter than the original 78-item SPQ (Cohen et al., 2010). The SPQ-BR has acceptable reliability and validity in normed samples (Cohen et al., 2010), as well having good reliability in the current study (Cronbach's alpha = .91).

Social Cognition

A shortened version of The Awareness of Social Inference Test (TASIT-S; Honan, et al., 2016) was used to assess social cognition. TASIT-S is an empirically validated short version of the full TASIT (McDonald et al., 2003), an audiovisual measure that presents naturalistic conversations between two people. Part 1 of the test evaluates emotion perception, whereas Parts 2 and 3 assess theory of mind/social inference. Part 1 (Emotion Evaluation Test) has 10 videos ranging from 15 to 60 seconds in which one or two people are filmed engaging in everyday conversation. Following each video, participants are asked to choose from a set of seven emotional terms that they think the speaker was exhibiting: angry, sad, happy, revolted (disgusted), anxious (fearful), surprised, and neutral. Part 2 (Social Inference- Minimal) is comprised of 9 videos (15-60 s each) and examines the participant's ability to perceive social inference,

specifically the use of sarcasm. As in Part 1, each video depicts one or two people engaging in everyday conversation. Four questions follow each video asking the participant to report what the person in the video was *doing, saying, thinking,* and *feeling* with response options of "*yes*", "*no*" and "*don't know*". Part 3 (Social Inference-Enriched) has 9 videos (15-60 s each), four of which depict a scene with a person telling a white lie and 5 scenes of a person employing sarcasm. Part 3 includes additional information that informs the viewer of the speaker's true beliefs, such as a verbal aside or a visual cue that indicates the true nature of the interaction. The response options are the same as Part 2. Participants with >%20 "don't know" responses were excluded from analysis.

TASIT-S has demonstrated good ecological validity (McDonald et al., 2004), construct validity, and test-retest reliability (Honan et al., 2016; McDonald et al., 2006).

Aberrant Salience

The Aberrant Salience Inventory (ASI; Cicero et al., 2010) is a 29-item yes/no questionnaire that measures aberrant salience. Responses indicating aberrant salience are assigned a score of 1 and answers that are not indicative of aberrant salience are scored as 0. The ASI measures several correlated factors of aberrant salience: 1) increased feelings of significance; 2) sharpening of senses; 3) impending understanding, 4) heightened emotionality, and 5) heightened cognition. The ASI has acceptable internal consistent reliability as well as convergent, discriminant, and construct validity (Cicero et al., 2010). In my sample, each of the subscales had good internal consistency, with Cronbach's

alpha coefficients ranging from .65 to .72 as well as having good overall reliability in the current sample (Cronbach's alpha = .91). To create a composite ASI score, scores were averaged across all 29 items.

Covariates

Depression

Participants completed the Patient Health Questionnaire-9 (PHQ-9), a 9-item scale that assesses depression severity over the past two weeks (Kroenke et al., 2001). Participants rated each of the 9 items on a 4-point scale, ranging from '0'= Not at all, to '3' = Nearly every day. Total sum scores ≤4 suggest minimal depression which may not require treatment. Scores 5-9 suggest mild depression which may require only watchful waiting and repeated PHQ-9 at follow-up. Scores 10-14 suggest moderate depression severity; patients should have a treatment plan ranging from counseling, to follow-up, and/or pharmacotherapy. Scores 15-19 suggest moderately severe depression; patients typically should have immediate initiation of pharmacotherapy and/or psychotherapy. Scores 20 and greater suggest severe depression. This measure has been shown to be a reliable and valid measure of depression severity (Kroenke et al., 2001) and to have good reliability in the current sample (Cronbach's alpha = .89).

Anxiety

Participants completed the Generalized Anxiety Disorder Questionnaire (GAD-7; Spitzer et al., 2006), a 7-item scale that assesses anxiety symptoms. Participants reported how often in the past 2 weeks they experienced certain symptoms (i.e. "worrying",

"restlessness", and "irritability") using a 4-point Likert scale (e.g. "not at all sure" and "nearly every day." This measure has demonstrated good internal consistency, validity, and reliability (Spitzer, et al., 2006) and good reliability in the current sample (Cronbach's alpha = .92).

Sex

Participants reported their sex given the options Male or Female.

Overview of Statistical Analyses

All analyses were conducted using IBM SPSS Statistics (Version 27) statistical software. First, bivariate regression was used to examine schizotypy overall (SPQ Total) as a predictor of each outcome (TASIT Part 1, TASIT Part 2, and TASIT Part 3). Then, hierarchical regression was used to analyze the unique contributions of schizotypy, aberrant salience, and their interactions to TASIT performance. In the first model, each schizotypy term (SPQ Total, SPQ Positive, SPQ Negative, and SPQ Disorganized) were entered into the model with covariates (sex, anxiety, and depression). In the second model, aberrant salience (ASI) was added, and in the third model the interaction between schizotypy and aberrant salience was added. Non-dichotomous variables were mean centered in order to more easily interpret the parameters estimates.

Results

A total of 955 responses were recorded. Participants who did not view all survey items or who completed the survey in less than five minutes were excluded. If less than 80% of questions on a given measure were not answered, these responses were also

treated as missing. A total of 849 participants remained after these exclusions (72% female; M_{age}= 19.93, *SD*= 2.36).

See Appendix A for figures describing correlations, descriptive statistics, and sex effects. As expected, moderate to strong positive correlations were found among the SPQ scores (positive, negative, and disorganized), among each part of TASIT-S, and between ASI and SPQ scores (Appendix A). Of note, SPQ Disorganized and TASIT Part 3 were significantly positively correlated, indicating that, as disorganized schizotypy increased, social cognition- as measured by TASIT Part 3- improved (Tables A1 and A4).

Anxiety and depression were not associated with TASIT performance. However, robust sex effects were demonstrated for all parts of TASIT, such that females consistently outperformed males ($p < .001$; Table Appendix B). Aberrant salience was negatively correlated with the Emotion Evaluation component of TASIT (Part 1) for females, but not for males (Table 2).

Regression analyses revealed no significant associations between SPQ Total and any of TASIT scores (*p* values >.05) (Tables B1-B3). SPQ Positive was inversely related with all three parts of TASIT (Tables B4-B6). SPQ Negative did not significantly predict any TASIT scores (*p* values >.05) (Tables B7-B9). SPQ Disorganized was not associated with TASIT Part 1 or Part 2, but was positively associated with Part 3 (Tables B10-B12). The interaction term between SPQ and aberrant salience was not a significant predictor for any outcome, regardless of whether SPQ was analyzed overall or dimensionally.

The addition of aberrant salience as a predictor did not change the statistical significance of any of the above associations (Appendix B). When added to the model with SPQ Total, aberrant salience was negatively related to TASIT Part 1 and TASIT Part 3. Aberrant salience accounted for unique variance in TASIT Part 1 scores (R^2 = .038, *F-change* (1, 838) = 7.54, $p < .05$) and TASIT Part 3 scores (R^2 = .026, *F-change* (1, 818) = 4.79, $p < .05$), but not TASIT Part 2 scores.

When added to the model with SPQ Positive, aberrant salience was not associated with any part of TASIT, nor did it account for a significant variance in the model. When added to the model with SPQ Negative, aberrant salience negatively associated with all three parts of TASIT. The addition of aberrant salience accounted for a significant increase in variance for all three parts of TASIT (TASIT Part 1, R^2 = .037, *F-change*(1, 838) = 10.07, $p < .05$; TASIT Part 2, R^2 = .029, *F-change*(1, 831), $p < .05$; and for TASIT Part 3, R^2 = .026, *F-change*(1, 818) = 4.79, $p < .05$).

When added to the model with SPQ Disorganized, aberrant salience was negatively associated with all three parts of TASIT. The addition of aberrant salience accounted for a significant increase in variance for all three parts of TASIT (TASIT Part 1, R^2 = .038, *F-change*(1, 838) = 10.94, $p < .001$; TASIT Part 2 R^2 = .03, *F-change*(1, 831)= , $p < .05$; TASIT Part 3, R^2 = .044, *F-change*(1, 818) = 9.53, $p < .05$).

Discussion

This study investigated associations among schizotypy, aberrant salience, and social cognition. Results revealed that schizotypy showed varying patterns of associations with

social cognition. Specifically, schizotypy overall did not show associations with social cognition; the same null pattern of associations was found for negative schizotypy and the interaction between schizotypy and aberrant salience, contradicting our hypotheses. However, positive schizotypy was associated with social cognitive deficits, supporting our hypothesis at least in part. Interestingly, disorganized schizotypy was robustly positively associated with TASIT Part 3. This finding was surprising because disorganized psychosis has previously been linked to impaired social cognition/functioning (Hardy-Baylé, 1994; Sarfati et al., 1997). However, some researchers have argued that the SPQ does not properly measure the disorganized dimension of schizotypy and that other measures should be considered when assessing disorganized dimension of schizotypy (Kwapil et al., 2018; Gross et al., 2014). Another possible explanation for this finding is that increased endorsement of disorganized symptoms suggests is related to regarding oneself as an odd person, which may affect their day-to-day social interactions. Specifically, TASIT Part 3 assesses the participant's ability to discriminate between white lies and sarcastic exchanges. Therefore, disorganized persons may have more frequent exposure to these types of interactions than non-disorganized persons, thus improving their performance in these domains. Lastly, it has been found that the inclusion of verbal material in social interaction paradigms improves disorganized persons performance in ToM tasks, which is explicitly incorporated in TASIT Part 3, in contrast to TASIT Part 2 (Sarfati et al., 1999; Sarfati et al., 2000; McDonald et al., 2004; Honan et al., 2016).

In contrast to schizotypy, aberrant salience showed consistent associations with social cognitive impairments. This suggests that aberrant salience is generally a better indicator of social cognitive deficits than schizotypy. However, the association between aberrant salience and social cognition becomes non-significant when positive schizotypy is included as a predictor in the model. Further, positive schizotypy on its own is a robust predictor of social cognitive deficits. Thus, the patterns of these data suggest the possibility of a mediation model, by which positive schizotypy mediates the relationship between aberrant salience and social cognition (Baron & Kenny, 1986). This suggestion is reasonable, as aberrant salience and the positive symptomatology of schizotypy have been regarded as closely related constructs. Specifically, it has been argued that positive symptoms (such as hallucinations, delusions, and paranoia) affect one's ability to properly infer others' states of mind, and that aberrant salience may be the driving mechanism of positive psychosis (Kapur, 2003; Frith, 1992). Another theory is that psychosis may cause individuals to hypermentalize/over-attribute meaning to the cause of social interactions, which directly implicates heightened aberrant salience as a mechanism that negatively affects social abilities in individuals with psychosis (Brüne et al., 2011; Walter et al., 2009). However, it would be inappropriate to claim mediation according to these data, as this study is cross-sectional and prohibits the assumption of casualty. Thus, future studies should investigate the associations, as our results point toward the likelihood of potentially mediated effects.

Though the mixed pattern of associations between schizotypy and social cognition in this study did not support our hypothesis, they were not altogether surprising. The extant literature on schizotypy and social cognition is muddled and the small corpus of studies that have investigated schizotypy and TASIT specifically have found mixed results as well (Deptula & Bedwell, 2015; Abbott et al., 2013; Jahshan & Surgi, 2007; Quidé et al., 2018). For reasons yet unknown, ToM- which TASIT measures- seems to be less implicated in schizotypy, with some studies even showing better theory of mind performance compared to controls (Cowan et al., 2019). This suggests that schizotypy is either a) not severe enough to reliably demonstrate social cognitive deficits as it does in schizophrenia, b) not consistently impaired in the specific subdomains measured in this study (e.g., emotion processing and ToM), or c) some combination of both (Cowan et al., 2019; Jahshan & Sergi, 2007). Even in individuals with schizophrenia, it has been suggested that social cognitive deficits vary and deficits may be dependent on the current symptomatic state of the individual (Balogh et al., 2014; Bliksted et al., 2017). For example, Maat et al. (2015) found that social cognitive deficits, specifically emotion processing abilities, varied with remission status in schizophrenia, bolstering the argument that these impairments are state-dependent and may fluctuate over time. As such, these theories provide some context for the surprising results in which disorganized schizotypy was associated with better social inference in TASIT Part 3.

Due to the cross-sectional nature of this study, it is important to exercise caution in interpreting the findings, particularly in regard to the temporal and/or causal nature of the

relations among the variables examined. It is also important to recognize that this study relied solely on self-report measures, which are subject to bias. Additionally, TASIT has limited psychometric information, as do many social cognition measures, and the normative samples for the task contain primarily WEIRD participants (Henrich et al., 2010), as did our study (Pinkham et al., 2014; McDonald et al., 2004; Honan et al., 2016). Further, the clinical population included in the original TASIT studies included individuals with acquired brain injuries and did not include a group with active psychopathology, though TASIT was based on a task used to model social skills for individuals with schizophrenia (McDonald et al., 2004). As such, future studies should incorporate more culturally and ethnically diverse samples, include experimental groups with a variety of psychopathologies, and give attention to the psychometric properties of TASIT.

Though social cognition and neurocognition seem to be distinct constructs (Allen et al., 2007; Pinkham & Penn, 2006; Fett et al., 2011), it is important to recognize that schizotypes occasionally demonstrate neurocognitive impairments (Barrantes-Vidal et al., 2003; Raine et al., 1992; Park & McTigue, 1997). These findings fluctuate across studies, as some researchers have found no differences between schizotypes and controls in their neurocognitive abilities (Chun et al., 2013 Lenzenweger & Gold, 2000; Raine et al., 1992; Condray & Steinhauer, 1992) and those who do often uncover subtle deficits when compared to those found in schizophrenia-proper (Dinn et al., 2002). Despite these inconsistencies, future studies should include neurocognitive measures as control

variables in their studies so as to ensure that they are addressing possible confounding effects of neurocognitive deficits in their outcomes.

In regards to the clinical utility of these findings, it should be noted that, although aberrant salience was statistically related to social cognitive deficits, the models overall (including both schizotypy and aberrant salience) accounted for minimal variance in social functioning (ranging from 2% to 4%). Neurocognitive measures that assessed secondary verbal memory, immediate memory, and executive functioning have been shown to account for 20% to 40% of the variance in social functioning, which was actually considered a limiting factor in these studies (Couture et al., 2006; Green et al., 2000). Therefore, it is necessary to consider the narrow clinical utility of targeting aberrant salience in intervention efforts focusing on improving social functioning in individuals with psychosis.

The findings of this study suggest that aberrant salience and positive schizotypy are risk factors for social cognitive impairment. More specifically, aberrant salience seems to be a better indicator of social cognitive deficits than schizotypy, except when positive schizotypy is included in the model. The patterns of these findings suggest the possibility of mediated effects, which should be investigated in future studies with data appropriate for mediation analysis. Additionally, future studies should continue to employ more naturalistic measures of social cognition and collect data from a wide variety of populations, including diverse ethnic groups and those with differing psychopathologies.

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APPENDIX A

CORRELATION MATRIX, SCATTER PLOTS, DESCRIPTIVE STATISTICS, AND SEX EFFECTS

Table A1

Correlation matrix of SPQ, SPQ subscales, ASI, and TASIT

		TASITPt 1	TASITPt 2	TASITPt 3	SPQTotal	SPQPos	SPQNeg	SPQDis	ASI
TASITPt2		.390**	--						
	Sig.	.000							
TASITPt3		.430**	.608**	--					
	Sig.	.000	.000						
SPQTotal		-.006	-.014	.025	--				
	Sig.	.857	.681	.470					
SPQPos		-.090**	-.065	-.060	.845**	--			
	Sig.	.009	.058	.083	.000				
SPQNeg		.064	.005	.037	.779**	.429**	--		
	Sig.	.064	.876	.286	.000	.000			
SPQDis		.029	.045	.115**	.777**	.541**	.431**	--	
	Sig.	.392	.197	.001	.000	.000	.000		
ASI		-.097**	-.064	-.073*	.393**	.440**	.153**	.350**	--
	Sig.	.005	.066	.035	.000	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table A2

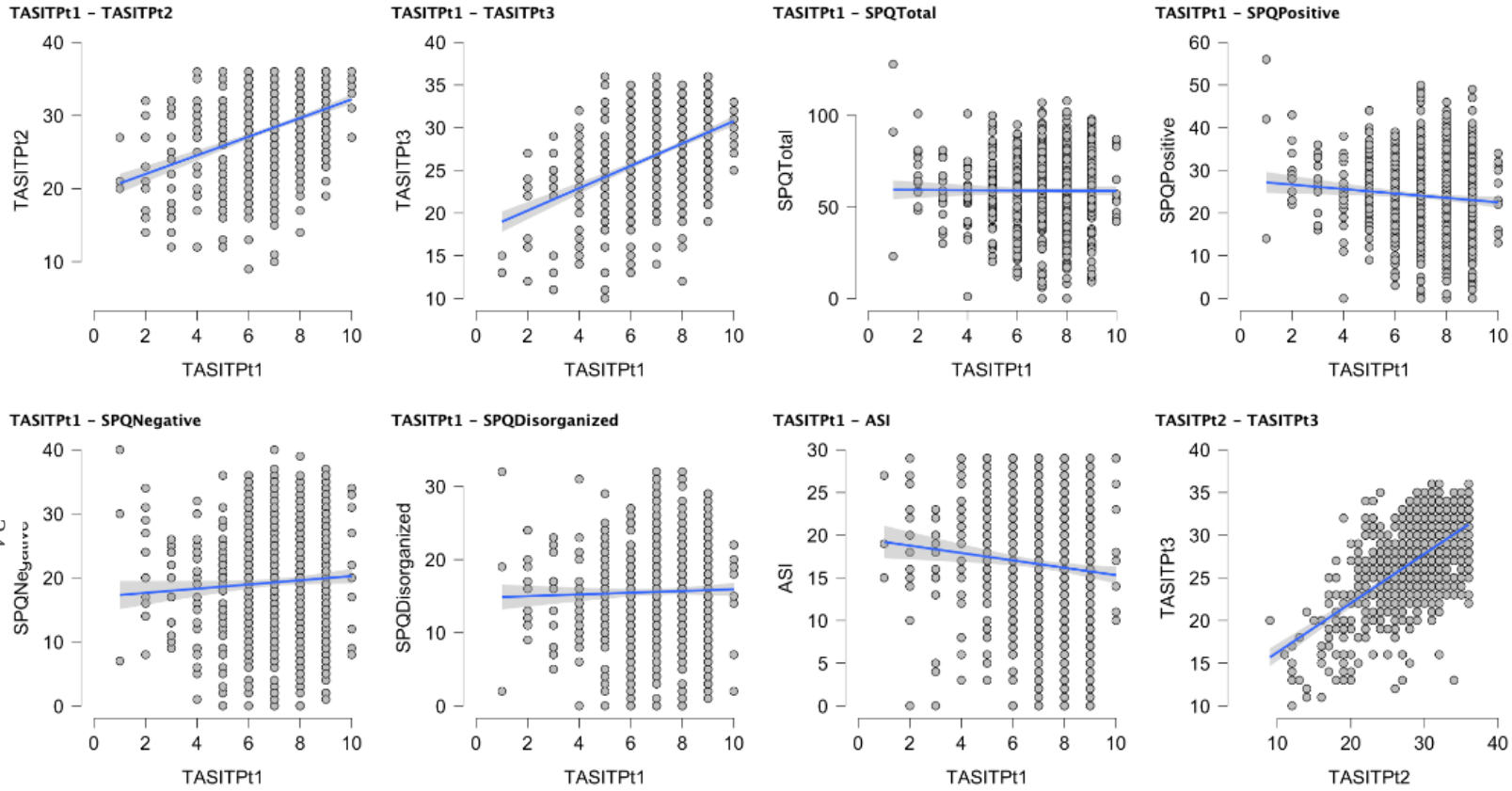
TASITPt1 - TASITPt2
TASITPt2
TASITPt1
TASITPt1 - TASITPt3
TASITPt3
TASITPt1
TASITPt1 - SPQTotal
SPQTotal
TASITPt1
TASITPt1 - SPQPositive
SPQPositive
TASITPt1
TASITPt1 - SPQNegative
SPQNegative
TASITPt1
TASITPt1 - SPQDisorganized
SPQDisorganized
TASITPt1
TASITPt1 - ASI
ASI
TASITPt1
TASITPt2 - TASITPt3
TASITPt3
TASITPt2

Table A3

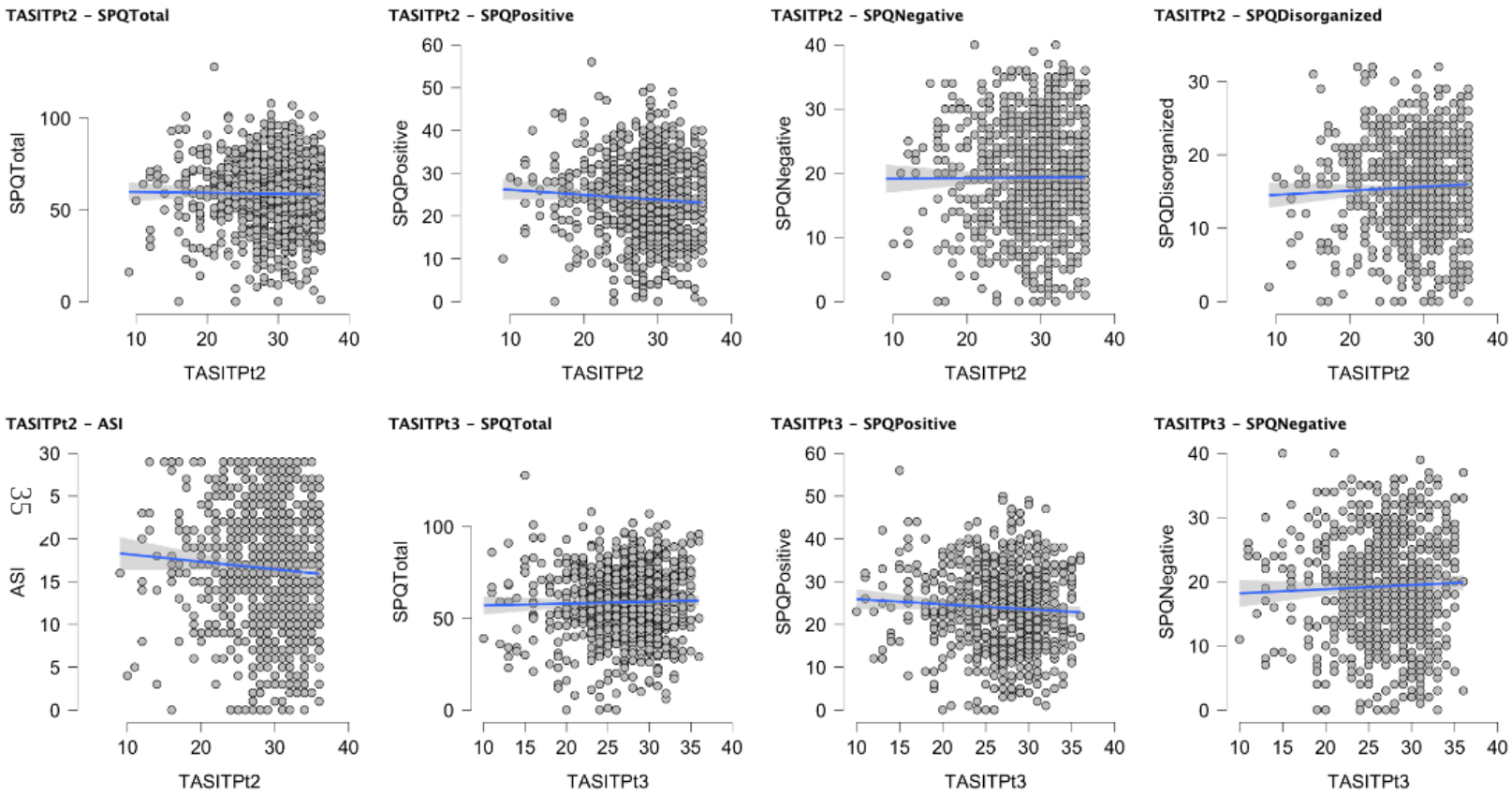
TASITPt2 – SPQTotal
SPQTotal
TASITPt2
TASITPt2 – SPQPositive
SPQPositive
TASITPt2
TASITPt2 – SPQNegative
SPQNegative
TASITPt2
TASITPt2 – SPQDisorganized
SPQDisorganized
TASITPt2
TASITPt2 – ASI
ASI
TASITPt2
TASITPt3 – SPQTotal
SPQTotal
TASITPt3
TASITPt3 – SPQPositive
SPQPositive
TASITPt3
TASITPt3 – SPQNegative
SPQNegative
TASITPt3

Table A4

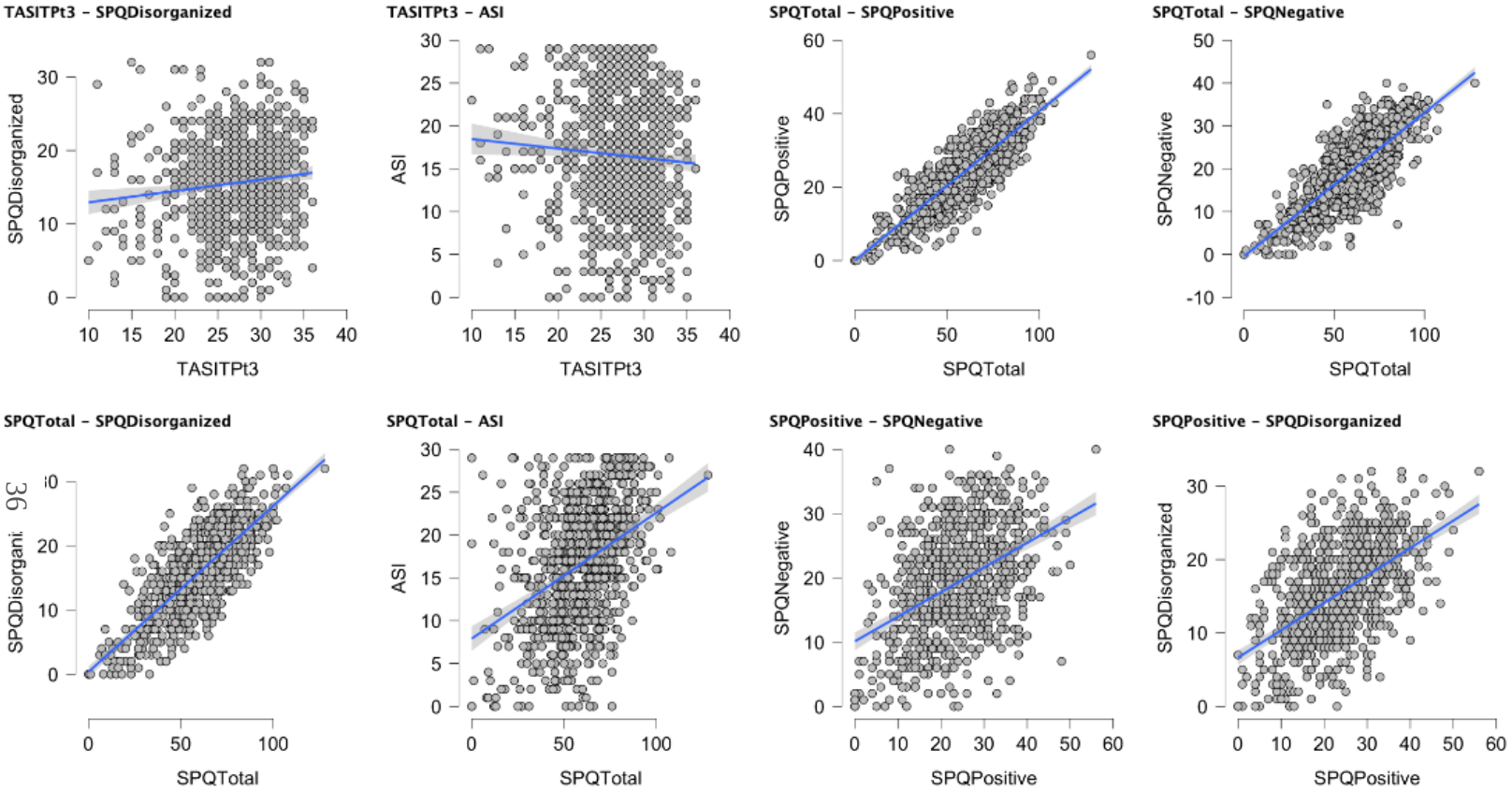
TASITPt3 – SPQDisorganized
SPQDisorganized
TASITPt3
TASITPt3 – ASI
ASI
TASITPt3
SPQTotal – SPQPositive
SPQPositive
SPQTotal
SPQTotal – SPQNegative
SPQNegative
SPQTotal
SPQTotal – SPQDisorganized
SPQTotal
SPQTotal – ASI
ASI
SPQTotal
SPQPositive – SPQNegative
SPQNegative
SPQPositive
SPQPositive – SPQDisorganized
SPQDisorganized
SPQPositive

Table A5

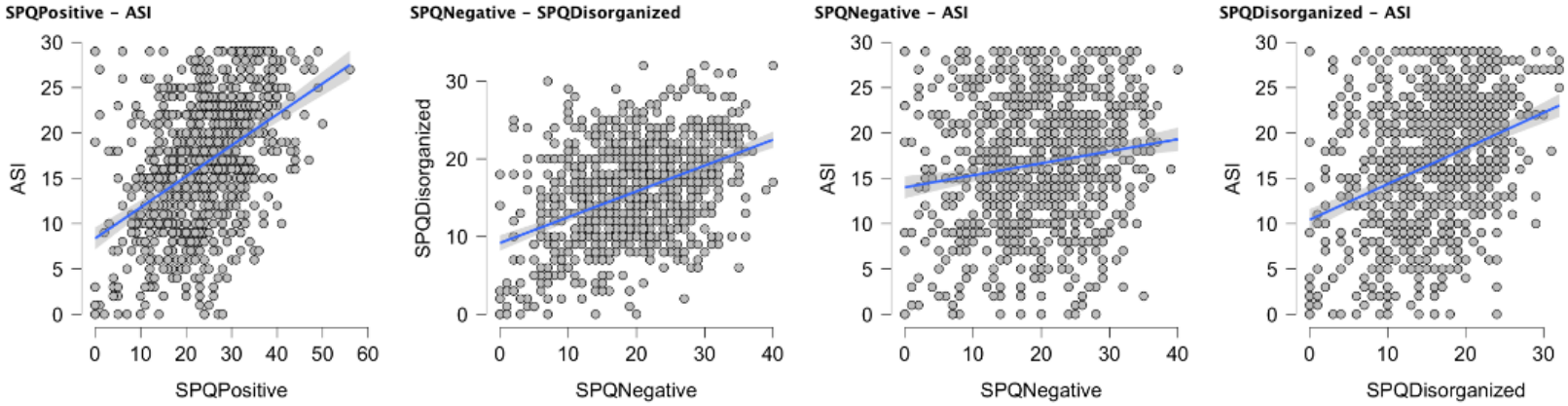
SPQPositive – ASI
ASI
SPQPositive
SPQNegative – SPQDisorganized
SPQDisorganized
SPQNegative
SPQNegative – ASI
ASI
SPQNegative
SPQDisorganized – ASI
ASI
SPQDisorganized

Table A6
Descriptive Statistics of Study Measures

	N	Mean	Std. Deviation	Skewness		Kurtosis	
					SE		SE
SPQ Total	849	58.9117	19.22485	-.295	.084	.236	.168
SPQ Positive	849	23.9965	9.25433	-.054	.084	-.037	.168
SPQ Negative	849	19.3227	8.26675	-.104	.084	-.488	.168
SPQ Disorganized	849	15.5925	6.37849	-.168	.084	-.235	.168
ASI	846	16.5626	7.18531	-.262	.084	-.607	.168
TASITPt1	849	7.1143	1.60627	-1.070	.084	1.356	.168
TASITPt2	839	28.5602	5.14732	-.942	.084	.806	.169
TASITPt3	825	27.0448	4.76070	-.802	.085	.716	.170

Table A7
Sex Effects for TASIT Parts 1, 2, and 3

TASIT Part 1					TASIT Part 2					TASIT Part 3				
Group		Effect		Sig.	Group		Effect		Sig.	Group		Effect		Sig.
		B	SE				B	SE				B	SE	
1	SPQ Pos	-.064	.015	.000	1	SPQ Pos	-.136	.056	.015	1	SPQ Pos	-.158	.046	.001
	SPQ Neg	.031	.016	.052		SPQ Neg	.024	.053	.647		SPQ Neg	.054	.048	.258
	SPQ Dis	.052	.022	.017		SPQ Dis	.113	.082	.168		SPQ Dis	.171	.071	.016
	ASI	.008	.017	.647		ASI	.049	.054	.366		ASI	.026	.044	.564
	GAD-7	.002	.031	.960		GAD-7	.044	.091	.629		GAD-7	-.116	.080	.147
	PHQ-9	-.028	.028	.304		PHQ-9	-.093	.076	.222		PHQ-9	-.022	.068	.746
2	SPQ Pos	-.025	.009	008	2	SPQ Pos	-.080	.028	004	2	SPQ Pos	-.085	.028	002
	SPQ Neg	.006	.009	.474		SPQ Neg	-.031	.029	.280		SPQ Neg	-.020	.027	.452
	SPQ Dis	.012	.013	.342		SPQ Dis	.087	.041	.035		SPQ Dis	.162	.038	.000
	ASI	-.023	.010	.027		ASI	-.061	.036	.091		ASI	-.061	.034	.069
	GAD-7	.026	.017	.117		GAD-7	.065	.051	.204		GAD-7	.019	.049	.696
	PHQ-9	.008	.016	.608		PHQ-9	.048	.047	.304		PHQ-9	.056	.045	.208

Multi-group analysis of sex effects. Group 1 is males and Group 2 is females.

APPENDIX B

REGRESSION ANALYSES

Table B1

Hierarchical regression results for TASIT Part 1 with predictors SPQ Total and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	.017	.105	.264	-.013	.047
	PHQ-9	.004	.014	.758	-.023	.032
	Sex	.540	.124	.000	.295	.784
	SPQ Total	-.006	.004	.067	-.013	.000
2	SPQ Total	-.004	.004	.338	-.011	.004
	ASI	-.023	.008	.006	-.039	-.007
3	SPQ Total	-.004	.004	.338	-.011	.004
	ASI	-.023	.008	.007	-.040	-.006
	SPQTotalxASI	-6.56E-6	.000	.985	-.001	.001

Table B2

Hierarchical regression results for TASIT Part 2 with predictors SPQ Total and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	.050	.050	.312	-.047	.147
	PHQ-9	.012	.045	.783	-.076	.101
	Sex	1.692	.401	.000	.905	2.480
	SPQ Total	-.022	.011	.057	-.044	.001
2	SPQ Total	-.016	.012	.171	-.040	.007
	ASI	-.042	.027	.123	-.095	.011
3	SPQ Total	-.016	.012	.173	-.040	.007
	ASI	-.043	.027	.118	-.097	.011
	SPQTotalxASI	.000	.001	.796	-.003	.002

Table B3

Hierarchical regression results for TASIT Part 3 with predictors SPQ Total and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	-.035	.046	.456	-.125	.056
	PHQ-9	.043	.042	.308	-.040	.126
	Sex	1.463	.375	.000	.727	2.200
	SPQ Total	-.002	.011	.852	-.023	.019
2	SPQ Total	.005	.011	.644	-.017	.027
	ASI	-.055	.025	.029	-.105	-.006
3	SPQ Total	.005	.011	.638	-.017	.027
	ASI	-.058	.026	.023	-.108	-.008
	SPQTotalxASI	-.001	.001	.489	-.003	.001

Table B4

Hierarchical regression results for TASIT Part 1 with predictors SPQ Positive and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	.024	.015	.118	-.006	.054
	PHQ-9	.005	.014	.724	-.022	.031
	Sex	.576	.124	.000	.333	.819
	SPQ Positive	-.029	.007	.000	-.041	-.016
2	SPQ Positive	-.024	.007	.001	-.038	-.010
	ASI	-.014	.009	.092	-.031	.002
3	SPQ Positive	-.024	.007	.001	-.038	-.010
	ASI	-.014	.009	.094	-.031	.002
	Positive x ASI	-3.735E-5	.001	.961	-.002	.001

Table B5

Hierarchical regression results for TASIT Part 2 with predictors SPQ Positive and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	.061	.049	.211	-.035	.158
	PHQ-9	.008	.044	.851	-.078	.094
	Sex	1.768	.400	.000	.982	2.553
	SPQ Positive	-.071	.021	.001	-.113	-.029
2	SPQ Positive	-.064	.023	.006	-.109	-.019
	ASI	-.024	.028	.390	-.078	.031
3	SPQ Positive	-.064	.023	.005	-.109	-.019
	ASI	-.022	.028	.425	-.077	.033
	Positive x ASI	.001	.002	.677	-.004	.006

Table B6

Hierarchical regression results for TASIT Part 3 with predictors SPQ Positive and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	-.012	.046	.801	-.102	.079
	PHQ-9	.055	.041	.183	-.026	.135
	Sex	1.562	.374	.000	.827	2.297
	SPQ Positive	-.057	.020	.004	-.096	-.018
2	SPQ Positive	-.048	.021	.027	-.090	-.006
	ASI	-.030	.026	.242	-.081	.021
3	SPQ Positive	-.047	.021	.029	-.089	-.005
	ASI	-.032	.026	.223	-.083	.019
	Positive x ASI	-.001	.002	.652	-.006	.003

Table B7

Hierarchical regression results for TASIT Part 1 with predictors SPQ Negative and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	.010	.015	.532	-.020	.039
	PHQ-9	-.005	.014	.730	-.032	.023
	Sex	.517	.125	.000	.272	.762
	SPQ Negative	.007	.008	.377	-.008	.022
2	SPQ Negative	.007	.008	.360	-.008	.022
	ASI	-.025	.008	.002	-.041	-.010
3	SPQ Negative	.007	.008	.362	-.008	.022
	ASI	-.026	.008	.001	-.042	-.010
	Negative x ASI	.000	.001	.670	-.002	.001

Table B8

Hierarchical regression results for TASIT Part 2 with predictors SPQ Negative and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	.037	.049	.452	-.059	.133
	PHQ-9	.001	.045	.979	-.087	.090
	Sex	1.661	.402	.000	.873	2.449
	SPQ Negative	-.023	.025	.352	-.072	.026
2	SPQ Negative	-.023	.025	.360	-.071	.026
	ASI	-.052	.026	.043	-.103	-.002
3	SPQ Negative	-.023	.025	.354	-.072	.026
	ASI	-.057	.026	.029	-.108	-.006
	Negative x ASI	-.004	.003	.195	-.009	.002

Table B9

Hierarchical regression results for TASIT Part 3 with predictors SPQ Negative and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	-.038	.046	.402	-.128	.051
	PHQ-9	.038	.042	.368	-.045	.121
	Sex	1.451	.375	.000	.715	2.187
	SPQ Negative	.008	.023	.743	-.038	.053
2	SPQ Negative	.008	.023	.728	-.037	.054
	ASI	-.052	.024	.032	-.099	-.005
3	SPQ Negative	.008	.023	.734	-.038	.053
	ASI	-.055	.024	.024	-.103	-.007
	Negative x ASI	-.002	.003	.337	-.008	.003

Table B10

Hierarchical regression results for TASIT Part 1 with predictors SPQ Disorganized and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	.011	.015	.466	-.019	.041
	PHQ-9	-.002	.014	.863	-.030	.025
	Sex	.524	.125	.000	.280	.769
	SPQ Disorganized	.001	.010	.884	-.018	.021
2	SPQ Disorganized	.010	.010	.334	-.010	.029
	ASI	-.027	.008	.001	-.043	-.011
3	SPQ Disorganized	.010	.010	.337	-.010	.029
	ASI	-.026	.008	.002	-.042	-.010
	Disorg x ASI	.001	.001	.384	-.001	.003

Table B11

Hierarchical regression results for TASIT Part 2 with predictors SPQ Disorganized and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	.026	.049	.599	-.070	.122
	PHQ-9	-.016	.045	.715	-.105	.072
	Sex	1.646	.401	.000	.859	2.433
	SPQ Disorganized	.025	.031	.425	-.037	.087
2	SPQ Disorganized	.044	.032	.177	-.020	.107
	ASI	-.062	.027	.021	-.114	-.009
3	SPQ Disorganized	.044	.032	.178	-.020	.107
	ASI	-.059	.027	.029	-.112	-.006
	Disorg x ASI	.002	.004	.642	-.005	.009

Table B12

Hierarchical regression results for TASIT Part 3 with predictors SPQ Disorganized and ASI

Model		Effect		Sig.	95% CI	
		B	Std. Error		LL	UL
1	GAD-7	-.055	.045	.226	-.144	.034
	PHQ-9	.011	.042	.786	-.071	.093
	Sex	1.487	.372	.000	.757	2.218
	SPQ Disorganized	.096	.029	.001	.038	.153
2	SPQ Disorganized	.119	.030	.000	.060	.177
	ASI	-.076	.025	.002	-.125	-.028
3	SPQ Disorganized	.119	.030	.000	.060	.178
	ASI	-.076	.025	.002	-.126	-.027
	Disorg x ASI	.000	.003	.957	-.007	.006