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Appraisal of self-reference, delusional ideation and memory in a normal sample

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APPRAISAL OF SELF-REFERENCE, DELUSIONAL IDEATION AND MEMORY IN A
NORMAL SAMPLE

by

Madelaine Clair Burley, B.A (Hons.), University of Waterloo, Waterloo, Ontario, Canada, 2008

A Thesis

presented to Ryerson University

In partial fulfillment of the
requirements of the degree of

Master of Arts

in the Program of

Psychology

Toronto, Ontario, Canada, 2010

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Appraisal of Self-Reference, Delusional Ideation and Memory in a Normal Sample

Master of Arts, 2010

Madelaine Clair Burley

Psychology

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I investigated whether self-referent appraisal bias (SRB) mediates the relation between delusional thinking and self-referent memory (SRM). Forty normal adults participated. Participants rated how much 80 statements were about them on a five-point scale and the ratings were summed to operationalize SRB. Corrected hit rate (Pr) from an incidental recognition memory test for these statements was the dependent measure of SRM. Peters Delusion Inventory (PDI) scores correlated with Pr ($r = -.34$) and there was a trend toward correlation between SRB and Pr ($r = -.25$). SRB mediated the relation between PDI score and Pr with age, standardized memory and language achievement scores as covariates (Baron & Kenny, 1986). Bootstrapping analyses confirmed that the change in the model was significant with SRB as a mediator. These findings suggest that individual differences, such as SRB, mediate SRM performance. This suggests that such subtle biases could mediate cognitive impairment in psychosis, which has implications for treatment.

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My thesis sheds light on recent findings linking self-referent processing to memory functioning in normal individuals. Recent review papers and meta-analyses predict that self-referent processes and memory share common neural networks. In addition, there is a substantial history of cognitive research on the *Self-Reference Effect* (SRE; Rogers, 1977) in memory that links self-referent appraisal to a mnemonic advantage; however, this effect has been understudied in relation to the psychotic spectrum and has potential implications for cognitive models of delusions. The purpose of this thesis is to bridge the gap between these divergent areas of research by clarifying the role of self-referent appraisal in memory, explore cognitive functioning along the continuum of delusional thinking, and test predictions made by meta-analyses of brain-imaging research and cognitive models of delusions.

Common Network Hypothesis

Recently, reviews of the neuroimaging literature by Buckner and Carroll (2007), Hassabis and Maguire (2007), and a subsequent meta-analysis by Spreng, Mar and Kim (2009) reached similar conclusions: Many cognitive processes previously posited to be distinct from one another share common neurological underpinnings. This so-called “common network”, which encompasses the medial temporal lobes, medial prefrontal region and the medial and lateral parietal regions, shows activation during a variety of tasks including memory tasks, prospective memory (future thinking) tasks, spatial navigation tasks, theory of mind tasks and also the “default mode” (Raichle et al., 2001), when subjects are at rest (Schulman et al., 1997; Mazoyer et al., 2001). Buckner and Carroll hypothesized that the common activation pattern could be due to a common element involved in each of these tasks and proposed that *self-projection* could be the uniting feature. Hassabis and Maguire contended that the common element underlying the tasks associated with the common network is *scene construction*. Although it is not yet clear why

these diverse tasks utilize the same brain regions, the common network hypothesis has multiple implications for clinical disorders.

Previously, impairments in these tasks were examined in isolation, but the above framework suggests that there may be better ways to understand the scope of impairment, the mechanisms of impairment, or rehabilitation strategies for disorders with impairment in tasks relying on the common network. One such disorder, schizophrenia, demonstrates impairment in all the areas identified to be associated with the common network. Schizophrenia is a major cause of disability worldwide and ranks as one of the most costly disorders to afflict humans (Global Burden of Disease, WHO). This disorder is characterized by the presence of positive (e.g., hallucinations, delusions) and negative (e.g., affective flattening, avolition) symptoms of psychosis. Despite the general success of pharmacological advances in managing symptoms of psychosis, most persons with schizophrenia experience persistent impairments in daily and community functioning. Cognitive impairment is increasingly being recognized as a unique domain of impairment in schizophrenia (Heinrichs, 2005) and is a robust mediator of functional outcome among patients (Bowie & Harvey, 2006); these findings have recently motivated cognition as a specific therapeutic target (Gold, 2004).

As previously mentioned, impairments in cognition in schizophrenia are broad. Memory impairments are prominent in schizophrenia (Lepage, 2007) with explicit memory (e.g. episodic, autobiographical) being the most impaired. In a meta-analysis of theory-of-mind tasks, Bora, Yucel and Pantelis (2009) reported large effect sizes for impairment in non-remitted schizophrenia samples and smaller, but still significant effect sizes in remitted schizophrenia samples, and suggested that theory-of-mind deficits form a trait impairment in schizophrenia. D'Argembeau, Raffard and Van der Linden (2008) reported that persons with schizophrenia

demonstrated impairments in generating mental images of past events and even greater impairment in generating images of future events, suggesting that schizophrenia disturbs one's prospective memory. Impairment in allocentric (environment-based) navigation has also been recently reported in schizophrenia (e.g. Weniger & Irlle, 2008; Hanlon et al., 2006; Daniel, Dibo-Cohen, Carité, Boyer & Denis, 2007). Finally, anomalous activity has been found during the brain's default mode during periods of rest or inactivity in the brains of patients with schizophrenia (Bluhm et al., 2007; Whitfield-Gabrieli et al., 2009).

Given that schizophrenia has been associated with impairment in all of the domains proposed to rely on the common network, it is important both theoretically and practically to understand how this network functions and how dissociable these tasks are from one another. Furthermore, considering these processes to be interrelated produces areas of inquiry that have previously been under-studied in schizophrenia. One such area, and the focus of this study, is the intersection between appraisal of salience related to "self" and memory. In turn, understanding the relation between these processes may inform theories regarding the cognitive mechanisms underlying delusional thought.

Delusions and Cognition

Delusions are described by the American Psychiatric Association (2000) as "fixed beliefs" about external reality that are not endorsed by culture and are maintained despite strong disconfirmatory evidence. Content of delusions varies, but common themes include persecution, self-reference (belief that neutral material in the environment has special personal significance) and grandiosity (belief that one is special or has special abilities). Early definitions of delusions posited that these beliefs differ from normal beliefs in their certainty, steadfastness and bizarre or impossible content (Jaspers, 1913). Recently, it has been argued that the definition of delusion

should be adjusted to reflect a continuum of belief rather than a dichotomy because qualitative studies of delusions often report that these criteria are not strictly met. For instance, in a study of the delusions of 119 schizophrenia patients, Strauss (1969) reported that as many as half could be categorized as questionable due to the fact that patients were not fully convinced that their delusions were true. Further evidence for the legitimacy of a continuous conceptualization of delusions stems from the finding that belief in delusional thoughts varies over time (Garety, 1985) and there is a high prevalence rate (10-15%) of delusional beliefs in the general population (van Os, Hanssen, Bijl, & Ravelli, 2000; van Os, Hanssen, Bijl, & Vollebergh, 2001).

Cognitive models of delusions purport that biases in cognition and reasoning underlie the development and maintenance of delusions. Several different cognitive biases have been reliably associated with delusional beliefs. These include the ‘jumping to conclusions’ bias (JTC; Menon, Mizrahi, & Kapur, 2008; Garety, Hemsley, & Wessely, 1991), attribution of positive events to internal sources (Kaney & Bentall, 1996; Candido & Romney, 1990), and attribution of negative events to external sources (Lyon, Kaney & Bentall, 1994), bias against disconfirmatory evidence (BADE; Moritz & Woodward, 2004, 2006), belief inflexibility (Garety et al., 2005), and liberal acceptance (Moritz & Woodward, 2004). A principal components analysis of these biases yielded four independent factors, suggesting that these biases may each play a separate role in delusion development and maintenance (Moritz et al., 2010). In a review of proposed cognitive models of delusions, Garety and Freeman (1999) concluded that the literature supports models implicating probabilistic reasoning biases (Garety & Hemsely, 1994) and attributional style (Bentall, 1994). Blackwood, Howard, Bentall and Murray (2001) also cite evidence that attentional biases (threat stimuli) and theory-of-mind deficits may play a role in the inferential biases apparent in deluded patients with schizophrenia; these biases/deficits are not apparent in

non-deluded patients. Early evidence supports these existing models, but support is not unequivocal and future research is needed to refine them.

Based on their review, Blackwood and colleagues (2001) proposed a unified cognitive model for the development of persecutory delusions that emphasizes the central role of abnormal social beliefs, including liberally biased appraisal of self-reference and threat. In a 2004 study, Blackwood et al. tested these predictions using eight male participants with acute persecutory delusions and age and gender-matched healthy controls. The study included two sessions, one in which the sentence stimuli were neutral and either ambiguously self-referent (“He is sleeping”) or unambiguously other-referent (“Graeme is sleeping”) and one in which the sentences were threatening and either ambiguously self-referent (“He is a pervert”) or unambiguously other-referent (“John is a pervert”). The task was for participants to indicate (‘yes/no’) whether the sentence stimuli were self-referent. They found as predicted that both the healthy and deluded samples identified more ambiguous than unambiguous sentences as self-referent, but did not find that the deluded sample rated more ambiguous sentences as self-referent than the healthy sample. Their second prediction, which was that the deluded sample would rate more threat statements as self-referent than the healthy sample, was also not supported. Blackwood and colleagues suggested that characteristics of their stimuli including high concreteness and threat stimuli content may have affected their results. Interestingly, however, the delusional sample endorsed more unambiguously other-referent statements as self-referent than the healthy sample. Although this evidence was indirect, it supports a self-referent bias, but not a threat bias, among the deluded sample. Nonetheless, these findings await replication with more appropriate stimuli, a larger sample and more sensitive measurements.

In 2003, Sass and Parnas proposed an alternative model implicating self-referent cognition to account for psychotic symptoms. Based on a narrative review of phenomenological literature on schizophrenia, they proposed that *hyperreflexivity*, or exaggerated self-awareness leads to a subjective experience of externalization of the self, which they propose underlies positive symptoms of psychosis, including delusions. Also central in this model is the hypothesis that diminished subjective self-experience, or *self-affection*, underlies psychotic symptomatology. Although this model is currently theoretical and does not make explicit predictions regarding self-referent cognition and appraisal, it highlights the need to explore the phenomenological aspects of schizophrenia, particularly concerning self-experience.

The models of Blackwood et al. and Sass and Parnas both implicate self-referential processing in delusions. However, whereas the model proposed by Blackwood et al. presumes that persecutory delusions have unique etiology, the model by Sass and Parnas does not separate etiology of delusions by content and presumes that common processes underlie all delusions. Whether these models compliment or contradict one another is unclear, since the sample used by Blackwood only had active persecutory delusions.

Menon and colleagues (2008) reported a similar pattern of appraisal bias among patients with delusions of reference, suggesting that this bias may not be specific to persecutory delusions, as proposed by Blackwood et al. (2004). In an imaging study designed to examine brain activity when experiencing subjective feelings of self-referentiality (Menon et al., 2008), patients with referential delusions and a healthy control sample were presented with neutral and emotional statements that were either objectively self-referent or ambiguous and asked to give a yes/no response to the question “Do you feel that this statement is about you?”. Sentence stimuli included 20 neutral statements (“He likes coffee”), 20 emotional statements (“He is feeling very

happy today”, “He is stupid”) and 20 individually tailored statements about participants’ personal history based on interviews conducted prior to the study (“His mother died recently”). The sentence stimuli were each tailored to the gender of participants and in the neutral and emotional conditions were designed to reflect generic abstract situations that should be equally applicable across groups. The goal was to compare brain activation patterns between the groups in the 3 conditions. The main findings of the study were that the deluded group showed hyperactivation in the striatum and limbic regions, but hypoactivation in the cortical midline structures (CMS) and the medial and dorso-lateral prefrontal cortex (PFC). Menon et al. (2008) also reported that participants in the referential delusion group endorsed more neutral and emotional statements as being about themselves than did participants in the control group. That is, participants with referential delusions showed a self-referent appraisal bias. The fact that biased self-referent appraisal has been found in this group suggests that it is not specific to persecutory delusions, but prevalence of persecutory delusions in the sample was not reported. The neutral and emotional stimuli were intended to be equally applicable across groups and this finding was unanticipated; therefore it needs to be replicated to ensure that it was not a product of the stimuli or sample.

In summary, there is evidence of several cognitive biases associated with delusions. Two cognitive models, one by Blackwood and colleagues (2001) and one by Sass and Parnas (2003), predict an association between biases in self-referent cognition and delusions. Preliminary findings support this hypothesis (Blackwood et al., 2004; Menon et al., 2008), but it remains unclear whether this bias is specific to delusions with certain themes (i.e., persecution) or applies to delusions generally. Further research is needed to replicate these findings and test the predictions of these models.

Self-Reference and Memory

The findings of Blackwood et al. (2004) and Menon et al. (2008) raise an interesting empirical question: why might delusions be related to a self-referential appraisal bias? Based on the common network hypothesis, this question has potential implications for memory function in schizophrenia, which is supported by the long-studied SRE (Rogers, 1977; Rogers, Kuiper, & Kirker, 1977). SRE refers to the finding that information processed in reference to the self (i.e. does this adjective describe you?) is better remembered than information processed in other ways such as semantically, phonemically or structurally. This effect has been replicated in different cultures and the conditions under which it can reliably be reproduced have been reported in several meta-analyses (Bellezza, 1993; Czienskowski, 1997; Czienskowski & Giljohann, 2002; Symons & Johnson, 1997). It has generally been found that self-referent encoding produces a medium effect size ($d = .65$) when compared to semantic processing and a small effect size ($d = .35$) when compared to processing in relation to an intimate other (e.g. your mother). SRE is purported to work by promoting elaboration and organization of information and is most beneficial for information that is abstract and cannot be easily visualized. It has also been found that information that is judged to be self-descriptive is more easily recalled than other information, a phenomenon called the ‘congruent information hypothesis’ (Bellezza, 1992).

Examination of the SRE using maximally sensitive assessment of self-reference and memory suggests that the relation between self-reference and memory performance may not be strictly linear and that self-referent memory is phenomenologically distinct from other forms of memory (Conway & Dewhurst, 1995; Conway, Dewhurst, Pearson & Sapute, 2001). Building on the more common SRE paradigms based on dichotomous decisions, Conway and Dewhurst (1995) used continuous appraisal of self-reference in three between-subjects experiments to

explore the relations between self-referent appraisal and recollective processes in recognition memory. In each experiment, participants were asked to make judgments about trait adjectives on a scale from one to five: One group of participants rated the self-reference of adjectives, one group rated how much the adjectives referred to the Prime Minister and one group rated the valence of the adjectives. Subsequently, they were given a recognition memory test using Tulving's (1985) Remember-Know paradigm. That is, participants were asked to indicate whether adjectives were old or new, and for old adjectives, whether their recognition was accompanied by a vivid recollective experience (constituting a 'Remember' response) or not (constituting a 'Know' response). A between-subjects design was used to prevent carry-over effects from contaminating Remember/Know responding. Recognition performance did not reliably differ between encoding conditions; however, self-referent encoding was associated with significantly more Remember responses relative to Know responses, suggesting that self-referent encoding elicits recollective memory encoding. Greater proportions of correct Know responses were reported in the low self-referent encoding groups, reinforcing the distinct processes used in self-referent memory. The finding that self-referent encoding produces a greater proportion of Remember responses than tasks low in self-reference was later replicated and termed the *Self Reference Recollection Effect* (SRRE; Conway et al., 2001).

In the same study, Conway and Dewhurst (1995) also examined the effect of level of self-reference on recognition. Contrary to what was anticipated, greater proportions of correct recognitions were found for items given extreme high *or* low ratings of self-reference compared to items given moderate ratings. Formal statistical tests indicated that there was a significant difference in proportion remembered between moderately rated and highly rated items, but not items rated low in self-reference. Although the pattern is not as straightforward as would be

anticipated, SRE can be detected using continuous self-reference ratings, since higher recognition rates are seen for highly rated items than for moderately rated items. Conway, Dewhurst, Pearson and Sapute (2001) replicated this finding and argued that self-referent memory is controlled by a unique system, the *self-memory system* (Conway & Pleydell-Pearce, 2000). Conway and colleagues (2001) propose that items given moderate and low ratings of self-reference would both initially be maintained in memory to the same extent because they have not yet had the chance to be integrated into the self-knowledge schema whereas over an adequate period of time low self-reference items would fade and most moderate self-referent items would be integrated. Highly self-referent items, they argue, may be more quickly integrated into long-term memory due to high importance. To support this hypothesis, they note that studies using extremely brief retention periods fail to demonstrate SRRE, whereas studies using longer retention periods reliably produce it. Although this model adequately explains their pattern of results, it remains largely theoretical.

The unique nature of self-referent memory has also been suggested by neuroimaging studies; the neurological underpinnings of the SRE have been examined on multiple occasions. A recent review of 27 imaging studies conducted by Northoff and colleagues (2006) suggested that across different functional domains (e.g., verbal, spatial, emotional, and facial) self-referential processing relies on the cortical midline structures (CMS). Northoff and colleagues proposed that the interaction between self-reference and retrieval may be a key component of autobiographical memory. McCrae et al. (2004) and Fossati et al. (2004) reported that successful encoding and retrieval of self-referential stimuli (trait adjectives) were associated with activation in the dorsal-medial prefrontal cortex (DMPFC; as cited by Northoff et al., 2004). Based on functional-connectivity analyses, Lou et al. (2004) reported on a network comprising the DMPFC and

medial parietal cortex (MPC), posterior cingulate cortex and precuneus; the authors concluded that the MPC mediates between cortical midline structures during episodic retrieval of self-related adjectives and is essential for successful self-representation (as cited by Northoff et al., 2004). Recently, van der Meer, Costafreda, Aleman and David (2010) conducted a meta-analysis of studies of self-reflection and proposed that the ventral (V)MPFC tags information relevant for self, and DMPFC is involved in decisions regarding the self.

Despite the many replications of the SRE, including neuroimaging studies, only one study has explored whether this memory advantage is maintained in schizophrenia. A PsycInfo search for “self reference effect” in the abstract and “schizophrenia” in the title yielded only one result. Jia, Zhu, Han and Zhang (2008) tested whether SRE is maintained in schizophrenia by comparing 16 patients with insight into their symptoms, 16 patients without insight into their symptoms and 16 healthy controls. They reported that insight was not correlated with SRE, but that significant differences were found between the control group and the schizophrenia group without insight on the SRE task, suggesting that SRE is impaired in at least some schizophrenia samples.

The study by Jia et al. (2008) did not support insight as a moderator of SRE in schizophrenia; however, it is unclear whether or how the SRE relates to different subtypes of schizophrenia and what mechanisms underlie impairment. Cognitive models of delusions, as well as the common network hypothesis (Buckner & Carroll, 2007; Hassabis & Maguire, 2007; Spreng et al., 2009), predict that appraisal of self-relevant stimuli and memory are related to one another, but the relation between appraisal of self-relevance and subsequent memory for self-relevant information has not been fully explored. The finding by Blackwood et al. (2004) and Menon et al. (2008) that self-referential appraisal is biased in delusional samples predicts that

people with schizophrenia should have a self-referent memory advantage; in contrast, Jia and colleagues (2008) report that SRE is impaired in schizophrenia. On the surface, these findings seem contradictory. That is, SRE impairment in the face of a bias towards self-referent appraisal in schizophrenia does not appear consistent with the relations predicted by both the SRE literature and the congruent information hypothesis (Bellezza, 1992).

However, because research on self-referent bias is extremely limited, the strength and consequences of this bias are unknown. The studies by Blackwood et al. (2004) and Menon et al. (2008) were the first to demonstrate evidence of a self-referent appraisal bias. If self-referent bias is related to delusional thinking, as would be predicted by cognitive models of delusions, the continuum model of psychosis (van Os, Hanssen, Bijl, & Ravelli, 2000) predicts that it should also be present in normal individuals who report delusional thought. Studies of SRE have typically used group comparisons for analysis rather than a continuous approach. Thus, SRE has been evaluated as either present or absent and is marked by a group memory advantage when compared to control conditions. However, as demonstrated by Conway and Dewhurst (1995), continuous appraisals of self-reference can yield interpretable results and provide a means of studying individual differences in self-referent appraisal and their relations to constructs, such as self-referent memory and delusional ideation. Although at the item level SRE provides a memory advantage in that items rated as self-referent are better recalled, on a subject level, self-referent encoding may yield different results; specifically, the tendency to appraise items as self-referent may not provide a memory advantage. Since delusional ideation is a continuous construct, it is also possible that self-referent appraisal bias is a continuous construct, in which case it could be a mediator of self-referent memory in normal populations. To reconcile conflicting findings from the SRE and schizophrenia literatures and clarify the role of self-referent bias in self-referent

memory, it is necessary to study the relation between self-referent bias, delusional ideation and self-referent memory in a normal sample. Research on these constructs could one day help to refine existing treatment models for delusions and develop memory rehabilitation strategies for schizophrenia.

In summary, there is theoretical as well as practical benefit to exploring the relation between self-referential appraisal bias and memory – this bias could help to explain self-referent memory impairment in schizophrenia, but will also inform our understanding of salience judgments and their relation to normal memory processes.

Current Study

The purpose of my thesis is to clarify the role of appraisal of self-reference in normal memory processes as well as the relation between appraisal of self-reference and subclinical delusional ideation. Individuals with schizophrenia often experience memory impairments; however, research on cognitive functioning in schizophrenia has rarely drawn a contrast between self versus other appraisal. Further, research on the SRE characterizes it as advantageous to memory, so it could have practical applications as a cognitive remediation technique. Based on Jia and colleagues (2008), Blackwood et al. (2004) and Menon et al. (2008), it was hypothesized that:

- 1) Delusional ideation and schizotypal personality traits would predict poor self-referent memory (SRM).
- 2) Delusional ideation and schizotypal personality traits would predict self-referent appraisal bias (SRB).
- 3) SRB would predict poorer performance on a SRM task above and beyond common factors known to affect memory and measures of delusional ideation and schizotypy.

Methods

Procedure

Study participation was individual and completed in a single two-hour session. After giving informed consent to participate in the study, a brief history and basic demographic information was obtained using a standard lab interview. Participants then completed four standardized clinical measures, a newly developed computerized SRM task, and two standardized cognitive measures, described below.

Clinical Assessment.

PDI.

Delusional ideation was measured using the Peters Delusion Inventory (PDI; Peters, Joseph, & Garety, 1999). The PDI was developed specifically to investigate subclinical delusional thinking in non-clinical populations. Constructs measured by the PDI include distress, preoccupation and conviction associated with delusional-themed beliefs; for each of 40 statements on the PDI, participants indicate whether the statement is true of them or not and rate their distress, preoccupation and conviction according to five-point Likert scales. To gain a more general measure of delusional ideation, distress, preoccupation and conviction ratings for all items were added to produce a summary score. The range of possible summary scores is from 0 to 600.

SPQ-L.

Schizotypal personality characteristics were measured using a Likert version of the Schizotypal Personality Questionnaire (SPQ-L; Wuthrich & Bates, 2005). The SPQ-L is a 74-item scale that measures diagnostic criteria for schizotypal personality disorder based on DSM-III criteria. The scale measures features of schizotypal personality disorder including odd speech,

odd behaviour, unusual perceptual experiences, paranoia, absence of close friends, constricted affect, magical thinking, social anxiety and ideas of reference. Because the SPQ-L uses a five-point Likert scale to measure responses, it is reported to have good sensitivity in non-clinical samples. This scale has excellent reliability (alphas for subscales ranged from .75 - .96).

The SPQ-L and the PDI have been validated for use in normal populations and have demonstrated that they predict diagnoses of Schizotypal Personality Disorder (SPD; *Diagnostic and statistical manual of mental disorders : DSM-IV*, 2000) as well as cognitive features that accompany SPD and schizophrenia (Raine, 2006). Although the foci of the SPQ-L and PDI are similar, the scales measure distinct constructs. Both scales were included to determine whether the distinction between delusional ideation and schizotypal traits is important.

PAS.

A modified version of the Personality Assessment Screener (PAS; Morey, 1991) was used to characterize likelihood of psychological disorders in the sample, as in previous work from our lab (e.g., Girard, Christensen, & Rizvi, 2010). The scale was designed to screen for current and previous psychological disorders and includes questions relating to symptoms of specific psychological disorders such as psychosis, anxiety, and depression. In addition, this modified version incorporates subscales from the Personality Assessment Inventory (PAI; Morey, 1990) regarding alcohol abuse, drug abuse, negative impression management ('faking bad') and positive impression management ('faking good'). The scale was further modified for the purpose of this thesis to exclude 2 items assessing suicidality, as this was considered to be inappropriate for normal participants (following discussions with the university research ethics board). The remaining 58 items were administered. Due to the exclusion of these items, PAS

scores may underestimate likelihood of psychological disorders in the sample. The modified version can be found in Appendix B.

DASS.

Participants completed the 21-item version of the Depression Anxiety Stress Scales (DASS; Antony, Bieling, Cox, Enns & Swinson, 1998) to account for the potential effects of state stress, depression and anxiety on memory performance. The DASS has been normed in both clinical and community samples and has good psychometric properties.

Self-Referential Appraisal Bias Memory Task.

The primary measure of interest in this study was performance on a newly developed Remember/Know/New incidental SRM task. For this purpose, the dependent variables were calculated from the hit rate minus false alarm rate for Remember and Know responses to New and Old items, or corrected hit rate (Pr; Snodgrass & Corwin, 1988). A Remember/Know/New task was used to enable examination of recollective processes, since unique relations have been reported between recollection and SRE (Conway et al., 1995) and recollection and schizophrenia (Danion, Rizzo & Bruant, 1999). One of the goals of the study was to replicate the findings of Conway and Dewhurst (1995), Blackwood et al. (2004) and Menon et al. (2008), so the task was designed to be as similar to those tasks as possible, with necessary adjustments to accommodate a memory component. Additional characteristics of the SRM task and stimuli were chosen with reference to the recommendations made by Symons and Johnson (1997) based on their meta-analysis for design of SRE memory tasks. An incidental task was chosen because incidental memory has been demonstrated to maximize performance in schizophrenia samples (Aleman, Hijman, de Haan, & Kahn, 1999; Lepage, 2007) and produces greater effect sizes in SRE studies (Symons and Johnson, 1997).

Stimuli.

Stimuli for the SRM task consist of 160 brief, gender-tailored generic sentences that describe abstract personal characteristics and life events that were intended to be applicable to most people. Sentences varied in structure and content to increase ecological validity. The stimuli include 40 sentences developed by Menon et al. (2008; i.e., the neutral and emotional, but not personalized sentences) as well as 120 valence and structurally matched sentences. Since appraisal bias has successfully been demonstrated with these stimuli, the new sentences were developed to match those developed by Menon. Content of some stimuli was adjusted to be more suitable to a normal sample; full stimuli are included in appendix A. For each original sentence, 3 were developed to match: one with similar valence and structure, and two with opposite valence and similar structure, resulting in four lists of stimuli. For example, the sentence “He dreams of winning the lottery” was matched with “He imagines touring the world”, “He fears catching the flu” and “He dreads paying the bills”. The opposite valence lists were to balance the proportion of positive and negative stimuli. To ensure that any effect found was not the result of sentence-specific content, each list of 40 stimuli was paired with both opposite-valence lists, resulting in four lists of 80 valence-balanced stimuli. The lists were counterbalanced between participants such that each saw one of the four valence-balanced lists of 80 stimuli at encoding. The 80 unstudied sentences were used as lures at the recognition stage. Stimuli were presented in random order to prevent ordering effects.

Encoding Phase.

Stimuli were presented on a computer using E-prime (Psychology Software Tools). Stimulus presentation parameters were based on those used by Menon and colleagues (2009), but were adjusted following pilot testing to increase task sensitivity. During the encoding portion,

participants viewed one of the counterbalanced lists (80 sentence stimuli) at a rate of 2.5 seconds per sentence plus 3 seconds to rate how much each sentence was about them on a scale from 1 (“No, not at all.”) to 5 (“Yes, definitely.”). Participants were told that this was a decision-making task. Following the encoding phase, there was a 25 to 30 minute delay period before the recognition task. The delay period duration was based on examples in the literature (Symons & Johnson 1997) and pilot data.

Delay Filler Tasks.

During the delay period, participants completed filler tasks to ensure that they were not rehearsing items. Only tasks requiring skills independent of those associated with the common neural network were used in the delay period; these include the Response Switching Task (RST; Cheyne, Carriere, & Smilek, 2009), which measures everyday lapses in attention and memory, the Motor Praxis task, an assessment of sensorimotor skills (Gur et al., 2001), and Penn Continuous Performance Test-Number and Letter Version, a measure of continuous attention (Gur et al., 2001).

Recognition Phase.

Following the delay period, participants were presented with 80 old and 80 new sentences in random order using E-Prime and asked to judge whether each sentence was remembered, known or new. Recollection instructions were adapted from a previous version used in our lab (Patel, 2009) and were consistent with those used in the literature (e.g., Gardiner & Java, 1990). Responses were self-paced and participants were given unlimited time to respond, but were encouraged to respond as quickly and accurately as possible. To reduce impulsive or random responding, a 3-second delay was introduced between stimulus presentation and presentation of response options.

Cognitive Assessment.

WMS-IV.

To provide a brief estimate of memory function for non-self-referent information the Logical Memory subtest of the Wechsler Memory Scale – fourth edition was administered (WMS-IV; Wechsler, 2009). The Logical Memory subtest consists of two brief narrative passages presented aurally, which are followed by immediate and delayed recall and delayed recognition memory tests for the details of the passages. The WMS-IV was used to account for variability in performance on the SRM task due to general memory functioning.

WRAT-4.

The Wide Range Achievement Test – Reading Subtest (WRAT-4; Wilkinson & Robertson, 2006) is a standardized measure of achievement (based on experience) in language. The WRAT-4 Reading test was used to account for variability in performance on the SRM task due to linguistic achievement.

Participants

Data were collected from 41 participants (28 female). One participant did not follow task instructions, resulting in missing or uninterpretable data on the PDI, SRM task, WMS-IV and WRAT-4. This participant was excluded from the remaining analyses. A summary of mean scores on psychological and neuropsychological measures can be found in Tables 1 and 2. Participants were recruited through university psychology courses (N = 5) and community advertisements (N = 35) and were compensated with either course credit or a small cash honorarium. The mean age of participants was 34.23 ($SD = 14.27$) with an age range of 18 to 69. Of the 6 participants who reported that English was not their first language, all reported having learnt English before age 5. All participants reported normal vision, and no participants reported

a history of serious traumatic brain injury or neurological disorders. Two participants reported having been diagnosed with learning disabilities. Five participants reported having been diagnosed with a psychological disorder and 7 participants reported current use of medication to treat a mental health issue. Participants were not excluded on the basis of learning disorders or other mental health issues to keep the diversity of the sample and avoid excluding any meaningful variance. This study was approved by Ryerson University's Research Ethics Board.

Data Analysis

Preliminary Data Analysis

Task Validation.

Prior to testing the main hypotheses, performance on the SRM task was examined to determine whether the task is a valid measure of self-referent memory. The SRM task is unique from many other SRM tasks in that it uses a continuous approach to rating self-reference, so it was important to determine whether the predictions made by research on dichotomous self-reference ratings would stand using more sensitive ratings of self-reference. Response patterns in recognition memory by levels of self-reference rating are summarized in Table 2. The mean Pr for the task was .71 ($SD = .026$) with a range of .037 - .914. Mean raw hit and false alarm rates are summarized in Table 4.

Self-referent bias (SRB) was operationalized in this study as the sum of the participant's self-reference ratings. Raw SRB scores were adjusted to account for missing responses by dividing the raw score by the maximum total score possible (given missing data), then multiplying that by 400, the maximum possible score. The mean adjusted SRB score out of a possible 400 was 248.91 ($SD = 22.58$), or 3.11 out of 5 per item on average. The range of self-

reference rating scores was from 217 to 308. Table 3 summarizes the frequency of self-reference ratings from 1 to 5.

There was a significant difference in SRB score between counterbalanced lists with list means ranging from 237.282 to 267.217 (ANOVA: [$F(3, 36) = 3.96, p = .015, MSE = 415.33$]). Therefore, list condition was included as a covariate in the meditational analyses to control for the differences between lists.

Three repeated measures analyses of variance (ANOVAs) were conducted to test whether higher ratings of self-reference resulted in better overall memory performance, as is predicted by the SRE literature and previous studies (Conway & Dewhurst, 1995; Conway et al., 2001; Bellezza, 1992). Separate ANOVAs for Hit (Remember), Hit (Know) and Misses (New) responses compared the number of responses at each level of self-reference rating from 1 to 5. For each type of response (Remember, Know and New) at each level (1-5), the raw number of responses was divided by a sum score of the number of responses the participant made across response type for that level, resulting in proportion scores. Proportions were needed to meaningfully compare levels because the number of responses varied between levels of self-reference and type of response. Mean response proportions by response type and level of self-reference can be found in Table 3. Based on similar tasks (Conway & Dewhurst, 1995; Conway et al., 2001), it was hypothesized that higher Hit (Remember) but lower Hit (Know) rates would be seen when self-reference ratings were higher. Lower Misses (New) rates were also expected with higher self-reference ratings.

For Hit (Remember) responses, an omnibus ANOVA revealed a significant effect of level of self-reference such that there were higher proportions of Remember responses in the higher self-reference rating levels [$F(4, 156) = 5.25, p = .001, MSE = .029, \eta_p^2 = .12$]. A trend toward a

significant overall effect of self-reference rating was also found for Hit (Know) responses [$F(4, 156) = 2.17, p = .075, MSE = .020, \eta_p^2 = .053$] such that higher proportions of Know responses accompanied lower self-reference rating levels. A significant effect was found for the Misses following the same pattern as Know responses [$F(4, 156) = 3.67, p = .007, MSE = .014, \eta_p^2 = .086$]. These results are consistent with what was predicted by SRE literature and previous studies, suggesting that this SRM task is a valid measure of self-referent memory.

Correlations.

Correlational analyses were conducted to determine appropriate covariates to include in the regression analyses and to validate the SRM task and the construct of self-referent bias by ruling out potential confounding effects. All correlations were evaluated at an alpha level of .05, one-tailed, based on a priori hypotheses; a full correlation table can be found in Appendix C. As a preliminary test of the main hypotheses, the correlations between Pr and the PDI summary score, PDI subscales scores, SPQ-L total score, and SPQ-L subscale scores were examined. Significant correlations in the predicted direction were found between Pr and the PDI summary score ($r = -.34, p = .016$), the Conviction subscale ($r = -.33, p = .018$), the Distress subscale ($r = -.32, p = .022$) and the Frequency subscale ($r = -.34, p = .015$). Since scores on the PDI subscales were highly correlated ($r_s > -.85, p < .001$) and all were found to be correlated to Pr, the PDI total score was used as a predictor in the regression analyses to reduce collinearity. There was a trend toward a significant negative correlation between the Odd Beliefs/Magical Thinking subscale of the SPQ-L and Pr ($r = -.26, p = .054$), however, there were no significant correlations between total SPQ-L score or other SPQ-L subscale scores and Pr ($r_s > |.13|, p_s > .21$). Since there was only a trend toward a significant correlation between one of the nine SPQ-L scores and Pr, SPQ-L scores were not retained as predictors for the regression analyses.

A trend toward a significant correlation was found between SRB score and Pr ($r = -.25, p = .063$) and a significant correlation was found between SRB score and PDI total score ($r = .30, p = .03$). Although the correlation between SRB score and Pr did not reach statistical significance, it was of a medium-sized effect. Given the core predictions pertaining to SRB and its relation to both PDI total score and Pr, SRB was retained as a predictor in the regression analyses.

As predicted, a significant correlation was found between WRAT-4 reading score and Pr ($r = .46, p = .002$), so it was included as a covariate in the regression analyses. Significant correlations were found between the WMS-IV Logical Memory standardized Immediate recall score ($r = .48, p = .001$) and standardized Delayed recall score ($r = .42, p = .003$) and Pr. The WMS-IV Logical Memory Immediate and Delayed recall scores were highly correlated, so the Immediate recall score, which had a stronger correlation with Pr, was chosen as a covariate for the regression analyses. The DASS total score and Depression, Anxiety and Stress subscale scores were not correlated with Pr ($r_s < |.027|, p_s > .87$) and were therefore not included as covariates in the regression. There was a significant correlation between age and Pr ($r = -.43, p = .005$), so it was included as a covariate. There was no significant correlation between Pr and gender ($r = -.19, p = .25$). List counterbalance condition was included as a covariate based on preliminary analyses of the task (see above); there was a significant correlation between list counterbalance condition and SRB score ($r = .44, p = .002$), but no significant correlation between list condition and PDI total score ($r = .05, p = .38$) or list condition and Pr ($r = -.12, p = .23$). None of the other selected covariates correlated significantly with any of the predictors or mediators included in the regression analyses ($r_s < -.18, p > .26$).

A response bias index (Br; Snodgrass & Corwin, 1988), or the probability of saying yes to items in conditions of uncertainty, was calculated for each participant and correlational analyses

were conducted to determine whether SRB score was related to Br. No significant correlation was found between SRB score and Br ($r = .12, p = .46$), so Br was not included as a covariate in the regression analyses. These results also highlight that SRB scores do not reflect simple response biases.

Regression.

Prior to testing the main predictions using regression analyses, the data were screened for outliers. Visual inspection of the standardized residual versus standardized error plots, histograms and normal probability plots suggest that the assumptions of normality, linearity, homoscedasticity and independence were met. There were no studentized deleted residual values above $|t_{\alpha/2}(N - p - 1)df|$, suggesting that discrepancy levels were low (Cohen, Cohen, Aiken & West, 2002). There were 2 cases with centered leverage values greater than $3p/N$, however, the influence of these points was low, as indicated by Cook's D values below 1 and they were retained in the analyses.

Mediation Analyses

Regression.

Regression analyses were conducted to determine whether SRB score mediated the relation between PDI total score and Pr using a causal steps approach (Baron & Kenny, 1986). According to Baron and Kenny (1986), the following evidence is needed to infer mediation: 1) the relation between the predictor (independent variable) and dependent variable is significant (path c); 2) the relation between the predictor and mediator is significant (path a); 3) the relation between the mediator and dependent variable is significant, holding the effect of the independent variable constant (path c'); and 4) the Beta value of the direct effect of the independent variable on the dependent variable in step 3) must be lower than the correlation coefficient or not significantly

different from zero. For each of the following regressions, Age, WRAT-4 Reading score, WMS-IV Immediate Logical memory score and list condition were included as covariates. A summary of the mediation analyses is depicted in Figure 1. In the first analysis, the dependent variable (Pr) was regressed on the independent variable (PDI total score) to obtain the regression coefficient for path c ($\beta = -.24$, $p = .05$, $SE = .0003$). In the second analysis, the mediator variable (SRB score) was regressed on the independent variable (PDI total score) to obtain the regression coefficient for path a ($\beta = .31$, $p = .04$, $SE = .05$). In the third analysis, the dependent variable (Pr) was regressed on the independent (PDI total score) and mediator (SRB score) variables to obtain regression coefficients for paths b ($\beta = -.40$, $p = .004$, $SE = .001$) and c' ($\beta = -.11$, $p = .31$, $SE = .0003$). Using the causal steps approach, although the regression coefficient for path c is on the cusp of statistical significance, the change in significance between path c and path c' suggests a full mediation.

Bootstrapping.

Although the causal steps approach is still commonly used in social sciences research, it has recently been criticized for low statistical power resulting in increased Type II errors due to the number of formal tests required to infer mediation (Preacher & Hayes, 2004, 2008). If even one of the paths does not reach significance due to low power, Type II errors can occur. It has also been suggested that path c does not need to be significant for indirect effects to be present in the population since suppression effects can often mask significant relationships. Preacher and Hayes (2004) have recommended formal testing of the change in significance between path c and path c' using bootstrapping analyses as an alternative. Bootstrapping is also advantageous in that it is a nonparametric technique and hence makes no assumptions about the shape of the distributions of the variables or the sampling distribution of the statistic, and can yield reliable

results in small samples (Efron & Tibshirani, 1993). The technique consists of resampling a large number of new data sets from the original sample using sampling with replacement and computing a point estimate of the indirect effect ($c - c'$, or equivalently ab) across samples; a confidence interval for the size of the indirect effect is computed based on the point estimate and if the confidence interval does not contain zero, the indirect effect can be inferred to be different from zero.

Bootstrap analyses were conducted to formally test the significance of the indirect effect of SRB score on the relation between PDI total score and Pr using an SPSS macro developed by Preacher and Hayes (2008). The model consisted of Pr as the dependent variable, PDI total score as the independent variable, SRB score as a proposed mediator, and age, WRAT-4 reading score, WMS-IV Immediate Logical Memory score and list condition as covariates. Using a bias corrected and accelerated 95% confidence interval with 10,000 bootstrap samples, the true indirect effect is estimated to lie between -.0010 and -.000028. Because the 95% confidence interval does not contain zero, it can be concluded that the indirect effect is significantly different from zero ($p < .05$). Thus, these results support those of the above mediation analysis and indicate that there is at minimum an indirect effect.

Shrout and Bolger (2002) suggest that factors including suppression and temporal or theoretical distance between the predictor and dependent variable can result in the c path not reaching significance and it is therefore worth evaluating the potential for mediation effects even if the relation between the proposed predictor and dependent variable does not reach significance. In this case, there is a significant bivariate correlation between PDI total score and Pr, a correlation with .05 significance between PDI total score and Pr, and significant bootstrap

results. At present, it can only be concluded that an indirect effect exists but that SRB score mediates the relation between PDI total score and Pr.

Discussion

The purpose of this study was to examine the relation between subclinical delusional thought, SRB and SRM in a normal sample. Previous studies have reported that delusional symptoms in schizophrenia may be associated with an SRB (Blackwood et al., 2004; Menon et al., 2008). These findings are in line with predictions made by cognitive models of delusions (Blackwood et al., 2001; Sass & Parnas, 2003). It has also been previously reported that items judged to be self-referent are remembered more readily than items not judged to be self-referent (Bellezza, 1992) and that the mere act of judging the self-reference of items increases memory for those items (Rogers, 1977; Rogers, Kuiper & Kirker, 1977). In combination, these findings predict that an SRB ought to result in a memory advantage. Conversely, SRE is impaired in schizophrenia (Jia et al., 2008); the reason for this discrepancy is unclear. The current study sought to reconcile these inconsistencies by extending the finding of a relation between delusional symptoms and SRB to a normal population and characterizing the effect of SRB on memory. It was hypothesized that 1) delusional ideation would predict poor memory performance, that 2) delusional ideation would predict SRB and that 3) SRB would predict memory performance above and beyond delusional ideation. Although SPQ-L was not predictive of Pr, PDI total score was significantly correlated with Pr and the regression coefficient bordered significance. Regression and bootstrapping analyses supported the remaining hypotheses, suggesting that SRB mediates an indirect effect between PDI total score and Pr. The findings of this study have implications for understanding SRE, cognitive impairment in schizophrenia and delusions; these implications are discussed below.

SRE

Initial examination of my novel experimental task suggests that it is a valid and sensitive measure of SRM and SRB. As predicted, corrected hit rate (Pr), which reflects overall memory performance, significantly correlated with SRB scores. Although the purpose of this study was not to examine the dual process model of recognition (Tulving, 1985), a Remember-Know procedure was used to maximize task sensitivity to detect potential effects of SRB on memory and be amenable to follow-up studies in a clinical sample. As predicted, higher self-reference ratings corresponded with a higher proportion of Remember responses and there was a trend toward higher self-reference ratings corresponding with lower proportions of Know responses, suggesting that self-referent encoding is predictive of recollective, rather than familiarity, based recognition. Although the validity of multiple memory models in SRE is debated (for example, see Hirshman, Lanning, Master & Henzel, 2002), these results are generally in line with what has been reported in previous studies using similar methods (Conway & Dewhurst, 1995; Conway et al., 2001).

Examination of the mean proportion of correct responses by level of self-reference rating (summarized in Table 3) reveals that although there is a significant overall effect of self-reference rating on memory, studied items given self-reference ratings of 4, not 5, had the lowest proportion of New responses (misses), highest proportion of Remember responses and lowest proportion of Know responses. These results partially replicate previous findings that suggest that there may not be a direct linear relation between item-level rating of self-reference and memory performance. Previous studies using continuous assessment of self-reference have clumped items given moderate ratings of self-reference together, potentially masking important variability (Conway & Dewhurst, 1995; Conway et al., 2001). If this finding is replicable,

behavioural and neural models of self-referent memory, including the *self-memory system* model (Conway & Pleydell-Pearce, 2000) will need to account for it. The finding that self-reference ratings are not necessarily linearly related to memory performance has been replicated using different stimuli and task parameters suggesting that it is not an artifact of task design and merits closer inspection. Conway et al. (2001) suggest that items rated high in self-reference are given special importance and may be integrated into long-term memory differently than moderately self-referent information. A potential explanation for the current pattern of results consistent with this model is that items rated high in self-reference are immediately integrated without elaboration, which is a proposed mechanism of memory enhancement in SRE (Symons & Johnson, 1997). A second possible explanation is that items given ratings of 4 were more complex, undesirable, uncommon or abstract, resulting in deeper processing, but lower self-reference ratings. Related to the second proposed explanation is the fact that extreme ratings were used more commonly than any of the moderate ratings levels; thus, it is possible that self-reference interacted with rating distinctiveness, resulting in memory enhancement. Closer inspection of items and response patterns could detect these causes, but is beyond the scope of this thesis. While this finding remains perplexing, it is clear that assessment of self-reference using dichotomous ratings may mask other processes, which could hinder proper understanding of self-referent cognition. Correct understanding of SRM is important because it could have implications for rehabilitation techniques for memory impairment in schizophrenia.

Cognition and Delusional Ideation

Correlations, regression and bootstrapping analyses indicate that in this sample delusional ideation predicted poor SRM, which was mediated by SRB. Although the variance in memory performance accounted for by delusional ideation was small ($R^2\Delta = .055$), this is nonetheless

impressive, given that this was a normal sample with relatively low levels of delusional ideation and a normal range of memory function. SRB accounted for an additional 9% of the variance when added to the model, which is a medium-sized effect and fully mediated the relation between delusional ideation and self-referent memory. The continuum model of psychosis predicts that cognitive differences found in samples with low levels of psychotic symptoms should be replicable in samples with clinically significant symptoms, but with greater magnitude. Therefore, in a clinical sample, greater memory impairment and SRB would be predicted. This prediction is consistent with what was reported by Jia et al. (2008), although they did not select their sample based on delusional symptoms. Thus, although the effect sizes in this study were modest, the findings may still have significant theoretical and practical implications for understanding cognitive impairment in schizophrenia.

The finding that there was a correlation between Pr and PDI total, but not SPQ-L scores, suggests that it is delusional ideation rather than schizotypal personality traits per se that may be associated with impaired SRM. This finding is not consistent with the continuum model of psychosis, and in a review of the evidence supporting the continuum model, Johns and van Os (2001) noted that as is seen in clinical psychotic disorders, delusional symptoms are most often accompanied by other positive symptoms (such as hallucinations) in non-clinical samples. However, they also note from research on the factor structure of schizotypy that the relation between other symptoms in non-clinical samples is less clear. Whereas some authors have reported a three factor structure, akin to the positive, negative and disorganized symptom domains in schizophrenia, others propose a fourth factor unique to schizotypy relating to asocial tendencies (Vollema & van den Bosch, 1995; as cited in Johns & van Os, 2001). The hypothesis that impairment in SRM is uniquely related to delusional ideation is further supported in this

study by the fact that the only subscale on the SPQ-L to show a trend toward correlation with Pr was the Odd Beliefs/Magical thinking subscale, which is thematically linked to delusional ideation. The SPQ-L includes numerous subscales assessing heterogeneous symptoms and it is possible that items relating to delusion were too few to capture enough variance in delusional ideation to detect an effect. To confirm whether SRB is indeed uniquely related to delusions, follow-up studies in samples with schizotypal personality disorder and schizophrenia with and without delusional symptoms are needed. Based on the results of this study, it can be hypothesized that SRB will be seen in samples with schizotypal personality disorder or schizophrenia with delusions, but not without delusions. Similarly, clinical samples without delusion may not show impairment on SRM tasks.

Cognitive and Neural Models of Delusions

In this study, it was demonstrated that subclinical delusional ideation is associated with an SRB. This finding extends what has been reported by Blackwood et al. (2004) and Menon et al. (2008) to a normal sample. That this relation can be detected in a normal sample supports the notion that cognitive biases, like psychotic symptoms, can be thought of as continuous and may be involved in the development of psychosis. This finding is also consistent with predictions made by two cognitive models of schizophrenia: one proposed by Blackwood and colleagues (2001) to account for persecutory delusions and another proposed by Sass and Parnas (2003) theorizing that differences in self cognition can account for all symptoms of schizophrenia.

Although the current study used similar stimuli and task parameters to Blackwood et al. (2004) and Menon et al. (2008), the sample was not restricted to those with persecutory or referential delusions and delusional ideation and SRB was measured continuously (as opposed to being compared between groups), allowing for more sensitive assessment. Using continuous

measurement and analysis methods without restriction to a group with specific delusional content, a self-referent bias was detected. Although a self-referent bias was predicted by Blackwood and colleagues, they theorized that it would only be present in those with persecutory delusions. The PDI was designed to assess delusional ideation as a unitary construct, so a possible interpretation of the findings is that it is delusional ideation generally, rather than persecutory delusions specifically, that are related to self-referent bias. In this way, this study more strongly supports the model proposed by Sass and Parnas than that proposed by Blackwood and colleagues.

Van der Meer et al. (2010) proposed a neural model of self-reflection wherein the VMPFC tags information relevant for self, and DMPFC is involved in the decision-making process. van der Meer and colleagues note the relevance of this model for understanding patients' insight into their symptoms in schizophrenia. Given the finding of an SRB related to delusions in this thesis, this model may also have special relevance to deluded populations. Based on this study, differential activation would be predicted in the DMPFC in deluded samples. It is unclear whether hypo or hyperactivation would be expected, since past studies of self-reference in delusional samples have noted both in the MPFC, depending on the task used (Menon et al., 2008; Brüne et al., 2008). To date, no study has sought to isolate DMPFC activation in a heterogeneous deluded sample. Clarifying the relevant roles of the DMPFC and VMPFC in delusions are important since it has gone unrecognized in past research and could inform treatment and theory surrounding the development and maintenance of delusions.

Limitations

Because this study was exploratory in nature and the SRM task was newly developed, many assessments were included, so the analyses were limited to the main relations and hypotheses. Contrary to what was predicted, the SPQ did not relate to SRM or SRB. Predictions were not made regarding the subscales of SPQ, but there was evidence of a relation between SRM and the Odd Beliefs/Magical Thinking subscale, supporting the hypothesis that self-referent memory is uniquely associated with delusional ideation. In spite of this evidence, it is unclear why the PDI, but not the SPQ was related to SRM and SRB since the two were highly correlated and both designed to measure related constructs.

As previously mentioned, although the SRM task was newly developed for this study, it is similar to tasks used in previous studies (Conway & Dewhurst, 1995; Blackwood et al., 2004). The stimuli were similar to what has been used in previous studies and included equal numbers of positive, negative and neutral statements. Stimuli were intended to be abstract and ambiguous, however a current limitation is that no data were collected to characterize the valence and abstractness of the stimuli; this may be particularly challenging due to the sentence structure of the stimuli. Since the findings generally replicate what has been previously reported, it seems unlikely that either abstractness or valence affected the results, but this possibility cannot be evaluated with the current data. The cognitive model of persecutory delusions proposed by Blackwood and colleagues (2004) predicts that persecutory delusions should be associated with a bias to judge ambiguous threat stimuli as self-referent. The stimuli used in this study included negatively valenced statements that were similar to those characterized as threatening by Blackwood et al. (2004), but the effect of valence on self-referent bias and the relation between valence, self-reference ratings and delusional ideation was not explored. Because data regarding

valence was not collected, it is not possible to test whether there was any interaction between perceived valence by participants and self-referent bias. Similarly, although the PDI contains items assessing persecutory delusions, the content of reported delusional thoughts was not explored, therefore the possibility that the relations found were due wholly to persecutory delusions cannot be dismissed.

Another limitation of this study was sample size. SRB is a relatively new construct, and its relation to memory had never been tested; it was not known during the study design stage what the size of the relation might be and how many covariates would be used, rendering estimation of the necessary sample size to detect effects difficult. Although the sample size was sufficient to reliably demonstrate most of the hypothesized associations, the significance of the relation between PDI total score and Pr only just reached significance. The raw correlation between SRB and Pr was also marginally significant, but became significant when covariates were included in the regression analyses. Significance between the predictor and dependent variable is not needed to test for mediation, however, because the significance of this relation was marginal, it remains unclear whether SRB mediates a direct effect or an indirect effect in normal participants.

Future Directions

This study is the first to demonstrate a relation between SRB and SRM. Future studies should seek to replicate this finding in a larger sample of healthy adults, but also extend this finding to clinical samples with schizophrenia and schizotypal personality disorder. To determine whether SRB is uniquely related to delusions, follow-up studies in samples with schizotypal personality disorder and schizophrenia with and without delusional symptoms are needed. Based on the results of this study, it can be hypothesized that SRB will predict memory impairment in

samples with schizotypal personality disorder or schizophrenia with delusions, but not without delusions.

Although the main hypotheses were supported, closer inspection of the task parameters and stimuli could help to explain the unique pattern noted with self-reference ratings by ruling out confounds including complexity, abstractness, undesirability or uncommonness of traits. Although several moderators and mediators of SRM have been identified (e.g. Symons & Johnson, 1997), relatively few studies have examined SRM using purely continuous designs and doing so may help to identify additional confounds in the research.

The results of the current study support proposed cognitive models of delusions, but several questions remain. The current study suggests, consistent with predictions of the model by Sass and Parnas (2003) that subtle differences in self-cognition may underlie symptoms of schizophrenia. Although these early results are promising, this model has been largely untested and future studies should seek to examine the hypothesized relations between other symptoms of psychosis and self-cognition. Regarding Blackwood et al.'s (2001) model, the evidence is less clear; it is uncertain whether there is an interaction between threat and SRB and also whether there is an interaction between delusional themes and SRB. This study was not designed to test these predictions, but the results indirectly suggest that SRB may not be specific to persecutory delusions; this remains an empirical question to be addressed in future studies. The SRM task included potentially threatening stimuli and has demonstrated sufficient sensitivity to detect self-referent bias, so it could provide a means of testing the hypothesized interaction between threat and self-referent bias.

Similarly, although this study was not designed to test the neural model of self-referent cognition proposed by van der Meer and colleagues (2010), the results have direct implications,

which should be tested. The finding of a relation between delusional symptoms and self-referent appraisal predicts that differential activation should be found in the DMPFC during tasks involving self-referent decisions in deluded samples. Specifically, SRB could account for the differential activation often noted in this region in delusional samples. Although it is still unclear whether this finding applies to all delusional thought or certain themes of delusional thought, previous studies examining delusional samples using brain imaging techniques (Menon et al., 2008; Brüne et al., 2008) have chosen their deluded sample based on specific delusional themes and did not overtly seek to examine the association between activation in the DMPFC and self-referent appraisal. Future studies should examine this relation using heterogeneous delusional samples to determine whether this bias accounts for differential activation in the DMPFC.

Consistent with past research, the current study suggests that in normal populations, SRM is primarily based upon recollection rather than familiarity. Future studies are needed to test whether this is also true in clinical samples. Since recollective memory is often impaired in schizophrenia (Danion, Rizzo & Bruant, 1999), it is likely that psychotic samples may instead rely on familiarity-based memory systems. If, as predicted, psychotic samples have impaired SRM, understanding which memory systems support their memory will be essential to the development of effective cognitive remediation strategies.

Finally, since this was a correlational design, empirical tests are needed to determine whether SRB merely mediates SRM or causes SRM impairment. The model of psychosis proposed by Sass and Parnas (2003) suggests that cognitive biases may cause or precede the development of symptoms. If so, SRB could be used as a marker for early identification of at-risk populations. Alternatively, SRB could help to explain the development of delusions, which

could yield more effective prevention and treatment strategies. The purpose of cognitive models is to help explain complex disorders to ultimately assist with the development effective treatment and prevention strategies. Unfortunately, the causes and maintenance mechanisms of schizophrenia are poorly understood. Until the causes and core features of schizophrenia are clear, development of effective treatments will be hindered. Thus, future research should seek to determine why psychosis develops and persists.

In summary, in spite of the current limitations, there is much to be gained from the continued study of cognition in the continuum of psychosis. As demonstrated in the current study, there may exist links between basic cognitive processes, such as memory, and positive symptoms of psychosis. These links inform our understanding of memory processes in healthy individuals, but could also be important for understanding core impairments in schizophrenia. Continued study of the relation between basic cognitive processes and schizophrenia could ultimately lead to improved treatment of symptoms, cognitive impairments and prevention strategies.

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Table 1

Sample Characteristics

Age in years	34.23 (14.27)
Range	18-69
Gender (Male)	13 (32.5%)
DASS Total Score	25.05 (17.01)
Depression	8.25 (6.47)
Anxiety	5.56 (7.05)
Stress	11.25 (6.45)
PAS Total Score Probability of Problems (Frequency in sample)	
Low (P < 15)	5
Normal (15 < P < 29)	9
Mild (30 < P < 47)	6
Moderate (48 < P < 74)	8
Marked (75 < P < 99)	6
Extreme (P > 99)	0
PDI Total Score	82.73 (64.31)
Conviction	31.30 (22.15)
Distress	25.23 (23.27)
Frequency	26.20 (20.44)
SPQ-L	96.38 (41.48)
Ideas of Reference	12.00 (6.41)
Excessive Social Anxiety	14.45 (7.64)
Odd Beliefs/Magical Thinking	5.93 (5.33)
Unusual Perceptual Experiences	7.42 (5.46)
Odd or Eccentric Behaviour	9.83 (6.30)
No Close Friends	11.98 (7.32)
Odd Speech	13.95 (6.47)
Constricted Affect	9.02 (5.69)
Suspiciousness	11.12 (6.41)

Notes: unless otherwise specified, mean standardized scores are reported with standard deviations in parentheses (N=40). DASS = Depression Anxiety Stress Scale; PAS = Personality Assessment Screener; PDI = Peters Delusion Inventory; SPQ-L = Schizotypal Personality Questionnaire – Likert Version.

Table 2.

Cognitive Assessment

Measure	
WRAT-4 Reading Test	104.53 (12.03)
Range	79-126
WMS-IV Logical Memory	
Immediate Recall	10.88 (2.88)
Delayed Recall	10.58 (2.99)
Delayed Recognition (frequency by percentile range)	
<2	1
3-9	2
10-16	2
17-25	1
26-50	10
51-75	7
>75	17

Notes: unless otherwise specified, mean standardized scores are reported with standard deviations in parentheses (N=40). WRAT-4 = Wide Range Achievement Test, 4th edition; WMS-IV = Wechsler Memory Scale, 4th edition.

Table 3.

Response pattern for Old items in SRM Task by self-reference rating

Self-Reference Rating	1			2			3			4			5		
	N	R	K	N	R	K	N	R	K	N	R	K	N	R	K
Mean Self-Reference Rating Frequency		19.95			10.53			12.2			13.78			23.18	
Mean Response Frequency	4.27	10.15	5.53	1.62	6.18	2.72	2.22	7.25	2.72	1.85	9.65	2.28	3.4	14.8	4.97
Correct response proportion	0.22	0.52	0.26	0.15	0.57	0.23	0.16	0.59	0.23	0.13	0.68	0.17	0.14	0.64	0.22

Notes: N = response of New to old item (misses), R = response of Remember to old item, K = response of Know to old item.

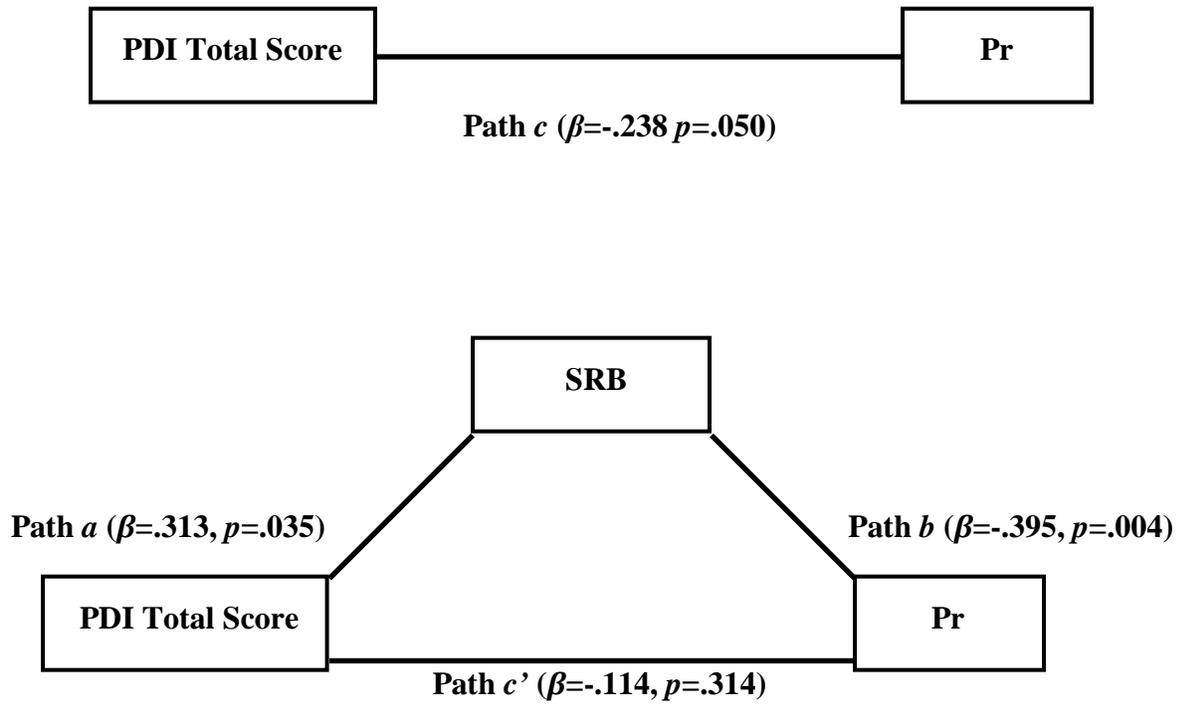
Table 4.

Mean response rates

Stimulus type	Response		
	New	Remember	Know
New	70.6 (7.85)	3.8 (3.96)	5.75 (6.10)
Old	13.27 (11.55)	48.25 (18.13)	18.22 (16.10)

Note: mean response presented, standard deviation in parentheses (N=40).

Figure 1. Mediation Model



Appendix A: SRM Task Stimuli

Female Stimuli			
<i>Original</i>	<i>Matched Structure, Matched Valence</i>	<i>Matched Structure, Opposite Valence</i>	<i>Matched Structure, Opposite Valence</i>
She is stupid	She is annoying	She is lucky	She is wise
She attacked the girl	She kicked the child	She loved the kid	She saved the boy
She almost choked to death	She nearly crashed her car	She always gives her all	She often calls her friends
She was in a horrible accident	She was in a hospital ward	She was in a fun class	She was in an awesome city
She hates her job	She hates her bedroom	She loves her wardrobe	She loves her hairstyle
She cheats on her partner	She disobeys her parents	She respects her family	She honours her elders
She is ugly	She is nasty	She is gentle	She is grateful
She lost her job	She failed her test	She found her phone	She earned her money
She has been impaired	She has seen tragedy	She has found strength	She has earned trust
She saw a body cancer	She hid the truth	She got a present	She found a coin
She might have cancer	She could get sick	She could be helpful	She might be fit
She is miserable	She is incompetent	She is considerate	She is perceptive
She is lonely	She is boring	She is patient	She is educated
She dreams of winning the lottery	She imagines touring the world	She fears catching the flu	She dreads paying the bills
She is feeling very happy today	She is feeling very alert today	She is feeling very low today	She is feeling very doubtful today
Everybody likes her	Everybody pleases her	Everybody avoids her	Everybody distrusts her
She is opinionated	She is different	She is accepted	She is moderate
She is a pervert	She is an outcast	She is a trend-setter	She is an advocate
She is hated by everyone	She is ignored by many	She is adored by friends	She is recognized by classmates
She is a liar	She is a sinner	She is a charmer	She is an inventor
She is tall	She is shapely	She is small	She is lean
She is sleepy	She is groggy	She is attentive	She is motivated
She likes walking the dog	She enjoys watering the garden	She avoids cleaning the stove	She dislikes making the bed
She goes to school	She goes to class	She goes to parties	She goes to dinner
She enjoys cereal for breakfast	She enjoys chocolate for dessert	She dislikes cola for breakfast	She dislikes oatmeal for dessert
She used to be in a choir	She used to be in a sports league	She used to be in a study group	She used to be in a fitness class

She scratched a CD	She broke a dish	She fixed a computer	She finished a paper
She wants to be a school teacher	She wants to be a scientist	She wants to be a manager	She wants to be a supervisor
She wants two kids	She wants two pets	She wants two cars	She wants two chairs
She likes collecting music	She likes collecting cards	She likes collecting posters	She likes collecting movies
She has brown hair	She has short nails	She has pink lips	She has large eyes
She is right handed	She is light skinned	She is rosy cheeked	She is bright eyed
She has a drivers licence	She has a health card	She has a phone number	She has a report card
She loses her keys often	She loses her phone often	She clears her desk often	She brushes her teeth often
She likes going to the cinema	She likes going to the park	She dislikes going to the dentist	She dislikes going to the hospital
She enjoys drinking coffee	She enjoys eating cake	She dislikes drinking tonic	She dislikes eating mold
She knows to ride a bike	She knows how to sew a button	She doesn't know how to cure a disease	She doesn't know how to build a house
She is around 20 years old	She is about average height	She is of medium build	She is from Canada
She can speak two languages	She can use word processors	She can't jump five feet	She can't make the NBA
She is tired	She is uneasy	She is eager	She is serious

Male Stimuli

<i>Original</i>	<i>Matched Structure, Matched Valence</i>	<i>Matched Structure, Opposite Valence</i>	<i>Matched Structure, Opposite Valence</i>
He is stupid	He is annoying	He is lucky	He is wise
He attacked the girl	He kicked the child	He loved the kid	He saved the boy
He almost choked to death	He nearly crashed his car	He always gives his all	He often calls his friends
He was in a horrible accident	He was in a hospital ward	He was in a fun class	He was in an awesome city
He hates his job	He hates his bedroom	He loves his wardrobe	He loves his hairstyle
He cheats on his partner	He disobeys his parents	He respects his family	He honours his elders
He is ugly	He is nasty	He is gentle	He is grateful
He lost his job	He failed his test	He found his phone	He earned his money
He has been impaired	He has seen tragedy	He has found strength	He has earned trust
He saw a body	He hid the truth	He got a present	He found a coin
He might have cancer	He could get sick	He could be helpful	He might be fit
He is miserable	He is incompetent	He is considerate	He is perceptive
He is lonely	He is boring	He is patient	He is educated

He dreams of winning the lottery	He imagines touring the world	He fears catching the flu	He dreads paying the bills
He is feeling very happy today	He is feeling very alert today	He is feeling very low today	He is feeling very doubtful today
Everybody likes him	Everybody pleases him	Everybody avoids him	Everybody distrusts him
He is opinionated	He is different	He is accepted	He is moderate
He is a pervert	He is an outcast	He is a trend-setter	He is an advocate
He is hated by everyone	He is ignored by many	He is adored by friends	He is recognized by classmates
He is a liar	He is a sinner	He is a charmer	He is an inventor
He is tall	He is shapely	He is small	He is lean
He is sleepy	He is groggy	He is attentive	He is motivated
He likes walking the dog	He enjoys watering the garden	He avoids cleaning the stove	He dislikes making the bed
He goes to school	He goes to class	He goes to parties	He goes to dinner
He enjoys cereal for breakfast	He enjoys chocolate for dessert	He dislikes cola for breakfast	He dislikes oatmeal for dessert
He used to be in a choir	He used to be in a sports league	He used to be in a study group	He used to be in a fitness class
He scratched a CD	He broke a dish	He fixed a computer	He finished a paper
He wants to be a school teacher	He wants to be a scientist	He wants to be a manager	He wants to be a supervisor
He wants two kids	He wants two pets	He wants two cars	He wants two chairs
He likes collecting music	He likes collecting cards	He likes collecting posters	He likes collecting movies
He has brown hair	He has short nails	He has pink lips	He has large eyes
He is right handed	He is light skinned	He is rosy cheeked	He is bright eyed
He has a drivers licence	He has a health card	He has a phone number	He has a report card
He loses his keys often	He loses his phone often	He clears his desk often	He brushes his teeth often
He likes going to the cinema	He likes going to the park	He dislikes going to the dentist	He dislikes going to the hospital
He enjoys drinking coffee	He enjoys eating cake	He dislikes drinking tonic	He dislikes eating mold
He knows how to ride a bike	He knows how to sew a button	He doesn't know how to cure a disease	He doesn't know how to build a house
He is around 20 years old	He is about average height	He is of medium build	He is from Canada
He can speak two languages	He can use word processors	He can't jump five feet	He can't make the NBA
He is tired	He is uneasy	He is eager	He is serious

Appendix B: Modified Psychology Assessment Screener (PAS)

Read each statement and decide if it is an accurate statement about you. Give **your own opinion** of yourself. Be sure to answer every statement. Mark your answer by circling the correct letter(s) that correspond to the following:

F = False, not true at all **ST = Slightly True** **MT = Mainly True** **VT = Very True**

If you need to change an answer, mark an “X” through the incorrect answer and then circle the appropriate letter(s).

1. There have been times when I could have been more thoughtful than I was.	F	ST	MT	VT
2. My best friends are those I use drugs with.	F	ST	MT	VT
3. Sometimes I cannot remember who I am.	F	ST	MT	VT
4. Sometimes I feel guilty about how much I drink.	F	ST	MT	VT
5. I don't take criticism very well.	F	ST	MT	VT
6. Sometimes I use drugs to feel better.	F	ST	MT	VT
7. My friends are available if I need them.	F	ST	MT	VT
8. I have trouble controlling my use of alcohol.	F	ST	MT	VT
9. I'm a very sociable person.	F	ST	MT	VT
10. There have been times when I've had to cut down on my drinking.	F	ST	MT	VT
11. Sometimes I'm too impatient.	F	ST	MT	VT
12. Since the day I was born, I was destined to be unhappy	F	ST	MT	VT
13. I'm a "take charge" type of person.	F	ST	MT	VT
14. I've tried just about every type of drug.	F	ST	MT	VT
15. Sometimes I'll avoid someone I really don't like.	F	ST	MT	VT
16. My drinking seems to cause problems in my relationships with others.	F	ST	MT	VT
17. I have visions in which I see myself forced to commit crimes.	F	ST	MT	VT
18. Sometimes I put things off until the last minute.	F	ST	MT	VT
19. People have told me that I have a drug problem.	F	ST	MT	VT
20. People don't understand how much I suffer.	F	ST	MT	VT
21. Drinking helps me get along in social situations.	F	ST	MT	VT
22. It's often hard for me to enjoy myself because I am worrying about things.	F	ST	MT	VT
23. I rarely get in a bad mood.	F	ST	MT	VT

24. Some people around me think I drink too much alcohol.	F	ST	MT	VT
25. I think I have three or four completely different personalities inside of me.	F	ST	MT	VT
26. Sometimes I let little things bother me too much.	F	ST	MT	VT
27. I never use drugs to help me cope with the world.	F	ST	MT	VT
28. Sometimes I have an alcoholic drink first thing in the morning.	F	ST	MT	VT
29. Some people do things to make me look bad.	F	ST	MT	VT
30. I've done some things that weren't exactly legal.	F	ST	MT	VT
31. Every once in a while I totally lose my memory.	F	ST	MT	VT
32. My drinking has caused me problems at home.	F	ST	MT	VT
33. I sometimes make promises I can't keep.	F	ST	MT	VT
34. My drug use has caused me financial strain.	F	ST	MT	VT
35. It's a struggle for me to get things done with the medical problems I have.	F	ST	MT	VT
36. Sometimes my vision is only in black and white.	F	ST	MT	VT
37. I never drive when I've been drinking.	F	ST	MT	VT
38. I have severe psychological problems that began very suddenly.	F	ST	MT	VT
39. I sometimes complain too much.	F	ST	MT	VT
40. People around me are faithful to me.	F	ST	MT	VT
41. I hardly ever drink alcohol.	F	ST	MT	VT
42. I am in good health.	F	ST	MT	VT
43. People think I'm aggressive.	F	ST	MT	VT
44. I've never had problems at work because of drugs.	F	ST	MT	VT
45. My drinking has never gotten me into trouble.	F	ST	MT	VT
46. My drinking has caused problems with my work.	F	ST	MT	VT
47. Some people try to keep me from getting ahead.	F	ST	MT	VT
48. I never use illegal drugs.	F	ST	MT	VT
49. I've used prescription drugs to get high.	F	ST	MT	VT
50. I have a bad temper.	F	ST	MT	VT
51. I spend money too easily.	F	ST	MT	VT
52. My drug use is out of control.	F	ST	MT	VT
53. I make friends easily.	F	ST	MT	VT
54. I've had health problems because of my drug use.	F	ST	MT	VT
55. I don't have any good memories from my childhood.	F	ST	MT	VT

56. It takes a lot to make me angry.	F	ST	MT	VT
57. My drug use has never caused me problems with my family/friends.	F	ST	MT	VT
58. I'm almost always a happy and positive person.	F	ST	MT	VT

Appendix C: Correlation table for covariate selection

		Correlations			
		Stimuli List	Age	Gender (0=f, 1=m)	DASS (0-63)
Stimuli List	Pearson Correlation	1	-.006	.083	.083
	Sig. (1-tailed)		.486	.305	.306
	N	40	40	40	40
Age	Pearson Correlation	-.006	1	.245	-.221
	Sig. (1-tailed)	.486		.064	.085
	N	40	40	40	40
Gender (0=f, 1=m)	Pearson Correlation	.083	.245	1	-.249
	Sig. (1-tailed)	.305	.064		.061
	N	40	40	40	40
DASS (0-63)	Pearson Correlation	.083	-.221	-.249	1
	Sig. (1-tailed)	.306	.085	.061	
	N	40	40	40	40
Depression	Pearson Correlation	-.018	-.216	-.162	.870**
	Sig. (1-tailed)	.455	.090	.159	.000
	N	40	40	40	40
Anxiety	Pearson Correlation	.088	-.272	-.193	.863**
	Sig. (1-tailed)	.294	.045	.117	.000
	N	40	40	40	40
Stress	Pearson Correlation	.140	-.069	-.283	.820**
	Sig. (1-tailed)	.195	.335	.039	.000
	N	40	40	40	40
Schizotypal Personality Disorder (Likert Version)	Pearson Correlation	-.075	-.102	-.043	.388*
	Sig. (1-tailed)	.323	.266	.395	.007
	N	40	40	40	40
Ideas of Reference	Pearson Correlation	-.007	-.138	-.242	.140
	Sig. (1-tailed)	.483	.197	.067	.194
	N	40	40	40	40
Excessive Social Anxiety	Pearson Correlation	-.025	-.108	.084	.354*
	Sig. (1-tailed)	.439	.253	.303	.013
	N	40	40	40	40
Odd Beliefs/Magical Thinking	Pearson Correlation	-.057	-.064	-.260	.151
	Sig. (1-tailed)	.363	.347	.053	.176
	N	40	40	40	40
Unusual Perceptual Experiences	Pearson Correlation	-.037	-.047	-.041	.351*
	Sig. (1-tailed)	.410	.387	.400	.013
	N	40	40	40	40
Odd or Eccentric Behaviour	Pearson Correlation	-.220	-.067	.001	.232
	Sig. (1-tailed)	.086	.342	.498	.075
	N	40	40	40	40
No Close Friends	Pearson Correlation	-.026	.054	.153	.355*
	Sig. (1-tailed)	.436	.371	.173	.012
	N	40	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Depression	Anxiety	Stress	Schizotypal Personality Disorder (Likert Version)
Stimuli List	Pearson Correlation	-.018	.088	.140	-.075
	Sig. (1-tailed)	.455	.294	.195	.323
	N	40	40	40	40
Age	Pearson Correlation	-.216	-.272	-.069	-.102
	Sig. (1-tailed)	.090	.045	.335	.266
	N	40	40	40	40
Gender (0=f, 1=m)	Pearson Correlation	-.162	-.193	-.283	-.043
	Sig. (1-tailed)	.159	.117	.039	.395
	N	40	40	40	40
DASS (0-63)	Pearson Correlation	.870**	.863**	.820**	.388**
	Sig. (1-tailed)	.000	.000	.000	.007
	N	40	40	40	40
Depression	Pearson Correlation	1	.650**	.580**	.417**
	Sig. (1-tailed)		.000	.000	.004
	N	40	40	40	40
Anxiety	Pearson Correlation	.650**	1	.531**	.236**
	Sig. (1-tailed)	.000		.000	.071
	N	40	40	40	40
Stress	Pearson Correlation	.580**	.531**	1	.348**
	Sig. (1-tailed)	.000	.000		.014
	N	40	40	40	40
Schizotypal Personality Disorder (Likert Version)	Pearson Correlation	.417**	.236**	.348**	1
	Sig. (1-tailed)	.004	.071	.014	
	N	40	40	40	40
Ideas of Reference	Pearson Correlation	.141	.087	.133	.717**
	Sig. (1-tailed)	.193	.296	.207	.000
	N	40	40	40	40
Excessive Social Anxiety	Pearson Correlation	.368**	.190	.355**	.759**
	Sig. (1-tailed)	.010	.120	.012	.000
	N	40	40	40	40
Odd Beliefs/Magical Thinking	Pearson Correlation	.194	-.050	.259	.374**
	Sig. (1-tailed)	.115	.380	.053	.009
	N	40	40	40	40
Unusual Perceptual Experiences	Pearson Correlation	.399**	.154	.356**	.722**
	Sig. (1-tailed)	.005	.171	.012	.000
	N	40	40	40	40
Odd or Eccentric Behaviour	Pearson Correlation	.291	.185	.118	.774**
	Sig. (1-tailed)	.034	.126	.235	.000
	N	40	40	40	40
No Close Friends	Pearson Correlation	.431**	.218	.266**	.804**
	Sig. (1-tailed)	.003	.088	.049	.000
	N	40	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Ideas of Reference	Excessive Social Anxiety	Odd Beliefs/Magical Thinking
Stimuli List	Pearson Correlation	-.007	-.025	-.057
	Sig. (1-tailed)	.483	.439	.363
	N	40	40	40
Age	Pearson Correlation	-.138	-.108	-.064
	Sig. (1-tailed)	.197	.253	.347
	N	40	40	40
Gender (0=f, 1=m)	Pearson Correlation	-.242	.084	-.260
	Sig. (1-tailed)	.067	.303	.053
	N	40	40	40
DASS (0-63)	Pearson Correlation	.140	.354	.151
	Sig. (1-tailed)	.194	.013	.176
	N	40	40	40
Depression	Pearson Correlation	.141	.368	.194
	Sig. (1-tailed)	.193	.010	.115
	N	40	40	40
Anxiety	Pearson Correlation	.087	.190	-.050
	Sig. (1-tailed)	.296	.120	.380
	N	40	40	40
Stress	Pearson Correlation	.133	.355	.259
	Sig. (1-tailed)	.207	.012	.053
	N	40	40	40
Schizotypal Personality Disorder (Likert Version)	Pearson Correlation	.717	.759	.374
	Sig. (1-tailed)	.000	.000	.009
	N	40	40	40
Ideas of Reference	Pearson Correlation	1	.489	.385
	Sig. (1-tailed)		.001	.007
	N	40	40	40
Excessive Social Anxiety	Pearson Correlation	.489	1	.066
	Sig. (1-tailed)	.001		.342
	N	40	40	40
Odd Beliefs/Magical Thinking	Pearson Correlation	.385	.066	1
	Sig. (1-tailed)	.007	.342	
	N	40	40	40
Unusual Perceptual Experiences	Pearson Correlation	.476	.462	.456
	Sig. (1-tailed)	.001	.001	.002
	N	40	40	40
Odd or Eccentric Behaviour	Pearson Correlation	.466	.476	.275
	Sig. (1-tailed)	.001	.001	.043
	N	40	40	40
No Close Friends	Pearson Correlation	.438	.548	.150
	Sig. (1-tailed)	.002	.000	.177
	N	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Unusual Perceptual Experiences	Odd or Eccentric Behaviour	No Close Friends
Stimuli List	Pearson Correlation	-.037	-.220	-.026
	Sig. (1-tailed)	.410	.086	.496
	N	40	40	40
Age	Pearson Correlation	-.047	-.067	.054
	Sig. (1-tailed)	.387	.342	.371
	N	40	40	40
Gender (0=f, 1=m)	Pearson Correlation	-.041	.001	.153
	Sig. (1-tailed)	.400	.498	.173
	N	40	40	40
DASS (0-63)	Pearson Correlation	.351	.232	.355
	Sig. (1-tailed)	.013	.075	.012
	N	40	40	40
Depression	Pearson Correlation	.399**	.291*	.431**
	Sig. (1-tailed)	.005	.034	.003
	N	40	40	40
Anxiety	Pearson Correlation	.154	.185	.218
	Sig. (1-tailed)	.171	.126	.088
	N	40	40	40
Stress	Pearson Correlation	.356	.118	.266
	Sig. (1-tailed)	.012	.235	.049
	N	40	40	40
Schizotypal Personality Disorder (Likert Version)	Pearson Correlation	.722**	.774**	.804**
	Sig. (1-tailed)	.000	.000	.000
	N	40	40	40
Ideas of Reference	Pearson Correlation	.476**	.466**	.438**
	Sig. (1-tailed)	.001	.001	.002
	N	40	40	40
Excessive Social Anxiety	Pearson Correlation	.462**	.476**	.548**
	Sig. (1-tailed)	.001	.001	.000
	N	40	40	40
Odd Beliefs/Magical Thinking	Pearson Correlation	.456**	.275*	.150
	Sig. (1-tailed)	.002	.043	.177
	N	40	40	40
Unusual Perceptual Experiences	Pearson Correlation	1	.512**	.527**
	Sig. (1-tailed)		.000	.000
	N	40	40	40
Odd or Eccentric Behaviour	Pearson Correlation	.512**	1	.547**
	Sig. (1-tailed)	.000		.000
	N	40	40	40
No Close Friends	Pearson Correlation	.527**	.547**	1
	Sig. (1-tailed)	.000	.000	
	N	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Odd Speech	Constricted Affect	Suspiciousness	PDI Distress
Stimuli List	Pearson Correlation	-.052	-.141	.122	.013
	Sig. (1-tailed)	.374	.192	.227	.468
	N	40	40	40	40
Age	Pearson Correlation	-.130	-.048	-.106	-.047
	Sig. (1-tailed)	.212	.383	.258	.388
	N	40	40	40	40
Gender (0=f, 1=m)	Pearson Correlation	-.217	.133	.022	.017
	Sig. (1-tailed)	.090	.207	.447	.458
	N	40	40	40	40
DASS (0-63)	Pearson Correlation	.344	.137	.412	.539
	Sig. (1-tailed)	.015	.199	.004	.000
	N	40	40	40	40
Depression	Pearson Correlation	.318	.250	.333	.467
	Sig. (1-tailed)	.023	.060	.018	.001
	N	40	40	40	40
Anxiety	Pearson Correlation	.260	.022	.319	.399
	Sig. (1-tailed)	.053	.446	.022	.005
	N	40	40	40	40
Stress	Pearson Correlation	.306	.087	.402	.515
	Sig. (1-tailed)	.027	.296	.005	.000
	N	40	40	40	40
Schizotypal Personality Disorder (Likert Version)	Pearson Correlation	.824	.722	.794	.718
	Sig. (1-tailed)	.000	.000	.000	.000
	N	40	40	40	40
Ideas of Reference	Pearson Correlation	.513	.332	.661	.603
	Sig. (1-tailed)	.000	.018	.000	.000
	N	40	40	40	40
Excessive Social Anxiety	Pearson Correlation	.633	.572	.563	.496
	Sig. (1-tailed)	.000	.000	.000	.001
	N	40	40	40	40
Odd Beliefs/Magical Thinking	Pearson Correlation	.102	-.062	.295	.443
	Sig. (1-tailed)	.265	.353	.033	.002
	N	40	40	40	40
Unusual Perceptual Experiences	Pearson Correlation	.518	.295	.571	.661
	Sig. (1-tailed)	.000	.032	.000	.000
	N	40	40	40	40
Odd or Eccentric Behaviour	Pearson Correlation	.685	.568	.486	.496
	Sig. (1-tailed)	.000	.000	.001	.001
	N	40	40	40	40
No Close Friends	Pearson Correlation	.616	.778	.617	.541
	Sig. (1-tailed)	.000	.000	.000	.000
	N	40	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		PDI Frequency	PDI Conviction	PDI Total Score
Stimuli List	Pearson Correlation	.091	.047	.050
	Sig. (1-tailed)	.289	.387	.381
	N	40	40	40
Age	Pearson Correlation	.024	.060	.012
	Sig. (1-tailed)	.441	.356	.472
	N	40	40	40
Gender (0=f, 1=m)	Pearson Correlation	-.023	-.079	-.028
	Sig. (1-tailed)	.445	.314	.432
	N	40	40	40
DASS (0-63)	Pearson Correlation	.391**	.381**	.451**
	Sig. (1-tailed)	.006	.008	.002
	N	40	40	40
Depression	Pearson Correlation	.353**	.324**	.393**
	Sig. (1-tailed)	.013	.021	.006
	N	40	40	40
Anxiety	Pearson Correlation	.245**	.227**	.301**
	Sig. (1-tailed)	.064	.079	.030
	N	40	40	40
Stress	Pearson Correlation	.409**	.432**	.465**
	Sig. (1-tailed)	.004	.003	.001
	N	40	40	40
Schizotypal Personality Disorder (Likert Version)	Pearson Correlation	.661**	.648**	.693**
	Sig. (1-tailed)	.000	.000	.000
	N	40	40	40
Ideas of Reference	Pearson Correlation	.631**	.658**	.645**
	Sig. (1-tailed)	.000	.000	.000
	N	40	40	40
Excessive Social Anxiety	Pearson Correlation	.415**	.413**	.453**
	Sig. (1-tailed)	.004	.004	.002
	N	40	40	40
Odd Beliefs/Magical Thinking	Pearson Correlation	.478**	.465**	.472**
	Sig. (1-tailed)	.001	.001	.001
	N	40	40	40
Unusual Perceptual Experiences	Pearson Correlation	.637**	.565**	.636**
	Sig. (1-tailed)	.000	.000	.000
	N	40	40	40
Odd or Eccentric Behaviour	Pearson Correlation	.411**	.368**	.437**
	Sig. (1-tailed)	.004	.010	.002
	N	40	40	40
No Close Friends	Pearson Correlation	.477**	.470**	.509**
	Sig. (1-tailed)	.001	.001	.000
	N	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Logical Memory Immediate Recall (WMS-IV)	Logical Memory Delayed Recall (WMS-IV)	WRAT Reading Test
Stimuli List	Pearson Correlation	-.058	.015	-.175
	Sig. (1-tailed)	.361	.464	.140
	N	40	40	40
Age	Pearson Correlation	-.087	.004	.030
	Sig. (1-tailed)	.296	.490	.427
	N	40	40	40
Gender (0=f, 1=m)	Pearson Correlation	-.144	-.128	-.043
	Sig. (1-tailed)	.188	.216	.397
	N	40	40	40
DASS (0-63)	Pearson Correlation	-.018	.060	-.211
	Sig. (1-tailed)	.456	.368	.096
	N	40	40	40
Depression	Pearson Correlation	-.015	.130	-.060
	Sig. (1-tailed)	.464	.211	.367
	N	40	40	40
Anxiety	Pearson Correlation	-.081	-.075	-.256
	Sig. (1-tailed)	.310	.323	.066
	N	40	40	40
Stress	Pearson Correlation	.055	.108	-.216
	Sig. (1-tailed)	.367	.253	.091
	N	40	40	40
Schizotypal Personality Disorder (Likert Version)	Pearson Correlation	.028	.051	.091
	Sig. (1-tailed)	.431	.378	.289
	N	40	40	40
Ideas of Reference	Pearson Correlation	.011	-.064	-.114
	Sig. (1-tailed)	.473	.347	.242
	N	40	40	40
Excessive Social Anxiety	Pearson Correlation	.178	.254	.043
	Sig. (1-tailed)	.135	.057	.396
	N	40	40	40
Odd Beliefs/Magical Thinking	Pearson Correlation	-.334*	-.236	-.118
	Sig. (1-tailed)	.018	.072	.235
	N	40	40	40
Unusual Perceptual Experiences	Pearson Correlation	.147	.178	.188
	Sig. (1-tailed)	.183	.136	.122
	N	40	40	40
Odd or Eccentric Behaviour	Pearson Correlation	.026	.001	.249
	Sig. (1-tailed)	.438	.497	.060
	N	40	40	40
No Close Friends	Pearson Correlation	.050	.049	.100
	Sig. (1-tailed)	.381	.383	.269
	N	40	40	40

*. Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Self-Referent Bias Score	Corrected Hit Rate (Pr)	Response Bias Index (Br)
Stimuli List	Pearson Correlation	.439	-.119	.109
	Sig. (1-tailed)	.002	.233	.251
	N	40	40	40
Age	Pearson Correlation	-.153	-.431	-.144
	Sig. (1-tailed)	.173	.003	.187
	N	40	40	40
Gender (0=f, 1=m)	Pearson Correlation	-.063	-.186	-.140
	Sig. (1-tailed)	.350	.125	.195
	N	40	40	40
DASS (0-63)	Pearson Correlation	.105	-.016	.073
	Sig. (1-tailed)	.259	.462	.328
	N	40	40	40
Depression	Pearson Correlation	.017	.024	-.042
	Sig. (1-tailed)	.459	.442	.399
	N	40	40	40
Anxiety	Pearson Correlation	.073	-.027	.245
	Sig. (1-tailed)	.327	.435	.064
	N	40	40	40
Stress	Pearson Correlation	.180	-.036	-.034
	Sig. (1-tailed)	.133	.413	.418
	N	40	40	40
Schizotypal Personality Disorder (Likert Version)	Pearson Correlation	.108	-.024	-.071
	Sig. (1-tailed)	.253	.442	.332
	N	40	40	40
Ideas of Reference	Pearson Correlation	.114	-.068	-.016
	Sig. (1-tailed)	.241	.338	.461
	N	40	40	40
Excessive Social Anxiety	Pearson Correlation	-.104	.126	-.130
	Sig. (1-tailed)	.262	.220	.211
	N	40	40	40
Odd Beliefs/Magical Thinking	Pearson Correlation	-.027	-.257	-.074
	Sig. (1-tailed)	.433	.065	.325
	N	40	40	40
Unusual Perceptual Experiences	Pearson Correlation	.224	.013	-.198
	Sig. (1-tailed)	.083	.468	.111
	N	40	40	40
Odd or Eccentric Behaviour	Pearson Correlation	.080	.013	-.132
	Sig. (1-tailed)	.313	.469	.208
	N	40	40	40
No Close Friends	Pearson Correlation	.044	-.027	-.088
	Sig. (1-tailed)	.393	.434	.295
	N	40	40	40

**. Correlation is significant at the 0.01 level (1-tailed).

Correlations

		Stimuli List	Age	Gender (0=f, 1=m)	DASS (0-63)
Odd Speech	Pearson Correlation	-.052	-.130	-.217	.344
	Sig. (1-tailed)	.374	.212	.090	.015
	N	40	40	40	40
Constricted Affect	Pearson Correlation	-.141	-.048	.133	.137
	Sig. (1-tailed)	.192	.383	.207	.199
	N	40	40	40	40
Suspiciousness	Pearson Correlation	.122	-.106	.022	.412
	Sig. (1-tailed)	.227	.258	.447	.004
	N	40	40	40	40
PDI Distress	Pearson Correlation	.013	-.047	.017	.539
	Sig. (1-tailed)	.468	.388	.458	.000
	N	40	40	40	40
PDI Frequency	Pearson Correlation	.091	.024	-.023	.391
	Sig. (1-tailed)	.289	.441	.445	.006
	N	40	40	40	40
PDI Conviction	Pearson Correlation	.047	.060	-.079	.381
	Sig. (1-tailed)	.387	.356	.314	.008
	N	40	40	40	40
PDI Total Score	Pearson Correlation	.050	.012	-.028	.451
	Sig. (1-tailed)	.381	.472	.432	.002
	N	40	40	40	40
Logical Memory Immediate Recall (WMS-IV)	Pearson Correlation	-.058	-.067	-.144	-.018
	Sig. (1-tailed)	.361	.296	.188	.456
	N	40	40	40	40
Logical Memory Delayed Recall (WMS-IV)	Pearson Correlation	.015	.004	-.128	.060
	Sig. (1-tailed)	.464	.490	.216	.358
	N	40	40	40	40
WRAT Reading Test	Pearson Correlation	-.175	.030	-.043	-.211
	Sig. (1-tailed)	.140	.427	.397	.096
	N	40	40	40	40
Self-Referent Bias Score	Pearson Correlation	.439	-.153	-.063	.105
	Sig. (1-tailed)	.002	.173	.350	.259
	N	40	40	40	40
Corrected Hit Rate (Pr)	Pearson Correlation	-.119	-.431	-.186	-.016
	Sig. (1-tailed)	.233	.003	.125	.462
	N	40	40	40	40
Response Bias Index (Br)	Pearson Correlation	.109	-.144	-.140	.073
	Sig. (1-tailed)	.251	.187	.195	.328
	N	40	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Depression	Anxiety	Stress	Schizotypal Personality Disorder (Likert Version)
Odd Speech	Pearson Correlation	.316	.260	.306	.824
	Sig. (1-tailed)	.023	.053	.027	.000
	N	40	40	40	40
Constricted Affect	Pearson Correlation	.250	.022	.087	.722
	Sig. (1-tailed)	.060	.446	.296	.000
	N	40	40	40	40
Suspiciousness	Pearson Correlation	.333	.319	.402	.794
	Sig. (1-tailed)	.018	.022	.005	.000
	N	40	40	40	40
PDI Distress	Pearson Correlation	.467	.399	.515	.718
	Sig. (1-tailed)	.001	.005	.000	.000
	N	40	40	40	40
PDI Frequency	Pearson Correlation	.353	.245	.409	.661
	Sig. (1-tailed)	.013	.064	.004	.000
	N	40	40	40	40
PDI Conviction	Pearson Correlation	.324	.227	.432	.648
	Sig. (1-tailed)	.021	.079	.003	.000
	N	40	40	40	40
PDI Total Score	Pearson Correlation	.393	.301	.465	.693
	Sig. (1-tailed)	.006	.030	.001	.000
	N	40	40	40	40
Logical Memory Immediate Recall (WMS-IV)	Pearson Correlation	-.015	-.061	.055	.028
	Sig. (1-tailed)	.464	.310	.367	.431
	N	40	40	40	40
Logical Memory Delayed Recall (WMS-IV)	Pearson Correlation	.130	-.075	.108	.051
	Sig. (1-tailed)	.211	.323	.253	.378
	N	40	40	40	40
WRAT Reading Test	Pearson Correlation	-.060	-.256	-.216	.091
	Sig. (1-tailed)	.357	.056	.091	.289
	N	40	40	40	40
Self-Referent Bias Score	Pearson Correlation	.017	.073	.180	.108
	Sig. (1-tailed)	.459	.327	.133	.253
	N	40	40	40	40
Corrected Hit Rate (Pr)	Pearson Correlation	.024	-.027	-.036	-.024
	Sig. (1-tailed)	.442	.435	.413	.442
	N	40	40	40	40
Response Bias Index (Br)	Pearson Correlation	-.042	.245	-.034	-.071
	Sig. (1-tailed)	.399	.064	.418	.332
	N	40	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Ideas of Reference	Excessive Social Anxiety	Odd Beliefs/Magical Thinking
Odd Speech	Pearson Correlation	.513	.633	.102
	Sig. (1-tailed)	.000	.000	.265
	N	40	40	40
Constricted Affect	Pearson Correlation	.332	.572	-.062
	Sig. (1-tailed)	.018	.000	.353
	N	40	40	40
Suspiciousness	Pearson Correlation	.661	.563	.295
	Sig. (1-tailed)	.000	.000	.033
	N	40	40	40
PDI Distress	Pearson Correlation	.603	.496	.443
	Sig. (1-tailed)	.000	.001	.002
	N	40	40	40
PDI Frequency	Pearson Correlation	.631	.415	.478
	Sig. (1-tailed)	.000	.004	.001
	N	40	40	40
PDI Conviction	Pearson Correlation	.658	.413	.465
	Sig. (1-tailed)	.000	.004	.001
	N	40	40	40
PDI Total Score	Pearson Correlation	.645	.453	.472
	Sig. (1-tailed)	.000	.002	.001
	N	40	40	40
Logical Memory Immediate Recall (WMS-IV)	Pearson Correlation	.011	.178	-.334
	Sig. (1-tailed)	.473	.135	.018
	N	40	40	40
Logical Memory Delayed Recall (WMS-IV)	Pearson Correlation	-.064	.254	-.236
	Sig. (1-tailed)	.347	.057	.072
	N	40	40	40
WRAT Reading Test	Pearson Correlation	-.114	.043	-.118
	Sig. (1-tailed)	.242	.396	.235
	N	40	40	40
Self-Referent Bias Score	Pearson Correlation	.114	-.104	-.027
	Sig. (1-tailed)	.241	.262	.433
	N	40	40	40
Corrected Hit Rate (Pr)	Pearson Correlation	-.068	.126	-.257
	Sig. (1-tailed)	.338	.220	.065
	N	40	40	40
Response Bias Index (Br)	Pearson Correlation	-.016	-.130	-.074
	Sig. (1-tailed)	.461	.211	.325
	N	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Unusual Perceptual Experiences	Odd or Eccentric Behaviour	No Close Friends
Odd Speech	Pearson Correlation	.518**	.685**	.616**
	Sig. (1-tailed)	.000	.000	.000
	N	40	40	40
Constricted Affect	Pearson Correlation	.295*	.568**	.778**
	Sig. (1-tailed)	.032	.000	.000
	N	40	40	40
Suspiciousness	Pearson Correlation	.571**	.486**	.617**
	Sig. (1-tailed)	.000	.001	.000
	N	40	40	40
PDI Distress	Pearson Correlation	.661**	.496**	.541**
	Sig. (1-tailed)	.000	.001	.000
	N	40	40	40
PDI Frequency	Pearson Correlation	.637**	.411**	.477**
	Sig. (1-tailed)	.000	.004	.001
	N	40	40	40
PDI Conviction	Pearson Correlation	.565**	.368**	.470**
	Sig. (1-tailed)	.000	.010	.001
	N	40	40	40
PDI Total Score	Pearson Correlation	.636**	.437**	.509**
	Sig. (1-tailed)	.000	.002	.000
	N	40	40	40
Logical Memory Immediate Recall (WMS-IV)	Pearson Correlation	.147	.026	.050
	Sig. (1-tailed)	.183	.438	.381
	N	40	40	40
Logical Memory Delayed Recall (WMS-IV)	Pearson Correlation	.178	.001	.049
	Sig. (1-tailed)	.136	.497	.383
	N	40	40	40
WRAT Reading Test	Pearson Correlation	.188	.249	.100
	Sig. (1-tailed)	.122	.060	.269
	N	40	40	40
Self-Referent Bias Score	Pearson Correlation	.224	.060	.044
	Sig. (1-tailed)	.083	.313	.393
	N	40	40	40
Corrected Hit Rate (Pr)	Pearson Correlation	.013	.013	-.027
	Sig. (1-tailed)	.468	.469	.434
	N	40	40	40
Response Bias Index (Br)	Pearson Correlation	-.196	-.132	-.088
	Sig. (1-tailed)	.111	.208	.295
	N	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Odd Speech	Constricted Affect	Suspiciousness	PDI Distress
Odd Speech	Pearson Correlation	1	.660	.523	.468
	Sig. (1-tailed)		.000	.000	.001
	N	40	40	40	40
Constricted Affect	Pearson Correlation	.660	1	.461	.282
	Sig. (1-tailed)	.000		.001	.039
	N	40	40	40	40
Suspiciousness	Pearson Correlation	.523	.461	1	.727
	Sig. (1-tailed)	.000	.001		.000
	N	40	40	40	40
PDI Distress	Pearson Correlation	.468	.282	.727	1
	Sig. (1-tailed)	.001	.039	.000	
	N	40	40	40	40
PDI Frequency	Pearson Correlation	.400	.239	.686	.933
	Sig. (1-tailed)	.005	.069	.000	.000
	N	40	40	40	40
PDI Conviction	Pearson Correlation	.425	.249	.662	.893
	Sig. (1-tailed)	.003	.061	.000	.000
	N	40	40	40	40
PDI Total Score	Pearson Correlation	.443	.264	.709	.966
	Sig. (1-tailed)	.002	.050	.000	.000
	N	40	40	40	40
Logical Memory Immediate Recall (WMS-IV)	Pearson Correlation	.086	.175	-.094	-.117
	Sig. (1-tailed)	.298	.140	.283	.236
	N	40	40	40	40
Logical Memory Delayed Recall (WMS-IV)	Pearson Correlation	.077	.155	-.064	-.072
	Sig. (1-tailed)	.318	.171	.347	.329
	N	40	40	40	40
WRAT Reading Test	Pearson Correlation	.215	.234	-.187	-.169
	Sig. (1-tailed)	.091	.073	.125	.149
	N	40	40	40	40
Self-Referent Bias Score	Pearson Correlation	.172	.054	.219	.318
	Sig. (1-tailed)	.144	.370	.087	.023
	N	40	40	40	40
Corrected Hit Rate (Pr)	Pearson Correlation	.131	.052	-.127	-.319
	Sig. (1-tailed)	.209	.376	.218	.022
	N	40	40	40	40
Response Bias Index (Br)	Pearson Correlation	.098	-.005	-.107	-.061
	Sig. (1-tailed)	.273	.488	.256	.353
	N	40	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		PDI Frequency	PDI Conviction	PDI Total Score
Odd Speech	Pearson Correlation	.400	.425	.443
	Sig. (1-tailed)	.005	.003	.002
	N	40	40	40
Constricted Affect	Pearson Correlation	.239	.249	.264
	Sig. (1-tailed)	.069	.061	.050
	N	40	40	40
Suspiciousness	Pearson Correlation	.686	.662	.709
	Sig. (1-tailed)	.000	.000	.000
	N	40	40	40
PDI Distress	Pearson Correlation	.933	.893	.966
	Sig. (1-tailed)	.000	.000	.000
	N	40	40	40
PDI Frequency	Pearson Correlation	1	.968	.989
	Sig. (1-tailed)		.000	.000
	N	40	40	40
PDI Conviction	Pearson Correlation	.968	1	.975
	Sig. (1-tailed)	.000		.000
	N	40	40	40
PDI Total Score	Pearson Correlation	.989	.975	1
	Sig. (1-tailed)	.000	.000	
	N	40	40	40
Logical Memory Immediate Recall (WMS-IV)	Pearson Correlation	-.131	-.111	-.122
	Sig. (1-tailed)	.210	.248	.226
	N	40	40	40
Logical Memory Delayed Recall (WMS-IV)	Pearson Correlation	-.035	-.021	-.044
	Sig. (1-tailed)	.416	.448	.393
	N	40	40	40
WRAT Reading Test	Pearson Correlation	-.185	-.186	-.184
	Sig. (1-tailed)	.126	.126	.128
	N	40	40	40
Self-Referent Bias Score	Pearson Correlation	.293	.265	.299
	Sig. (1-tailed)	.033	.049	.030
	N	40	40	40
Corrected Hit Rate (Pr)	Pearson Correlation	-.344	-.332	-.339
	Sig. (1-tailed)	.015	.018	.016
	N	40	40	40
Response Bias Index (Br)	Pearson Correlation	-.048	.026	-.029
	Sig. (1-tailed)	.365	.438	.431
	N	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Logical Memory Immediate Recall (WMS-IV)	Logical Memory Delayed Recall (WMS-IV)	WRAT Reading Test
Odd Speech	Pearson Correlation	.086	.077	.215
	Sig. (1-tailed)	.298	.318	.091
	N	40	40	40
Constricted Affect	Pearson Correlation	.175	.155	.234
	Sig. (1-tailed)	.140	.171	.073
	N	40	40	40
Suspiciousness	Pearson Correlation	-.094	-.064	-.187
	Sig. (1-tailed)	.283	.347	.125
	N	40	40	40
PDI Distress	Pearson Correlation	-.117	-.072	-.169
	Sig. (1-tailed)	.236	.329	.149
	N	40	40	40
PDI Frequency	Pearson Correlation	-.131	-.035	-.185
	Sig. (1-tailed)	.210	.416	.126
	N	40	40	40
PDI Conviction	Pearson Correlation	-.111	-.021	-.186
	Sig. (1-tailed)	.248	.448	.126
	N	40	40	40
PDI Total Score	Pearson Correlation	-.122	-.044	-.184
	Sig. (1-tailed)	.226	.393	.128
	N	40	40	40
Logical Memory Immediate Recall (WMS-IV)	Pearson Correlation	1	.863**	.344*
	Sig. (1-tailed)		.000	.015
	N	40	40	40
Logical Memory Delayed Recall (WMS-IV)	Pearson Correlation	.863**	1	.245
	Sig. (1-tailed)	.000		.064
	N	40	40	40
WRAT Reading Test	Pearson Correlation	.344*	.245	1
	Sig. (1-tailed)	.015	.064	
	N	40	40	40
Self-Referent Bias Score	Pearson Correlation	.148	-.004	-.011
	Sig. (1-tailed)	.181	.489	.474
	N	40	40	40
Corrected Hit Rate (Pr)	Pearson Correlation	.478**	.420**	.456**
	Sig. (1-tailed)	.001	.003	.002
	N	40	40	40
Response Bias Index (Br)	Pearson Correlation	-.105	-.120	.060
	Sig. (1-tailed)	.259	.230	.357
	N	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).

Correlations

		Self-Referent Bias Score	Corrected Hit Rate (Pr)	Response Bias Index (Br)
Odd Speech	Pearson Correlation	.172	.131	.098
	Sig. (1-tailed)	.144	.209	.273
	N	40	40	40
Constricted Affect	Pearson Correlation	.054	.052	-.005
	Sig. (1-tailed)	.370	.376	.488
	N	40	40	40
Suspiciousness	Pearson Correlation	.219	-.127	-.107
	Sig. (1-tailed)	.087	.218	.256
	N	40	40	40
PDI Distress	Pearson Correlation	.318	-.319	-.061
	Sig. (1-tailed)	.023	.022	.363
	N	40	40	40
PDI Frequency	Pearson Correlation	.293	-.344	-.048
	Sig. (1-tailed)	.033	.015	.385
	N	40	40	40
PDI Conviction	Pearson Correlation	.265	-.332	.026
	Sig. (1-tailed)	.049	.018	.438
	N	40	40	40
PDI Total Score	Pearson Correlation	.299	-.339	-.029
	Sig. (1-tailed)	.030	.016	.431
	N	40	40	40
Logical Memory Immediate Recall (WMS-IV)	Pearson Correlation	.148	.478	-.105
	Sig. (1-tailed)	.181	.001	.259
	N	40	40	40
Logical Memory Delayed Recall (WMS-IV)	Pearson Correlation	-.004	.420	-.120
	Sig. (1-tailed)	.489	.003	.230
	N	40	40	40
WRAT Reading Test	Pearson Correlation	-.011	.456	.060
	Sig. (1-tailed)	.474	.002	.367
	N	40	40	40
Self-Referent Bias Score	Pearson Correlation	1	-.246	.122
	Sig. (1-tailed)		.063	.228
	N	40	40	40
Corrected Hit Rate (Pr)	Pearson Correlation	-.246	1	.002
	Sig. (1-tailed)	.063		.496
	N	40	40	40
Response Bias Index (Br)	Pearson Correlation	.122	.002	1
	Sig. (1-tailed)	.228	.496	
	N	40	40	40

** . Correlation is significant at the 0.01 level (1-tailed).

* . Correlation is significant at the 0.05 level (1-tailed).