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Exploring the relationship between fantasy proneness and delusional beliefs in psychosis and non-clinical individuals

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ABSTRACT

Delusions are a core feature of psychopathology while fantasy proneness (FP) is a trait that describes a predisposition towards fantastical thinking, vivid mental imagery and an overactive imagination. The relationship between FP and delusional experiences has not yet been examined in the literature. The current study hypothesised that FP would be significantly associated with and predict delusion severity as well as the associated delusional distress, preoccupation and conviction. Ninety-five patients with current psychosis (schizophrenia and bipolar I disorder) were assessed for overall delusional severity using the PANSS (clinician-rated) and the Peters Delusions Inventory (PDI; self-report). FP was assessed using the Creative Experiences Questionnaire (CEQ). Forty-six healthy control participants also completed the PDI and CEQ. Significant positive correlations were observed between FP and delusion severity in both groups; and distress, preoccupation and conviction in patients only. Linear regression analyses, controlling for manic and depressive symptoms, revealed that greater FP predicted higher levels of severity, distress, preoccupation, and conviction associated with delusions in patients, and higher severity only in healthy controls. The findings highlight the role of specific cognitive biases in delusional experiences, and empirically support models of unusual belief formation and maintenance.

1. Introduction

1.1. Delusions and their proposed mechanisms

Delusions are a significant and distressing aspect of psychosis and have adverse consequences for functioning (Harrow et al., 2004) and psychological wellbeing (Freeman et al., 2014). They are defined as decidedly implausible beliefs that are strongly held and are not altered in the face of contradictory evidence (American Psychiatric Association, 2013). While delusion formation and maintenance have been traditionally examined primarily in schizophrenia (Bebbington and Freeman, 2017; Rossell et al., 1998), they have been increasingly studied in other mental and physical illnesses such as bipolar disorder (BD) (Smith et al., 2017), anorexia nervosa (Phillipou et al., 2017), body dysmorphic disorder (Rossell et al., 2014), traumatic brain injury (Rossell et al., 2010), stroke (Torrisi et al., 2018) and Alzheimer's disease (Connors et al., 2018).

Presently, the mechanisms underlying delusion formation and maintenance are only partially understood, with a number of psychological, neurological, cognitive and lifestyle factors proposed (Broyd et al., 2017). Cognitive biases are a recognised component in delusion manifestation (Bell et al., 2006). One of the most established of these in the delusion literature is the 'jumping to conclusions' bias, defined as the inclination to make rushed decisions based on insufficient evidence (Garety and Freeman, 2013). Confirmation bias, where an individual selectively ignores information that is contrary to their delusional beliefs, has also been suggested to contribute to delusion maintenance (Garety and Freeman, 2013). Extrapolating from the notion that cognitive biases are dispositions that encourage unusual thinking patterns adversely influencing belief evaluation, the present study sought to investigate the contribution of fantasy proneness to the experience of delusions.

1.2. Fantasy proneness

Fantasy proneness describes the tendency for an individual to engage in deep bouts of fantastical thinking (Wilson and Barber, 1983) and has also been described as a disposition towards vivid mental imagery and memories (Aleman and de Haan, 2004), psychic experiences (Wilson and Barber, 1983) and an overactive creative imagination (Vygotsky, 2004; Weibel et al., 2018). Consequently, it can be conceptualised as a cognitive bias, and may be related to the

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manifestation of psychopathology. As a cognitive bias and general thinking style, it differs from other psychopathology-related constructs such as magical thinking, which is defined as the belief or acceptance that two events that do not have a quantifiable and/or qualifiable association might still do so (Eckblad and Chapman, 1983). Fantasy proneness is a trait-like construct that demonstrates a predisposition to fantastical thoughts and experiences, while magical thinking can be more transient and dependent on the mental state of the individual. Magical thinking is related to a formed association, as seen in how a belief that aliens are controlling one's behaviour and movement, a situation that can dissipate outside of a psychotic episode. While fantasy-prone individuals may be more likely to entertain such scenarios and demonstrate magical thinking (Dasse et al., 2015), these two constructs are different in nature.

A few studies have investigated the relationship between fantasizing and psychopathology, with evidence that fantasy proneness is associated with higher levels of depression, dissociation and personality disorders (Rauschenberger and Lynn, 1995; Waldo and Merritt, 2000). However, no study to date has specifically investigated associations between fantasy proneness and delusions. The plausibility of such a relationship is supported by a number of previous investigations, now overviewed briefly.

Fantasy proneness has been linked to the intensity of paranormal experiences (Spanos et al., 1993) and fantasy prone individuals are more likely to develop and accept pseudomemories (Hyman and Billings, 1998). Laws and Bhatt (2005) extended this by demonstrating that fantasy proneness was related specifically to the generation of false memories, and not the failure of memory (forgetting). Critically, in a sample of healthy controls, they observed that false memories were related to delusional ideation. This important association has yet to be examined in clinical samples. Additionally, fantasy proneness has been linked to both schizotypy (Sánchez-Bernardos and Avia, 2006) and creative capacity (Lack et al., 2003), constructs which have been associated with the presence of and increased risk for psychopathological experiences in psychosis populations (Carson, 2011; Crabtree and Green, 2016; Thomas et al., 2018) and healthy controls (Preti and Vellante, 2007; Verdoux and van Os, 2002). The relationship between fantasy proneness and constructs such as schizotypy (Sánchez-Bernardos and Avia, 2006) and magical thinking (Dasse et al., 2015) should be clarified.

1.3. The current study

To extend current conceptualisations of delusion mechanisms, the present study sought to comprehensively investigate associations between fantasy proneness and delusional beliefs in a mixed sample of patients experiencing psychosis as well as in a group of healthy controls. Delusion severity was examined using clinician-rated (patients only) and self-reported (both groups) measures. The relationships between fantasy proneness and three other key characteristics of delusions – distress, preoccupation, and conviction – were also examined. We hypothesised that a clinical cohort would show greater fantasy proneness and self-reported delusion severity than healthy controls, and that increasing levels of fantasy proneness would significantly predict increasing levels of delusional beliefs in both groups, as well as greater levels of distress, preoccupation and conviction associated with these beliefs.

2. Method

2.1. Participants

Ninety-five outpatients with current psychosis (DSM-IV schizophrenia and BD I disorder) on stable doses of antipsychotic medication were recruited from community support groups and community care units (in north-west Melbourne, including the Northern Hospital). Those diagnosed with schizophrenia (n = 48) were not floridly symptomatic, while individuals with BD were either euthymic (n = 37) or in a mild depressive episode (n = 10). Diagnosis was ascertained using the Structured Clinical Interview for DSM-IV (SCID; First and Gibbon, 2004). Only patients with no other co-morbid Axis 1 diagnoses (including schizoaffective disorder) were included in the study. Forty-six healthy control participants (HCs) were recruited from advertisements in the local community: they were excluded if they had a family or personal history of mental illness, personal anti-psychotic or anti-depressant medication use. All participants were screened and excluded if the following were present: current substance abuse (previous 6 months), history of traumatic brain injury and neurological disease. All participants had English as their first language and were 18–65 years old. Ethical approval was obtained from the North Western Mental Health and University of Melbourne ethics committees in Melbourne, Australia. All participants provided voluntary informed consent before assessment.

2.2. Measures

2.2.1. Symptom and demographic assessment

Psychotic symptomatology (including delusions) was assessed using the Positive and Negative Symptom Scale (PANSS; Kay et al., 1987) in the patient group. The PANSS P1 subscale score was used as a clinician-rated measure of delusion severity. Self-reported delusional beliefs were assessed in both groups using the 21-item Peters Delusion Inventory (PDI; Peters et al., 1999) overall score (PDI-total). Three associated ratings of delusional distress (PDI-D), preoccupation (PDI-P) and conviction (PDI-C) were individually measured on a 1–5 Likert scale per item, with final scores for each domain calculated by summing up the recorded responses (Peters et al., 1999).

Mania and depression severity were measured using the Young Mania Rating Scale (YMRS; Young et al., 1978) and the Beck Depression Inventory (BDI; Beck et al., 1961) respectively. YMRS was not administered to HCs. Basic demographic and clinical information (e.g. age, sex, length of illness, etc.) was also collected. Full-scale intelligence was estimated using the National Adult Reading Test (NART; Nelson, 1982).

2.2.2. Fantasy proneness assessment

The Creative Experiences Questionnaire (CEQ; Merckelbach et al., 2001) is a widely-used self-report measure of fantasy proneness, comprising 25 items (Yes/No) relating to experiences of fantastical thoughts. Examples of scale items include: ‘I often confuse fantasies with real memories’ and ‘Many of my fantasies have a realistic intensity’ . An overall fantasy proneness score is calculated by summing the total number of ‘Yes’ responses. The CEQ has good test-retest reliability and internal consistency (Cronbach's alpha = 0.72), and established construct validity (Merckelbach et al., 2001).

2.3. Statistical analysis

Independent samples t-tests were conducted to characterise and compare the clinical and demographic profile and CEQ scores between patients and HCs. Spearman's correlations were conducted in both groups separately to assess the relationships between CEQ score and delusion measures (P1 [patients only], PDI total, PDI-D, PDI-P and PDI-C). Additional correlations were conducted between delusion measures and scores for mania (patients only), depression, length of illness (patients only) and full-scale intelligence to identify potential covariates for the regressions. Finally, hierarchical linear regressions to assess the variance in the delusion measures predicted by the CEQ score were then conducted for all significant correlations in both groups separately. As the main focus was to identify the independent contributions of fantasy proneness to delusions, all significant covariates were entered in Block 1, with the CEQ score in Block 2. Multicollinearity between predictors

Table 1
Demographic and clinical characteristics of the sample.

Variable	Patients (N = 95) M (SD)	Controls (N = 46) M (SD)
Age (years)	41.80 (10.41)	43.41 (11.86)
Gender (% male)	54.7%	45.7%
Years of education	14.56 (3.55)	15.55 (3.73)
Premorbid intelligence (NART)*	104.82 (11.02)	109.35 (8.08)
Age of onset	22.58 (6.73)	–
Length of illness	19.23 (9.96)	–
Medication (CPZE)[a]	339.93 (347.24)	–
PANSS P1 - delusions	2.81 (1.67)	–
PANSS positive	13.35 (5.55)	–
PANSS negative	10.26 (3.73)	–
PANSS general	24.74 (6.13)	–
YMRS total	1.69 (2.23)	–
BDI total*	17.05 (13.13)	7.22 (8.13)
CEQ total*	9.18 (5.06)	5.70 (3.82)
PDI total*	7.28 (5.08)	3.57 (3.51)
PDI-distress*	22.35 (18.49)	7.37 (8.28)
PDI-preoccupation*	21.38 (17.42)	8.43 (8.20)
PDI-conviction*	27.05 (18.94)	12.22 (9.93)

Note. M = group mean. SD = standard deviation. NART = National Adult Reading Test. CPZE = Chlorpromazine equivalence. PANSS = Positive and Negative Syndrome Scale. YMRS = Young Mania Rating Scale. BDI = Beck Depression Inventory. CEQ = Creative Experiences Questionnaire. PDI = Peters Delusions Inventory.

[a] Antipsychotics only.

* $p < 0.05$.

was checked by examining the Variance Inflation Factor (VIF) before the results were interpreted. α was set at $p < 0.05$.

3. Results

3.1. Clinical, demographic and CEQ comparisons between groups

Clinical and demographic comparisons are presented in Table 1. Patients significantly differed from HCs ($p < 0.05$) on measures of fantasy proneness (CEQ) and self-reported delusion severity, distress (D), preoccupation (P) and conviction (C) (PDI), as well as premorbid intelligence and depressive symptoms (BDI).

3.2. Correlational analyses between the fantasy proneness and clinical measures

Results of the Spearman's correlations are presented in Table 2. For patients, CEQ scores were significantly positively correlated with all five delusion ratings (PANSS P1, PDI total, PDI-D, PDI-P and PDI-C). Scores on the clinician-rated PANSS P1 and self-reported PDI total were also significantly correlated. Significant correlations were also observed between the YMRS and BDI scores and the majority of the five delusions measures: these scores were therefore included as covariates in all subsequent regression analyses. Full-scale intelligence was associated with PDI-C only, and so included only in that regression. No associations were observed between delusion ratings and length of illness. For the HC group, CEQ score was significantly positively correlated with the PDI total score. Only BDI total was significantly correlated with PDI total and so included as a covariate in the regression.

3.3. Regression analyses on the delusion measures

Based on the significant correlation results, five regression analyses were conducted in the patient group with P1, PDI total, PDI-D, PDI-P and PDI-C as the individual dependent variables. These are presented in Table 3. In four regressions (P1, PDI total, PDI-D, PDI-P), the predictive models were significant with the YMRS and BDI scores entered, explaining between 17% to 30% of the variance. Significant changes in R^2 were produced upon introduction of the CEQ score as well, explaining between 6.6% to 19% of the variance. In the regression on PDI-C, the predictive model was not significant with the covariates entered, explaining only 6% of the variance. Significant changes in R^2 were observed when CEQ score was added, explaining an additional 6% of the variance.

One regression was conducted for the HC group, with PDI total as the dependent variable. A trending change in R^2 was observed when BDI total was entered, $\beta = 0.28$, $t(43) = 1.94$, $p = 0.060$, explaining 8% of the variance in PDI total scores, $F(1, 43) = 3.74$, $p = 0.060$. A significant change in R^2 was produced upon introduction of CEQ score, $\beta = 0.36$, $t(43) = 2.44$, $p = 0.019$, explaining 11.4% of the variance in PDI total scores, $F(1, 42) = 5.95$, $p = 0.019$. All VIFs were well within commonly accepted levels (O' Brien, 2007) for all six regressions (VIF < 2), thus alleviating concerns about multicollinearity between predictors affecting the results.

4. Discussion

The aim of this study was to examine associations between fantasy proneness and delusional experience. Study hypotheses were supported, whereby patients with psychosis demonstrated greater fantasy proneness than healthy controls. More specifically, increased fantasy proneness significantly predicting increased clinician-rated and self-reported delusion severity and greater distress, preoccupation and conviction associated with these experiences in a clinical cohort. Additionally, fantasy proneness also predicted the presence of delusional beliefs in healthy individuals. As the first study to concurrently

Table 2
Spearman's correlations between P1, PDI measures and CEQ with length of illness, YMRS, and BDI scores.

	PANSS P1	PDI total		PDI-D		PDI-P		PDI-C		Length of illness	YMRS total	BDI total		FSIQ	
	PT	PT	HC	PT	HC	PT	HC	PT	HC	PT	PT	PT	HC	PT	HC
Delusions															
PANSS P1	–	–	–	–	–	–	–	–	–	0.046	0.30*	0.23*	–	−0.15	–
PDI total	0.54**	–	–	–	–	–	–	–	–	−0.008	0.24*	0.28*		0.12	−0.12
PDI distress (PDI-D)	0.56**	0.89**	0.44*	–	–	–	–	–	–	−0.11	0.19	0.42**		−0.008	−0.38*
PDI preoccupation (PDI-P)	0.64**	0.90**	0.65**	0.93**	0.61**	–	–	–	–	−0.10	0.20	0.32*		−0.078	−0.14
PDI conviction (PDI-C)	0.65**	0.89**	0.20	0.83**	0.10	0.89**	0.10	–	–	−0.065	0.22*	0.17		−0.25*	0.30
Fantasy proneness															
CEQ total	0.42**	0.40**	0.37*	0.55**	0.13	0.57**	0.26	0.47**	0.038	0.083	0.20*	0.44**		−0.11	0.13

Note: PT = patients. HC = healthy controls. PT N = 95, HC N = 46. N for correlations with PDI sub-measures vary due to some patients/healthy controls reporting no delusional beliefs and hence not responding to sub-measures. For patients, PDI-D N = 86. PDI-P and PDI-C N = 87. For healthy controls, PDI-D N = 38. PDI-P and PDI-C N = 37. PANSS = Positive and Negative Syndrome Scale. PDI = Peters Delusions Inventory. CEQ = Creative Experiences Questionnaire. YMRS = Young Mania Rating Scale. BDI = Beck Depression Inventory. FSIQ = Full-scale intelligence.

* $p < 0.05$.

** $p \leq 0.000$.

Table 3
Multivariate predictors of delusion severity, distress, preoccupation and conviction in the patient group.

Predictors (P1 + P2, P3)		PANSS P1			PDI total			PDI distress			PDI preoccupation			PDI conviction			
		P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P[a]	P3
YMRS total + BDI total[a]	B[b]	0.35*	0.22^	–	0.23^	0.33*	–	0.17	0.49*	–	0.23^	0.44*	–	0.053	−0.057	−0.23^	–
YMRS total + BDI total[a], CEQ total		0.29*	0.055	0.37*	0.18	0.20	0.30*	0.11	0.33*	0.37*	0.17	0.25^	0.44*	0.009	−0.18	−0.23^	0.28^
Δ, *F*, *p*		0.20, 11.12*		0.10, 10.69*	0.19, 10.69*		0.66, 8.12*	0.30, 17.65*		0.10, 14.26*	0.28, 16.06*		0.15, 21.00*	0.060, 1.78^			0.060, 5.63^

Note: P1 = Predictor 1. P2 = Predictor 2. P3 = Predictor 3. Block 1 = P1 + P2. Block 2 = P3. PANSS = Positive and negative syndrome scale. PDI = Peters Delusions Inventory. YMRS = Young Mania Rating Scale. BDI = Beck Depression Inventory. CEQ = Creative Experiences Questionnaire.

[a] including FSIQ for PDI conviction analysis.

[b] standardised. $\Delta = R^2$ change.

^ $p < 0.05$.

* $p < 0.005$.

examine these relationships, findings align with the proposition that certain thinking styles and traits are related to both the manifestation and experience of psychopathology. In particular, it replicates and extends previous research in healthy control samples linking fantasy proneness to delusional ideation (Laws and Bhatt, 2005) and schizotypy (Sánchez-Bernardos and Avia, 2006).

The findings of this study are strengthened by the transdiagnostic nature of the sample used here. This suggests that fantasy proneness is a shared core mechanism underlying delusion formation and maintenance, observable in both clinical and non-clinical populations, and is not a by-product of illness-related factors. Consequently, clinical strategies to remediate this may be useful for both schizophrenia and BD. Additional investigations of fantasy proneness in other disorders with delusions (e.g. body dysmorphic disorder, Alzheimer's disease) are also warranted.

4.1. Effects on the breadth and severity of delusions

The increased propensity towards imaginative ideas not rooted in reality appears to relate to the breadth and severity of unusual beliefs experienced by psychosis patients. This finding is corroborated in both clinician-rated and self-reported delusion measures, strengthening its veracity. It also suggests that the severity of the unusual beliefs experienced is partly a result of the intensity of the internal bias towards fantasizing and mental imagery, thus supporting the role of this mechanism as a cognitive bias in delusion manifestation. This is aligned with the anomalous experience hypothesis of delusions (Freeman et al., 2014), which suggests that delusions arise as an individual tries to rationalise the existence of their hallucinations. Increased fantasy proneness in this scenario would facilitate this. Shared causation between delusions and hallucinations has also been previously proposed (Maher, 2006; Suhail and Ghauri, 2010).

In their original conceptualisation of fantasy proneness, Wilson and Barber (1983) identified potential causes of fantasizing, including feelings of loneliness and isolation, the desire to avoid negative contexts and experiences, and childhood hardship. These aspects have also been identified as risk factors for psychosis (Varese et al., 2012), suggesting that the relationship between fantasy proneness and delusions may also be driven in part by more concrete components. This could then be exacerbated by overactive thinking into full-blown delusions. Future studies should consider examining the confluence of early childhood experiences, current psychosocial context and delusion types to clarify this point.

4.2. Effects on the experience of delusions

The overactive fantastical thinking and vividness of mental imagery within fantasy proneness also appears to contribute to the levels of distress, preoccupation and conviction that accompany delusions in a clinical cohort. Vividness of mental imagery coupled with false memories and a detachment from reality may be facilitating greater conviction in delusional beliefs, contributing to greater distress. The loss of reality and tendency to lapse into wandering thinking patterns may be exacerbating an individual's levels of preoccupation with their unusual beliefs. The non-significance of these associations among non-clinical individuals could be realistically due to very low levels of all three aspects in this group.

While fantasy proneness is clearly not the only factor, the identification of these relationships highlights potential targets for remediation that might alleviate the impact of the delusional experience. One possible pathway is with cognitive behavioural therapy. By changing the tendency to fantasize, we may be able to reduce the severity, distress, preoccupation and conviction associated with delusions. On the other hand, acceptance and commitment therapy works to change an individual's relationship with their experiences (Thomas et al., 2014) by enabling the individual to embrace, accept and better manage their

delusions. This could also alleviate the negative impact of such experiences. There is current evidence supporting the effectiveness of remediation strategies for cognitive biases, with both metacognitive interventions and traditional cognitive remediation therapies demonstrating success in the reduction of the 'jumping to conclusions' bias (Andreou et al., 2015; Moritz et al., 2015).

4.3. Limitations, future research and significance

In interpreting these findings, some limitations must be considered. Firstly, delusions vary in nature and content. While our use of the broad PANSS delusion score was acceptable in this initial investigation, it precluded comparisons of how fantasy proneness might relate to specific delusion types such as persecutory delusions and somatosensory delusions. However, our findings are strengthened by similar relationships being observed in patients using both clinician-rated and self-reported measures. Future research using alternative comprehensive measures such as the Scale for the Assessment of Positive Symptoms (Andreasen, 1984) could help clarify the associations with delusional content and whether the fantasy proneness-delusion relationship is generalised or more circumspect.

Secondly, and on a related note, the construct of fantasy proneness encapsulates a number of different concepts such as an overactive imagination, vivid mental imagery, and daydreaming (Wilson and Barber, 1983). Our use of the CEQ, while more generalizable, did not permit us to investigate in greater depth the associations between delusions and individual aspects of fantasy proneness. Given the significant findings here, this is a fruitful area for future investigation. Delusions have also been related to reduced reality monitoring and thinking biases (Thoresen et al., 2014; Vorontsova et al., 2013), and it is unclear whether individuals with delusions can differentiate between them and general imagination. Clarifying this difference is beyond the scope of the current study. Future work using qualitative methods should be employed for this.

Thirdly, we did not examine cognitive deficits in relation to fantasy proneness in this study. Delusion formation and maintenance have been associated with attentional, reasoning, and metacognitive deficits (Bell et al., 2006; Coltheart, 2010). The relationship between cognition and fantasy proneness has yet to be clarified, and it could be that the same underlying cognitive deficits underlie both delusions and fantasy proneness. For example, a bias towards fantastical thinking could be a result of abnormal attention and inhibition. Executive function deficits have been linked to creative thinking (Abraham et al., 2007) which is a closely-related construct to fantasy proneness. While we did observe that full-scale intelligence was related to the distress (patients only) and conviction (HCs only) associated with delusional beliefs, it was not directly related to delusion severity in either group. As the first examination of this association, further work is warranted.

The present findings of a relationship between fantasy proneness and delusional beliefs in HCs support future in-depth investigations of fantasy proneness in relation to pre-clinical psychiatric symptoms in other proneness groups such as ultra-high risk individuals. Our findings were also limited by the cross-sectional nature of the study, which precluded conclusions about causal relationships between study variables. Longitudinal and predictive studies of fantasy proneness and psychopathology in clinical groups will also aid in clarifying the contributions of fantasy proneness to the experience of unusual beliefs.

In conclusion, the present study demonstrates how fantasy proneness may contribute to the severity and experience of delusional beliefs. The tendency towards an overactive imagination and sensitivity to fantastical thoughts thus appear to relate to the breadth of an individual's unusual beliefs and how patients particularly perceive them. As the first study to examine this relationship, it extends existing conceptualisations of the role of cognitive biases (e.g. jumping to conclusions bias), and indeed biases as a whole, in the manifestation and maintenance of delusions and related components.

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Contributors

EJT was responsible for drafting, analysis and write-up of the manuscript. KF and SLR reviewed and contributed to data interpretation and write-up of the manuscript. All authors have read and approved the final manuscript.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2018.12.081.

References

Abraham, A., Windmann, S., McKenna, P., Güntürkün, O., 2007. Creative thinking in schizophrenia: The role of executive dysfunction and symptom severity. Cognitive Neuropsychiatry. 12 (3), 235–258.
Aleman, A., de Haan, E.H.F., 2004. Fantasy proneness, mental imagery and reality monitoring. Personality Individ. Diff. 36 (8), 1747–1754.
American Psychiatric Association, 2013. 5th ed. American Psychiatric Publishing, Arlington, VA.
Andreasen, N.C., 1984. Scale for the Assessment of Positive Symptoms (SAPS). University of Iowa, Iowa City, IA.
Andreou, C., Schneider, B.C., Balzan, R., Luedecke, D., Roesch-Ely, D., Moritz, S., 2015. Neurocognitive deficits are relevant for the jumping-to-conclusions bias, but not for delusions: A longitudinal study. Schizophr. Res. 2 (1), 8–11.
Bebbington, P., Freeman, D., 2017. Transdiagnostic extension of delusions: schizophrenia and beyond. Schizophr. Bull. 43 (2), 273–282.
Beck, A.T., Ward, C.H., Mendelson, M.M., Mock, J.J., Erbaugh, J.J., 1961. An inventory for measuring depression. Arch. Gen. Psychiatry. 4 (6), 561–571.
Bell, V., Halligan, P.W., Ellis, H.D., 2006. Explaining delusions: a cognitive perspective. Trends. Cogn. Sci. 10 (5), 219–226.
Broyd, A., Balzan, R.P., Woodward, T.S., Allen, P., 2017. Dopamine, cognitive biases and assessment of certainty: A neurocognitive model of delusions. Clin. Psychol. Rev. 54, 96–106.
Carson, S.H., 2011. Creativity and psychopathology: a shared vulnerability model. Can. J. Psychiatry. 56 (3), 144–153.
Coltheart, M., 2010. The neuropsychology of delusions. Ann. N. Y. Acad. Sci. 1191, 16–26.
Connors, M.H., Ames, D., Woodward, M., Brodaty, H., 2018. Psychosis and clinical outcomes in Alzheimer disease: a longitudinal study. Am. J. Geriatr. Psychiatry. 26 (3), 304–313.
Crabtree, J., Green, M.J., 2016. Creative cognition and psychosis vulnerability: what's the difference? Creativity Res. J. 28 (1), 24–32.
Dasse, M.N., Elkins, G.R., Weaver 3rd, C.A., 2015. Correlates of the multidimensional construct of hypnotizability: paranormal belief, fantasy proneness, magical ideation, and dissociation. Int. J. Clin. Exp. Hypn. 63 (3), 274–283.
Eckblad, M., Chapman, L.J., 1983. Magical ideation as an indicator of schizotypy. J. Consult. Clin. Psychol. 51 (2), 215–225.
First, M.B., Gibbon, M., 2004. The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) and the Structured Clinical Interview for DSM-IV Axis II Disorders (SCID-II). In: Hilsenroght, M.J., Segal, D.L. (Eds.), Comprehensive Handbook of Psychological Assessment. John Wiley & Sons Inc, Hoboken, NJ, pp. 134–143.
Freeman, D., Startup, H., Dunn, G., Wingham, G., Cernis, E., Evans, N., et al., 2014. Persecutory delusions and psychological well-being. Soc. Psychiatry Psychiatr. Epidemiol. 49 (7), 1045–1050.
Garety, P.A., Freeman, D., 2013. The past and future of delusions research: from the inexplicable to the treatable. Br. J. Psychiatry. 203 (5), 327–333.
Harrow, M., Herbener, E.S., Shanklin, A., Jobe, T.H., Rattenbury, F., Kaplan, K.J., 2004. Followup of psychotic outpatients: Dimensions of delusions and work functioning in schizophrenia. Schizophr. Bull. 30 (1), 147–161.
Hyman Jr., I.E., Billings, F.J., 1998. Individual differences and the creation of false childhood memories. Memory. 6 (1), 1–20.
Kay, S.R., Fiszbein, A., Opler, L.A., 1987. The positive and negative syndrome scale (PANSS) for schizophrenia. Schizophr. Bull. 13, 261–276.
Lack, S.A., Kumar, V.K., Arevalo, S., 2003. Fantasy proneness, creative capacity, and styles of creativity. Percept. Mot. Skills. 96 (1), 19–24.
Laws, K.R., Bhatt, R., 2005. False memories and delusional ideation in normal healthy subjects. Personality Individ. Diff. 39 (4), 775–781.
Maher, B.A., 2006. The relationship between delusions and hallucinations. Curr. Psychiatry Rep. 8 (3), 179–183.

Merckelbach, H., Horselenberg, R., Muris, P., 2001. The Creative Experiences Questionnaire (CEQ): a brief self-report measure of fantasy proneness. Personality. Individ. Diff. 31 (6), 987–995.
Moritz, S., Thoering, T., Kuhn, S., Willenborg, B., Westermann, S., Nagel, M., 2015. Metacognition-augmented cognitive remediation training reduces jumping to conclusions and overconfidence but not neurocognitive deficits in psychosis. Front. Psychol. 6, 1048.
Nelson, H.E., 1982. National Adult Reading Test. NFER-Nelson, Windsor, UK.
O'Brien, R.M., 2007. A caution regarding rules of thumb for variance inflation factors. Qual. Quant. 41 (5), 673–690.
Peters, E.R., Joseph, S.A., Garety, P.A., 1999. Measurement of delusional ideation in the normal population: Introducing the PDI (Peters et al. Delusions Inventory). Schizophr. Bull. 25 (3), 553–576.
Phillipou, A., Mountjoy, R.L., Rossell, S.L., 2017. Overvalued ideas or delusions in anorexia nervosa? Aust. N. Z. J. Psychiatry. 51 (6), 563–564.
Preti, A., Vellante, M., 2007. Creativity and psychopathology: higher rates of psychosis proneness and nonright-handedness among creative artists compared to same age and gender peers. J. Nerv. Ment. Dis. 195 (10), 837–845.
Rauschenberger, S.L., Lynn, S.J., 1995. Fantasy proneness, DSM-III-R axis I psychopathology, and dissociation. J. Abnorm. Psychol. 104 (2), 373–380.
Rossell, S.L., Batty, R., Hughes, L., 2010. Impaired semantic memory in the formation and maintenance of delusions post-traumatic brain injury: a new cognitive model of delusions. Eur. Arch. Psychiatry Clin. Neurosci. 260 (8), 571–581.
Rossell, S.L., Labuschagne, I., Dunai, J., Kyrios, M., Castle, D.J., 2014. Using theories of delusion formation to explain abnormal beliefs in Body Dysmorphic Disorder (BDD). Psychiatry Res. 215 (3), 599–605.
Rossell, S.L., Shapleske, J., David, A., 1998. Sentence verification and delusions: A content-specific deficit. Psychol. Med. 28 (5), 1189–1198.
Sánchez-Bernardos, M.L., Avia, M.D., 2006. The relationship between fantasy proneness and schizotypy in adolescents. J. Nerv. Ment. Dis. 194 (6), 411–414.
Smith, L.M., Johns, L.C., Mitchell, R., 2017. Characterizing the experience of auditory verbal hallucinations and accompanying delusions in individuals with a diagnosis of bipolar disorder: A systematic review. Bipolar Disord. 19 (6), 417–433.
Spanos, N.P., Cross, P.A., Dickson, K., DuBreuil, S.C., 1993. Close encounters: an examination of UFO experiences. J. Abnorm. Psychol. 102 (4), 624–632.
Suhail, K., Ghauri, S., 2010. Phenomenology of delusions and hallucinations in schizophrenia by religious convictions. Ment. Health. Relig. Cult. 13 (3), 245–259.
Thomas, E.H., Rossell, S.L., Tan, E.J., Neill, E., Van Rheenen, T.E., Carruthers, S.P., et al., 2018. Do schizotypy dimensions reflect the symptoms of schizophrenia? Aust. N. Z. J. Psychiatry 4867418769746.
Thomas, N., Shawyer, F., Castle, D.J., Copolov, D., Hayes, S.C., Farhall, J., 2014. A randomised controlled trial of acceptance and commitment therapy (ACT) for psychosis: study protocol. B.M.C. Psychiatry. 14 (1), 198.
Thoresen, C., Endestad, T., Sigvartsen, N.P., Server, A., Bolstad, I., Johansson, M., et al., 2014. Frontotemporal hypoactivity during a reality monitoring paradigm is associated with delusions in patients with schizophrenia spectrum disorders. Cogn. Neuropsychiatry. 19 (2), 97–115.
Torrisi, M., De Luca, R., Pollicino, P., Leonardi, S., Marino, S., Maresca, G., et al., 2018. Poststroke delusions: What about the neuroanatomical and neurofunctional basis? Appl. Neuropsychol. Adult. 1–5. https://doi.org/10.1080/23279095.2017.1421536.
Varese, F., Smeets, F., Drukker, M., Lieverse, R., Lataster, T., Viechtbauer, W., et al., 2012. Childhood adversities increase the risk of psychosis: a meta-analysis of patient-control, prospective- and cross-sectional cohort studies. Schizophr. Bull. 38 (4), 661–671.
Verdoux, H., van Os, J., 2002. Psychotic symptoms in non-clinical populations and the continuum of psychosis. Schizophr. Res. 54 (1-2), 59–65.
Vorontsova, N., Garety, P., Freeman, D., 2013. Cognitive factors maintaining persecutory delusions in psychosis: the contribution of depression. J. Abnorm. Psychol. 122 (4), 1121–1131.
Vygotsky, L.S., 2004. Imagination and creativity in childhood. J. Russ. East. Eur. Psychol. 42 (1), 7–97.
Waldo, T.G., Merritt, R.D., 2000. Fantasy proneness, dissociation, and DSM-IV axis II symptomatology. J. Abnorm. Psychol. 109 (3), 555–558.
Weibel, D., Martarelli, C.S., Häberli, D., Mast, F.W., 2018. The Fantasy Questionnaire: a measure to assess creative and imaginative fantasy. J. Pers. Assess. 100 (4), 431–443.
Wilson, S.C., Barber, T.X., 1983. The fantasy-prone personality: Implications for understanding imagery, hypnosis, and parapsychological phenomena. In: Sheikh, A.A. (Ed.), Imagery: Current Theory, Research, and Application. Wiley, New York, NY, pp. 340–387.
Young, R.C., Biggs, J.T., Ziegler, V.E., Meyer, D.A., 1978. A rating scale for mania: reliability, validity and sensitivity. Br. J. Psychiatry. 133 (5), 429–435.