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The path from schizotypy to depression and aggression and the role of family stress

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Abstract

Background: Schizotypy is a multidimensional construct that consists of several personality traits linked to the vulnerability for psychosis. Positive schizotypy includes having paranormal beliefs. Negative schizotypy includes social anhedonia. Disorganised schizotypy includes social anxiety and communication disorder. Schizotypy may be related to depression and aggression through high expressed emotion (EE; a rating of criticism, hostility and emotional over-involvement in a close relative towards a person showing signs of mental disorder) in the context of family stress. This study tested, using path analyses, the hypotheses that schizotypy predicts depression and aggression through high perceived EE as criticism and irritability (hypothesis 1), and praise and intrusiveness in a close relative (hypothesis 2).

Methods: One hundred and four healthy participants listened to and rated the self-relevance of standard criticism and standard praise that denote EE. Participants rated their level of schizotypy, depression, aggression and perceived EE in self-report questionnaires. Two path models tested the hypotheses.

Results: Disorganised schizotypy, more than positive schizotypy, predicted the path to depression and aggression when perceived criticism and perceived EE-irritability were mediators. Disorganised schizotypy, more than negative schizotypy, predicted the path to depression and aggression when perceived praise and perceived EE-intrusiveness were mediators.

Conclusion: Greater perceived criticism, and less perceived praise in family communication, explain the path from disorganised schizotypy (more so than positive or negative schizotypy) to depression and aggression. These findings indicate a need to consider the thought disorder-EE link as a potential contributor to depression and aggression in people with schizophrenia.

Keywords: arousal, criticism, disorganisation, expressed emotion, path analysis, praise

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Schizotypy is a multidimensional construct consisting of many personality traits that are linked to subclinical experiences of psychosis (1). Positive schizotypy consists of perceptual aberrations, paranormal beliefs, delusional beliefs and referential thinking (here, referential thinking implies incorrectly interpreting and assigning unusual meaning to casual external events) (2). Negative schizotypy comprises a lack of pleasure in physical and social activities and social withdrawal. Cognitive disorganisation includes social anxiety, communication disorder and having poor cognitive control (3). Impulsive non-conformity is a fourth dimension of schizotypy that consists of violent, self-abusive and reckless behaviours and is thought to reflect aggression (2). Impulsive non-conformity is not considered to be a core schizotypal trait (4). Instead, impulsive non-conformity is considered subsidiary to positive schizotypy (5) because impulsivity and hostility seem to derive from core schizotypal traits, such as paranoia and suspiciousness (6).

The family context of the relationship between schizotypy to aggression

Aggression is characterised by behaving in a way that intends to inflict harm upon a victim when the victim is motivated to avoid the harm (7; 8). Aggression may be imitated (9) or arise in conflictual communication, such as when romantic partners criticise each other (10). People with schizophrenia and schizotypy, however, often show reactive aggression, rather than proactive aggression (11; 12; 13). Such reactive aggression could come about from patients perceiving criticism and hostility in the family (13), or high expressed emotion (EE) within the family context. EE is a rating of the level of criticism, hostility, emotional overinvolvement, warmth and/or positive comments from a family member towards the patient (14). Patients with schizophrenia

make three times as many criticisms and display more hostility when interacting with a high EE parent (15). Individuals with high schizotypy also encounter more EE-rated hostility than individuals with low schizotypy (16). Individuals with high schizotypy also react aggressively to peer victimisation (11).

The pathway from schizotypy to depression and aggression through perceived EE

High positive schizotypal traits are linked to negative metacognitive beliefs in depression (17). Negative meta-cognitive beliefs include being self-critical (18; 19). Depression may be linked to disorganised schizotypy more strongly than positive or negative schizotypy, since disorganised schizotypy is reported to be a better predictor of negative affect than positive or negative schizotypy (20). Unlike disorganised schizotypy which comprises "nervousness due to confusedness" (22), positive schizotypal experiences do not necessarily encompass negative affect in neuroticism/anxiety (21). Such negative affect in positive schizotypy is associated with disorganised schizotypy (20). Besides, anxiety in disorganised schizotypy is accompanied by low mood (23). Depression is also related to aggression (24), with reports of low-level depression coexisting with aggression (25). Disorganisation also appears to be linked to aggression, since disorganisation is greater among patients with schizophrenia who are aggressive than non-aggressive (26).

Social anxiety from being sensitive to reward and punishment from others may mediate the relationship of schizotypy to depression and aggression. Criticism and praise are types of social punishment and social reward, respectively. Self-criticism is the tendency to set unrealistically high self-standards and adopt a punitive stance toward oneself (27). Self-criticism increases sensitivity to threat and reward (27). Furthermore, sensitivity to punishment, which can include

criticism, relates to depression (28) and aggression (24). Hence, sensitivity to criticism could relate to depression and aggression. Perceiving criticism in the family predicts disorganised schizotypy and positive schizotypy (Premkumar, Dunn, Onwumere, & Kuipers, 2019), depression and aggression (29; 30; 27). Perceiving other types of social reward and punishment, such as peer rejection and peer acceptance, also relate to depression and aggression (31). Greater aggression relates to over-estimating peer acceptance, while greater depression relates to under-estimating peer acceptance, but perceiving more peer rejection in adolescence (31).

Likewise, an appetite for social reward may be related to negative schizotypy, depression and aggression (24). Negative schizotypy and depression constitute a reduced appetite for reward (32; 28; 33; 34), while aggression constitutes an excessive appetite for reward (35). Even though depression and aggression have opposing propensities for experiencing social reward, depressive symptoms, such as withdrawal, are associated with greater aggression when depression is associated with externalising problems, such as bullying and having few social contacts (24). Perceiving EE from perceiving a close relative's emotional involvement as intrusiveness and perceiving less reward from standard praise constitute a diminished appetite for social reward. Parental emotional overinvolvement relates to negative schizotypy (36). EE-emotional overinvolvement and perceived EE-intrusiveness are similar concepts, where both concepts refer to an excessive concern for the welfare of the person showing vulnerability for mental disorder (37; 14). Perceived EE-intrusiveness relates to less sensitivity to praise and greater negative schizotypy (Premkumar, Dunn, Onwumere, & Kuipers, 2019). Furthermore, perceived EE-intrusiveness relates to depression (29) and aggression as hostility (38). Hence, perceived EE from less perceived praise, but greater perceived EE-intrusiveness could be associated with negative schizotypy, depression and aggression.

Aims and hypotheses

Two theoretical models were proposed to explain the relationship between schizotypy, depression and aggression due to perceived EE. It was hypothesised that:

(1) Disorganised schizotypy and positive schizotypy would predict greater depression, and in turn severe aggression (Figure 1a). Greater perceived criticism and greater perceived EE-irritability would mediate the relationship between depression and severe aggression. Severe forms of aggression, namely anger and verbal aggression, are predicted here since the positive syndrome of schizophrenia is associated with acts of severe physical and verbal aggression more often/stronger than the negative syndrome (39; 40).

(2) Disorganised schizotypy and negative schizotypy would predict greater depression, and in turn mild aggression (Figure 1b). Less perceived praise, but greater perceived EE-intrusiveness, would mediate the relationship between depression and mild aggression. Mild aggression, namely anger and hostility, is predicted here, since the negative syndrome of schizophrenia is associated more often with milder aggression than the positive syndrome (39).

*** Insert Figure 1 about here ***

Methods

Participants

One hundred and four healthy participants took part. Participants were mainly young adults (80% were aged 30 years and below) and recruited by means of opportunistic sampling (75%;

university students in Psychology) or social networks. The majority of this sample was characterised in an earlier study (n = 98) (41), with six new participants being added to the current study. Seventy-seven percent were single, 15% were cohabiting and 8% of the sample were married. Sixty-eight percent were Caucasian, 24% were Asian and eight percent were African-Caribbean. Participants needed to have a close relative to participate so that they could rate the standard criticism, the standard praise and the Level of Expressed Emotion scale by referring to their close relative. A close relative was defined as a parent, sibling or partner with whom the participant had face-to-face or phone contact for at least 10 h per week. Participants provided informed consent before taking part. The study was approved by the Research Ethics Committee at the University's School of Social Sciences (No. 2013/27).

Assessments

Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE) (Mason and Claridge 2006, Mason, Claridge and Jackson, 1995)

The participants answered 'Yes' or 'No' to the 104 items on the O-LIFE. The scale has four subscales, namely Unusual Experiences (perceptual aberrations and magical ideation), Introvertive Anhedonia (emotional withdrawal and lack of pleasure), Cognitive Disorganisation (social anxiety, moodiness and lack of concentration) and Impulsive Non-conformity (lack of self-control). The subscales have good internal reliability (Cronbach's alpha, α) in the current sample: unusual experiences, $\alpha = 0.90$; introvertive anhedonia, $\alpha = 0.78$; cognitive disorganisation, $\alpha = 0.89$ and impulsive non-conformity, $\alpha = 0.70$.

Depression, Anxiety, and Stress Scale (DASS-21) (43)

Depression is characterised by tearfulness, irritability, social withdrawal and feeling guilty and worthless (44). Participants rated the DASS by referring to their past week. Seven items concerned depression and were rated on a four-point Likert scale ranging from 'Did not apply to me at all' to 'Applied to me very much or most of the time'. An item on depression was 'I couldn't seem to experience any positive feeling at all'. The depression subscale has good internal reliability in the current sample, alpha = 0.87.

Level of Expressed Emotion (LEE) (45; 37)

Participants rated their perception of their close relative over the last three months. The LEE scale consists of 38 items rated on a four-point Likert scale ranging from 'Untrue' to 'True'. The four LEE subscales are Criticism, Irritability, Intrusiveness and Lack of Emotional Support. LEE-Irritability corresponds to the hostility dimension, while LEE-Intrusiveness corresponds to the Emotional Over-Involvement dimension of the EE rating of the Camberwell Family Interview (14). The subscales have good to excellent internal reliability in the current sample as follows, criticism, $\alpha = 0.75$; irritability, $\alpha = 0.79$; intrusiveness, $\alpha = 0.81$ and lack of emotional support, $\alpha = 0.93$.

Buss and Perry Aggression Questionnaire (BPAQ) (46)

Participants rated the 21 items of the BPAQ on a seven-point Likert scale, ranging from 'extremely uncharacteristic of me' to 'extremely characteristic of me'. The questionnaire consists of four subscales, namely Physical Aggression, Verbal Aggression, Anger and Hostility. Physical and Verbal Aggression involve hurting or harming others. Anger denotes physiological arousal and

preparing for aggression. Hostility denotes resentment, suspiciousness and injustice. The scale has good construct validity because anger and hostility relate to emotionality (46). Verbal Aggression and Anger relate to assertiveness, and Verbal Aggression and Hostility relate to narcissism (47). The scale has good internal reliability (Cronbach's alpha, α) in the current sample, namely Physical Aggression, $\alpha = 0.88$; Verbal Aggression, $\alpha = 0.85$; Anger, $\alpha = 0.86$; and Hostility, $\alpha = 0.89$, total score, $\alpha = 0.93$.

Affective evaluation of standard criticism and standard praise

The participants listened to 40 standard criticisms and 40 standard praises reflecting EE-criticism and positive comments from a close relative. Forty neutral comments served as a non-emotion control. Participants rated the comments for their personal relevance by answering the question, 'How strongly do you relate to this comment?' on an 11-point Likert scale ranging from 0 = 'Not at all' to 10 = 'Very Strongly'. Likewise, participants rated the comments for their arousal by answering the question 'How arousing is this comment?'. The design of this experiment has been described in full elsewhere (Premkumar, Dunn, Onwumere, & Kuipers, 2019). Briefly, the style of delivering the criticism and praise verbally followed the conventions of rating a close relative for EE-criticism and EE-positive comments on the Camberwell Family Interview (the gold standard measure for rating EE) depending on tone and content of the comments (14). Neutral comments were about the weather and scientific facts. The comments were spoken by a male and a female Psychology student who were of a similar age and level of education. The relevance of the standard criticism and the relevance of standard praise were the dependent variables in this task. Relevance captures the appraisal of emotional stimuli regardless of their valence (48) and reflects perceived family EE better than arousal (Premkumar, Dunn, Onwumere, & Kuipers, 2019).

The median of the ratings of the relevance of the 40 comments in each condition (criticism, praise, and neutral comments) was calculated.

Statistical analysis

Skewness and kurtosis were in the normal range for all variables, ranging from -0.48 to 1.18 for skewness and from -0.93 to 1.15 for kurtosis. For exploratory purposes, two-tailed Pearson correlations were performed in SPSS, version 24, between the schizotypy subscales, median relevance of criticism, median relevance of praise, perceived EE, depression and aggression. Path analyses were performed in SPSS Amos, version 25. Two models specified the path from schizotypy to aggression via depression and perceived EE. The first model tested the first hypothesis of the path from Cognitive Disorganisation and Unusual Experiences to Depression. The path continued from Depression to Aggression via Relevance of Criticism and LEE-Irritability, where Aggression was the latent variable and Anger and Verbal Aggression were the observed variables (Figure 2). The second model tested the second hypothesis of the path from Cognitive Disorganisation and Introvertive Anhedonia to Depression. The path continued from Depression to Aggression via Relevance of Praise and LEE-Intrusiveness, where Aggression was the latent variable and Anger and Hostility were the observed variables (hypothesis 2, Figure 3). Maximum likelihood estimation and, due to the small sample size, a boot strapping procedure of 2,000 samples were used to calculate the parameters of the path model, including standardised indirect effects and their 90% confidence intervals. Several fit indices determined the criterion for a good fit between the hypothesised and observed models (49). A non-significant chi-square test indicates good fit. A good comparative fit index, i.e. >0.95, indicates that the hypothesized model fits the data well. A root-mean square error of approximation value of <0.05 indicates good fit, with values

between 0.08 and 0.1 representing mediocre fit and a value >0.1 indicating poor fit. The standardised root mean square residual represents the average value across all standardised residuals, and a value of <0.05 indicates good fit. The Akaike Information Criterion requires the fit statistic of the re-specified model to be lower than that of the hypothesized (default) model. The model was re-specified by studying the modification indices and standardised residuals and introducing covariances between unobserved variables (error variance) and/or introducing a direct path between the observed variables (50).

Results

Sample characteristics

Participants were mainly young (mean age 23.84±5.86 years) and female (79%) and single (77%). Compared to the normative sample of females (n = 237) aged 18 to 21 years (42), the current sample had higher Introvertive Anhedonia [$t(339)=4.4$, $p<0.001$], but did not differ on Unusual Experiences [$t(339)=1.69$, $p=0.09$], Cognitive Disorganisation [$t(339)=0.77$, $p=0.44$] and Impulsive Non-conformity [$t(339)=0.04$, $p=0.96$].

Correlations between schizotypy, aggression, perceived EE and depression

O-LIFE Unusual Experiences (positive schizotypy) correlated positively with the Relevance of Criticism, LEE-Criticism and LEE-Irritability, Depression, Physical Aggression, Verbal Aggression, Anger and Hostility (Table 1). O-LIFE Introvertive Anhedonia (negative schizotypy) correlated positively with Relevance of Criticism, LEE-Criticism, LEE-Irritability and LEE-Intrusiveness, Depression, Anger and Hostility, and negatively with Relevance of Praise. Cognitive Disorganisation (disorganised schizotypy) correlated positively with Relevance of

Criticism, LEE-Criticism, LEE-Irritability, LEE-Intrusiveness, Depression, Anger and Hostility, and negatively with Relevance of Praise.

Path from schizotypy to depression and aggression via relevance of criticism and perceived EE-irritability

The initial model indicated that the hypothesised model did not fit the data well (Table 2). To achieve acceptable goodness-of-fit, error covariances were specified based on the modification indices between (a) Cognitive Disorganisation and Unusual Experiences subscales of the O-LIFE, (b) Relevance of Criticism and LEE-Irritability, and (c) Anger and Verbal Aggression subscales of the BPAQ (Figure 2). The error variances of the O-LIFE subscales are expected to co-vary as per the psychometric properties of these scales, and so are the error variances of subscales of the BPAQ. Hence error covariances were applied to these pairs of observed variables. The error covariance between Relevance of Criticism and LEE-Irritability is plausible, because Relevance of Criticism and LEE-Irritability are related and are both measures of perceived EE-hostility (41) .

The following direct paths were significant and are mentioned in decreasing order of the size of the standardised path coefficients, namely Anger to Aggression (r=1.14, $p < 0.001$; note that a standardised regression coefficient >1 is legitimate in a path analysis (51)), Aggression to Verbal Aggression (r=0.57, p<0.001), Cognitive Disorganisation to Depression (r=0.48, p<0.001), Depression to Aggression (r=0.42, p<0.001), Depression to Relevance of Criticism (r=0.37, p<0.001), and Unusual Experiences to Depression (r=0.21, p=0.017). The following indirect paths were significant and are mentioned in decreasing order of the size of the standardised path coefficients, namely Depression to Anger (r=0.54, p=0.001), Depression to Verbal Aggression (r=0.27, p=0.001), Cognitive Disorganisation to Anger (r=0.26, p=0.001), Cognitive

Disorganisation to Aggression (r=0.23, p<0.001), Cognitive Disorganisation to Relevance of Criticism (r=0.18, p=0.001), Cognitive Disorganisation to Verbal Aggression (r=0.13, p<0.001), and (6) Unusual Experiences to Verbal Aggression (r = 0.06, p = 0.47).

Path from schizotypy to depression and aggression via relevance of praise and perceived EE-intrusiveness

The initial model indicated that the hypothesised model did not fit the data well (Table 2). Error covariance was specified between Cognitive Disorganisation and Introvertive Anhedonia as the modification indices indicated that this modification would improve the fit of the model. These observed variables are expected to be related because they are subscales of O-LIFE (Figure 3). A direct path was specified from Cognitive Disorganisation to BPAQ-Hostility. This modification is meaningful, since Cognitive Disorganisation predicts aggression (26). The re-specified model achieved acceptable goodness-of-fit. The following direct paths were significant, namely Depression to Aggression (r=0.76, p<0.001), Aggression to Anger (r=0.69, p<0.001), Aggression to Hostility (r=0.54, p<0.001), Cognitive Disorganisation to Depression (r=0.5, p <0.001), Cognitive Disorganisation to Hostility (r=0.37, p<0.001), Relevance of Praise to Aggression (r =-0.23, p=0.019), and Introvertive Anhedonia to Depression (r=0.0.19, p=0.024). The following indirect paths were significant, namely from Depression to Anger (r=0.56, p=0.001), Depression to Hostility (r=0.43, p=0.002), Cognitive Disorganisation to Aggression (r=0.4, p=0.001), Cognitive Disorganisation to Anger (r=0.28, p=0.001), Cognitive Disorganisation to Hostility (r=0.22, p=0.001), Introvertive Anhedonia to Aggression (r=0.16, p=0.008), Relevance of Praise to Anger (r=-0.16, p=0.011), Introvertive Anhedonia to Anger (r=0.11, p=0.008), Introvertive

Anhedonia to Hostility (r=0.08, p=0.006), and Introvertive Anhedonia to Relevance of Praise (r=-0.03, p=0.04).

*** Insert tables 2 and 3 and figures 2 and 3 about here ***

Discussion

People with a significant level of schizotypy, depression and aggression are reported to perceive high EE from their close relative (Premkumar, Dunn, Onwumere, & Kuipers, 2019; Hale, Raaijmakers, Hoof, & Meeus, 2011). Furthermore, disorganised, positive and negative dimensions of schizotypy and/or schizophrenia predict aggression (24; 11; 40). This is the first study to collectively examine the role of perceived EE in relationship with schizotypy, depression and aggression. Two path models predicted the path from schizotypy to depression and aggression, one via perceived EE as perceived criticism and LEE-Irritability and the other via perceived EE as perceived praise and LEE-Intrusiveness. In both models, disorganised schizotypy (O-LIFE Cognitive Disorganisation) was the strongest of the schizotypal traits to predict the path from schizotypy to aggression.

The path from disorganised schizotypy to depression and aggression

Social anxiety could mediate the relationship we observed between disorganised schizotypy and aggression. Disorganised schizotypy denotes social anxiety and communication disorder (52). Disorganised schizotypy also relates to social stress (53; 54; 55) and social anxiety as rejection sensitivity (56). In turn, disorganised schizotypy and social anxiety relate to poor recognition of anger (57; 58). Hence, aggression in schizotypy could be reactive to peer

victimisation (11). Disorganised schizotypy directly and indirectly predicted aggression as hostility, anger and verbal aggression in the current study. Hence, social anxiety, such as sensitivity to criticism and rejection, may mediate the relationship between disorganised schizotypy and aggression. Disorganised schizotypy relates to accepting unfair social rewards (59) and aggression (60). In turn, rejection sensitivity increases the likelihood of retaliation (61). Given that disorganised schizotypy also features lack of concentration and attentional deficits (62), it may be interesting to explore disorganised schizotypy in relation to attention deficit hyperactivity disorder which has been linked to antisocial behaviour through inattention and impulsivity (63).

The path from positive schizotypy and negative schizotypy to depression and aggression

Positive schizotypy (O-LIFE Unusual Experiences) directly predicted depression and indirectly predicted verbal aggression in the current study. Disorganised schizotypy and depression predicted the relevance of criticism. Having a high level of depression due to excessive negative meta-cognitive beliefs, such as being self-critical and perceiving criticism in others, could mediate the relationship between positive schizotypy and aggression. Consistent with this notion, perceiving victimisation from peers has been found to mediate the relation between positive schizotypy and aggression (11). Relevance of criticism could be seen as sensitivity to punishment. The behavioural inhibition system (BIS) and behavioural approach system (BAS) are two theoretical systems that could account for sensitivity to punishment and reward in criticism and praise, respectively, and explain the relationship between schizotypy and aggression (64; 65). The heighted BIS activation may account for sensitivity to punishment (32), such as self-criticism (27), and may explain the role of perceived criticism in mediating the relationships between positive schizotypy, depression and aggression. Likewise, negative schizotypy (O-LIFE Introvertive

Anhedonia) directly predicted depression and indirectly predicted the relevance of praise and aggression as hostility and anger in the current study. The BAS accounts for sensitivity to reward and the tendency to approach situations (32). The BAS puts psychoticism (a personality dimension that includes schizotypal traits) on a continuum with psychopathy (a personality dimension concerned with aggression) (64). Diminished BAS from praise in negative schizotypy may predict depression and aggression because BAS mediates the link between psychoticism and psychopathy (64). Future research could test the role of BIS/BAS activation in the relationships between perceived EE, schizotypy, depression and aggression.

Limitations, future directions and implications

The findings may be considered exploratory given the sample size (n=104). Although bootstrapping tests meant that the models were tested in 2,000 hypothetical samples, further research could test the re-specified models in a larger sample, and also explore possible gender differences in the path from schizotypy to depression and aggression, given that depression relates to being a victim of violence in women but being the perpetrator in men (66). Our participants were mostly university students studying psychology who may be better acquainted with the psychological concepts being investigated than the non-academic population. Therefore, the findings may not generalise to the wider sub-clinical population. Lastly, future research may test-re-test reliability of the affective evaluation task.

Our findings have implications for schizophrenia. Thought disorder in schizophrenia is the clinical analogy of disorganised schizotypy (67). Thought disorder comprises peculiar language, illogical thinking and loose association (52; 68). Patients with schizophrenia who have had a past criminal conviction and current thought disorder are more likely to be disorganised and act

violently than patients who do not have thought disorder (26). These previous findings, taken together with our findings (i.e. disorganised schizotypy predicting aggression through perceived criticism and less perceived praise), suggest that aggression in patients with thought disorder may be reactive to perceived family criticism/lack of praise and associated anger and stress. Thought disorder and the reactive nature of aggression thus should be considered when supporting patients with schizophrenia with a history of aggression and violence. Our findings also appear to be consistent with previous data showing that intensification of anger explains the link between positive symptoms and violence (40).

In conclusion, disorganised schizotypy, and to a lesser extent positive schizotypy and negative schizotypy, predict depression and aggression. Greater perceived criticism, but less perceived praise in family communication seem to explain the path from schizotypy to depression and aggression. Given that disorganised schizotypy is analogous with thought disorder in schizophrenia, schizophrenia patients with thought disorder tend to be disorganised and act violently than those without thought disorder (26). There is a need to consider thought disorder-EE link as a potential contributor to depression and aggression in people with schizophrenia.

Funding body agreements and policies

None.

Contributors

Preethi Premkumar wrote the first draft of the paper and contributed to study design, data collection, analysis and interpretation. Elizabeth Kuipers and Veena Kumari contributed to interpretation, review and editing, and gave final approval of the manuscript.

Conflict of interest

None.

Data Availability Statement

The data that support the findings will be available in zenodo.org at https://zenodo.org/record/3956134#.XxgTfy-ZNQI; DOI: 10.5281/zenodo.3956134 following a 6 month embargo from the date of publication to allow for commercialisation of research findings.

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Tables

Table 1. Descriptive statistics and Pearson correlations (paths *a* and *c'*, direct effect, of the mediation analyses) between schizotypy, aggression, perceived criticism and praise, depression and perceived expressed emotion

	Mean (S.D.)	1	2	3	4
1. O-LIFE – UE	8.93 (6.47)	-			
2. O-LIFE – IA	7.18 (4.45)	0.077	-		
3. O-LIFE – CD	13.21 (6.17)	0.48***	0.43***	-	
4. O-LIFE - IN	9.25 (3.77)	0.46***	0.12	0.46***	-
5. Relevance of criticism	4.83 (2.50)	0.26**	0.23*	0.41***	0.35***
6. Relevance of praise	5.83 (2.03)	0.05	-0.21*	-0.24*	-0.16
7. LEE – Criticism	9.28 (3.08)	0.25**	0.2*	0.32**	0.37***
8. LEE – Irritability	11.64 (3.67)	0.22*	0.23*	0.27**	0.27***
9. LEE – Intrusiveness	18.7 (5.23)	0.15	0.26**	0.22*	0.18
10. LEE – LES	31.86 (10.02)	0.13	0.17	0.1	0.36**
11. DASS – depression	9.94 (9.15)	0.44***	0.41***	0.58***	0.41***
12. BP – physical aggression	23.51 (11.40)	0.20*	0.15	0.12	0.51***
13. BP – verbal aggression	17.48 (7.31)	0.20*	-0.02	0.11	0.39***
14. BP – anger	19.74 (9.25)	0.29**	0.27**	0.31**	0.52***
15. BP – hostility	24.33 (11.86)	0.43***	0.36***	0.64***	0.50***

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; BP: Buss and Perry aggression questionnaire; DASS: depression, anxiety and stress scale; LEE: Level of expressed emotion scale; LEE – LES: lack of emotional support; O-LIFE: Oxford-Liverpool inventory of feelings and experiences; O-LIFE –

CD: O-LIFE Cognitive Disorganisation; O-LIFE – IA: O-LIFE Introvertive Anhedonia; O-LIFE – IN: O-LIFE Impulsive Non-conformity; O-LIFE – UE: O-LIFE Unusual Experiences

Tables

Table 2. Fit indices for the hypothesised and re-specified models of the path from schizotypy to depression and aggression

	CD and UE to Aggression via Depression, Relevance of criticism and LEE-Irritability		CD and IA to aggression via depression, perceived praise and perceived EE-intrusiveness	
	Hypothesised model	Re-specified model	Hypothesised model	Re-specified model
Chi-square	49.44	15.23	54.24	15.21
Df	12	10	12	10
P	<0.001	0.12	<0.001	0.125
CFI	0.81	0.97	0.78	0.97
GFI	0.88	0.96	0.87	0.96
RMSEA	0.17	0.07	0.18	0.07
90% lower CIs	0.12	<0.001	0.14	<0.001
90% upper CIs	0.23	0.14	0.24	0.14
SRMR	0.14	0.67	0.14	0.07
AIC				
Default model	81.44	51.23	86.24	51.21

Note: AIC: Akaike Information Criterion; CD – Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE) Cognitive Disorganisation; CFI: comparative fit index; CIs: confidence intervals; Df: degrees of freedom; GFI: goodness of fit index; RMSEA: root mean square error of approximation; IA – O-LIFE Introvertive Anhedonia; SRMR: Standardised root mean square residual; UE – – O-LIFE Unusual Experiences;

Figures title:

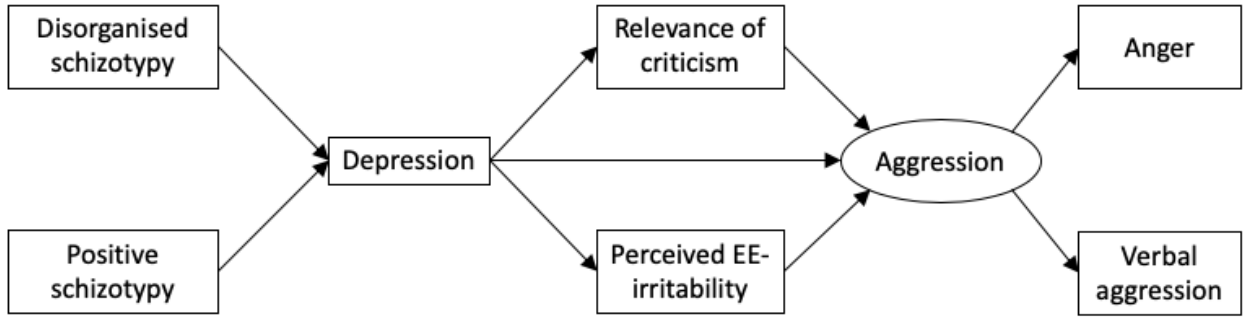
Figure 1. Hypothesised models of the path from schizotypy to depression and aggression, (a) from disorganised schizotypy and positive schizotypy to depression and aggression via relevance of criticism and perceived EE-irritability and (b) from disorganised schizotypy and negative schizotypy to depression and aggression via relevance of praise and perceived EE-intrusiveness. Variables in ovals are latent variables.

Figure 2. Modified path model of the path from disorganised schizotypy and positive schizotypy to depression and aggression via perceived criticism and perceived EE-irritability.

Figure 3. Modified path model of the path from disorganised schizotypy and negative schizotypy to depression and aggression via perceived praise and perceived EE-intrusiveness.

Figure 1

(a)


Disorganised schizotypy
Positive schizotypy
Depression
Relevance of criticism
Perceived EE-irritability
Aggression
Anger
Verbal aggression

(b)

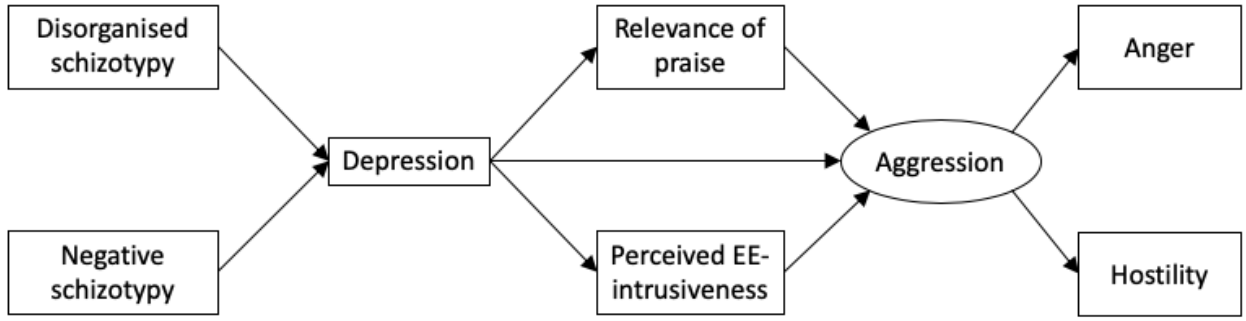
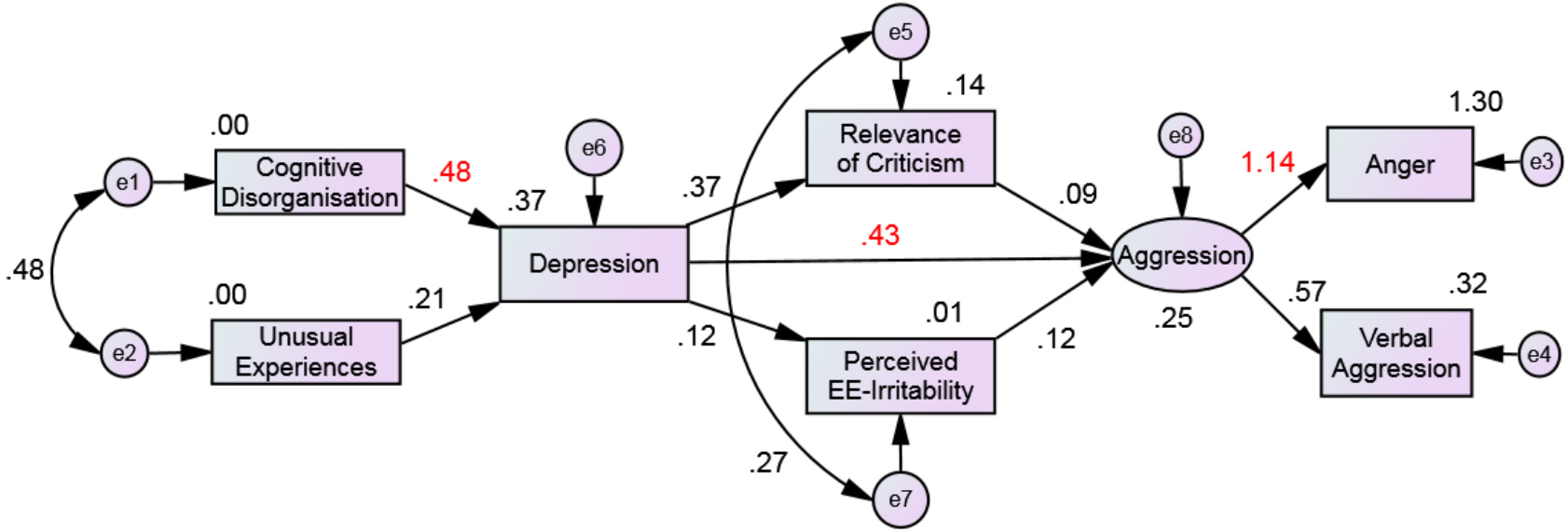
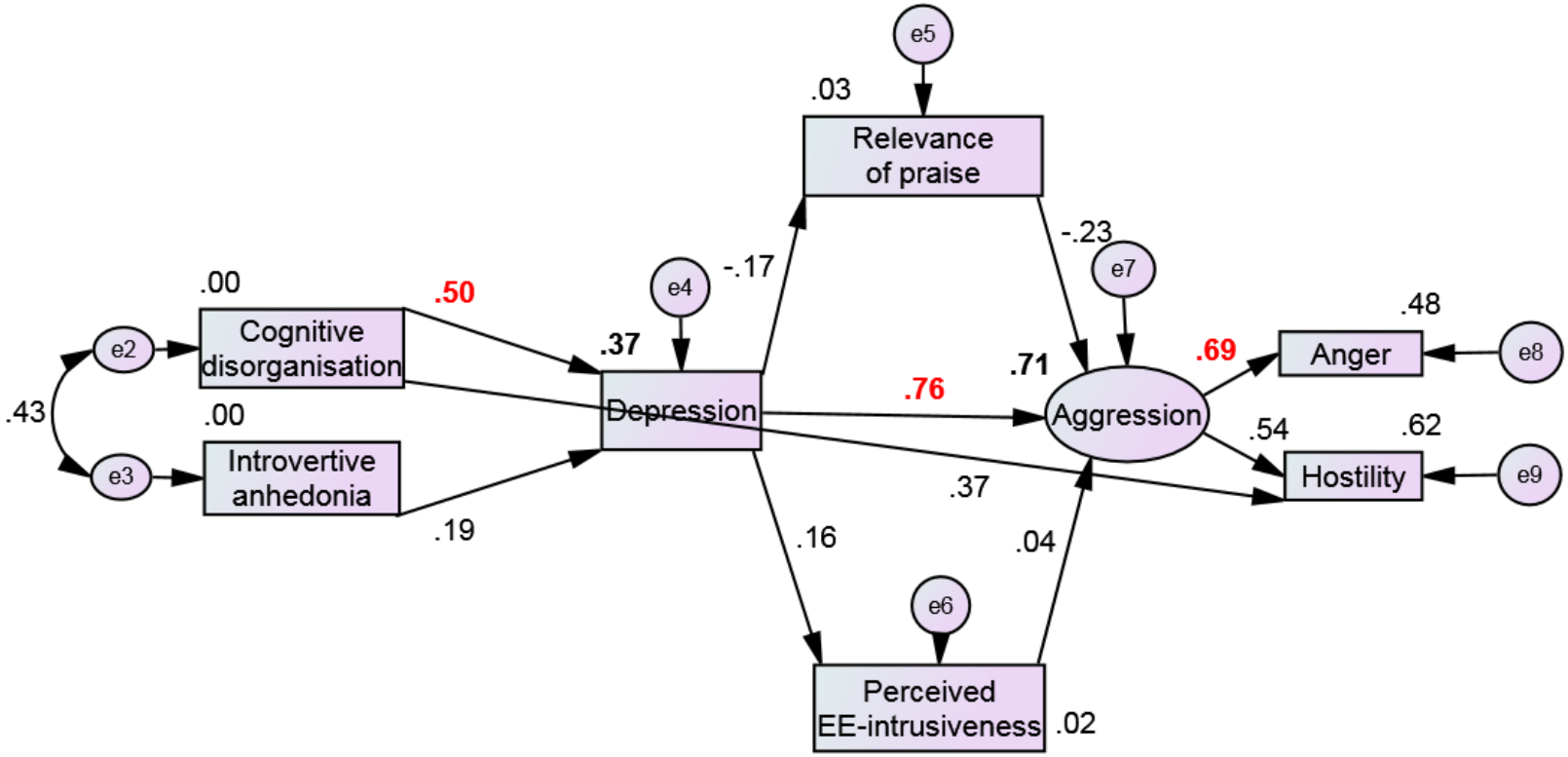

Disorganised schizotypy
Negative schizotypy
Depression
Relevance of praise
Perceived EE-intrusiveness
Aggression
Anger
Hostility

Figure 2



Notes: Values represent standardised coefficients; values in red represent the highest standardised path coefficients at each stage of the path; values besides observed variables (in boxes) are squared multiple correlations; values besides straight arrows are indirect, direct and total effects; values next to curved arrows are error covariances between endogenous variables; variables in circles or ovals are unobserved variables (latent variables or error variances).

Figure 3



Notes: Values represent standardised coefficients; values in red represent the highest standardised path coefficients at each stage of the path; values besides observed variables (in boxes) are squared multiple correlations; values besides straight arrows are indirect, direct

and total effects; values next to curved arrows are error covariances between endogenous variables; variables in circles or ovals are unobserved variables (latent variables or error variances).