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Cognitive Biases Questionnaire for Psychosis

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Objective: **The Cognitive Biases Questionnaire for psychosis (CBQp) was developed to capture 5 cognitive distortions (*jumping to conclusions, intentionalising, catastrophising, emotional reasoning, and dichotomous thinking*), which are considered important for the pathogenesis of psychosis. Vignettes were adapted from the Cognitive Style Test (CST),[1] relating to "Anomalous Perceptions" and "Threatening Events" themes. *Method:* Scale structure, reliability, and validity were investigated in a psychosis group, and CBQp scores were compared with those of depressed and healthy control samples. *Results:* The CBQp showed good internal consistency and test-retest reliability. The 5 biases were not independent, with a 2-related factor scale providing the best fit. This structure suggests that the CBQp assesses a general thinking bias rather than distinct cognitive errors, while Anomalous Perception and Threatening Events theme scores can be used separately. Total CBQp scores showed good convergent validity with the CST, but individual biases were not related to existing tasks purporting to assess similar reasoning biases. Psychotic and depressed populations scored higher than healthy controls, and symptomatic psychosis patients scored higher than their nonsymptomatic counterparts, with modest relationships between CBQp scores and symptom severity once emotional disorders were partialled out. Anomalous Perception theme and Intentionalising bias scores showed some specificity to psychosis. *Conclusions:* Overall, the CBQp has good psychometric properties, although it is likely that it measures a different construct to existing tasks, tentatively suggested to represent a bias of interpretation rather than reasoning, judgment or decision-making processes. It is a potentially useful tool in both research and clinical arenas.**

Key words: schizophrenia/thinking errors/delusions/hallucinations/cognitive behavior therapy for psychosis

Introduction

Recent biopsychosocial models of psychosis have emphasized the central role of cognitive factors,[2–5] both in terms of the content of appraisals[6,7] and the process of reasoning and metacognition.[8,9] Specifically, there is a large body of work demonstrating that cognitive biases play a key role in the formation and maintenance of delusions.[10]

The strongest evidence base relates to the "jumping to conclusions" (JTC)[8] and attributional biases.[11] The JTC bias refers to the tendency to gather little information before making a decision, thereby increasing the likelihood of inaccurate beliefs being formed hastily. It is present in schizotypal,[12,13] at-risk,[14] symptomatic,[8] and remitted[15] psychotic populations and is stable over time.[16] Attributional biases have been investigated mainly in persecutory[17,18] and, to a lesser extent, in grandiose delusions.[19] Deluded participants make external attributions for negative events[20] and, more specifically, favor personalizing attributions,[21] whereby other people, rather than circumstances, are blamed for negative events.[6,7]

While the research has focused on JTC and attributional biases, clinically it is apparent that individuals with psychosis show a range of cognitive biases, broadly reflecting those originally delineated by

Beck for emotional disorders.[22] This overlap is perhaps unsurprising, bearing in mind the close links between emotions and psychotic phenomena identified in recent models.[2,23] Thinking errors commonly observed include dichotomous thinking, emotionally based reasoning, and catastrophising. Although these biases have not been looked at systematically in psychosis, a few studies provide some support concordant with clinical impressions; a dichotomous thinking style[24] was found in deluded patients, which was related to a lack of belief flexibility,[8] while worry and catastrophising were demonstrated to be associated with delusion distress and persistence.[25] No study has looked directly at emotion-based reasoning; however, the association between paranoia and self-focus[26] and an internal processing bias toward threat[27] suggest that internal emotional states are important in driving delusions.[28]

However, the assessment of thinking errors in psychosis has lagged behind their theoretical and clinical developments.[29] They have tended to be studied in isolation, and some (JTC) have been researched more than others (emotional reasoning). The "beads" task has dominated research into the JTC bias[30] but is not easily adapted to the clinic. Similarly, the Attributional Style Questionnaire[31] and the Internal, Personal, and Situational Attributions Questionnaire[21] are too lengthy to be used routinely in therapy. The Ambiguous Intentions Hostility Questionnaire[32] assesses intentionalising, but its length and narrow focus make it impractical for use in routine practice.

A number of questionnaires assessing "Beckian" biases are available in the emotional disorders literature.[1,33–38] They consist mostly of case scenarios, whereby respondents indicate how they would usually respond in such situations. However, many of the case vignettes are inappropriate for people with psychosis; they typically revolve around achievement or interpersonal situations that assume the respondent is in employment or in a long-term relationship and are unlikely to resonate with such patients ("A special dinner gets spoilt because the main dish is slightly burnt"[1]; "You noticed recently that a lot of your friends are taking up golf and tennis").[37]

The aim of this study was to design a new scale to assess cognitive biases in people with psychosis, measuring a range of thinking styles frequently observed in this population, which would be user-friendly and practicable in both clinical and research settings.

Method

Construction of the Cognitive Biases Questionnaire for Psychosis

The Cognitive Biases Questionnaire for psychosis (CBQp) format was based on the Cognitive Style Test (CST),[1] consisting of 30 vignettes of everyday events (half pleasant and half unpleasant). Respondents imagine themselves in each situation and choose 1 of 4 possible cognitive responses to the scenario, representing general depressive distortions such as selective abstraction and overgeneralization.

The vignettes were adapted to psychosis by creating new scenarios to reflect 2 themes of major relevance to psychosis: "Anomalous Perceptions" (AP) and "Threatening Events" (TE). The cognitive biases to be assessed were selected on the basis of their relative frequency in psychosis, based on the authors' clinical experience, and consisted of jumping to conclusions (JTC), dichotomous thinking, intentionalising, emotional reasoning, and catastrophising.

The vignettes were generated by a subset of the authors on the basis of their clinical experience and distributed to the wider group for consultation. Six scenarios were generated for each bias, half relating to AP and half to TE (30 items total). Each vignette included a forced-choice response between 3 statements, illustrating absence of bias (score of 1); possible presence of bias (score of 2); and likely presence of bias (score of 3). The potential range of scores was 30–90 (15–45 for each theme and 6–18 for each thinking bias). The order of the responses was randomized across items to reduce potential response biases. The example below illustrates a TE scenario assessing "intentionalising" (scores in parentheses):

Imagine you receive a letter and you notice it is not sealed.

I am most likely to think: (please circle A, B, or C)

A: Someone has deliberately opened this letter already (3)
B: I wonder if this may have been opened again after it was written (2)
C: I don't think anything of it (1)

Feasibility Study. Once the list of items and instructions had been agreed by the research group, the order of the items was randomized and the questionnaire was administered to 10 psychosis patients (5 men and 5 women). They provided feedback on the wording and comprehensibility of items, relevance to their experiences, and general acceptability and feasibility of completing the measure. The feedback obtained was highly positive, with only minor amendments to the wording of some of the items required. The final questionnaire is presented in Appendix I.

Measures

Concurrent Validity.

Psychotic Symptoms Ratings Scales Psychotic Symptoms Ratings Scales (PSYRATS)[39] is a semistructured interview measuring psychological dimensions of delusions and hallucinations. Items are rated on a 5-point scale, with a potential range of scores for the hallucinations subscale of 0–44, and 0–24 for the delusions subscale.

Beck Depression Inventory/Beck Anxiety Inventory Beck Depression Inventory (BDI-II)[40] and Beck Anxiety Inventory (BAI)[41] are widely used 21-item self-report

questionnaires assessing the severity of depression and anxiety in clinical populations. Items are rated on a 4-point scale, with a potential range of scores of 0–63.

Construct Validity. For each bias 1 task/measure was used to ascertain construct validity:

Cognitive Style Test CST[1] assesses thinking biases in depression (see "Construction of the CBQp"). Events are classified into 3 themes relating to Beck's cognitive triad: "self," "world," and "future." It has good internal consistency and face validity.[1] Total scores (potential range: 30–120) were used to assess convergent validity with total and theme CBQp scores. Scores on the self items (potential range: 10–30) were also used as a proxy measure of emotional reasoning.

Probabilistic Reasoning Task (Beads Task) Probabilistic Reasoning Task[42] assesses the JTC bias. Participants are shown 2 jars of beads, 1 with 85 yellow and 15 black beads and the other with the opposite ratio. The jars are taken out of sight and a predetermined series of beads are shown 1 at a time. Participants are instructed to decide which jar the beads are being drawn from. The dependent variable is the number of beads requested, with 1 or 2 beads taken as evidence of a JTC response style.

Catastrophising Interview[43,44] Following an example worry topic of "exams," the Catastrophising Interview involves asking respondents about their delusional belief (X). They are first prompted by "What is it that worries you about X?" The response (Y) is followed by, "What about Y would worry you if it did actually happen?" The process is repeated until the participant is unable to generate another response, or they repeat the same content 3 consecutive times. The dependent variable is the number of catastrophising steps. This interview was found to be effective in distinguishing worriers from nonworriers,[43] and the number of catastrophising steps was correlated with worry scores in a deluded sample.[25]

Extreme Responding[8,24] *(Dysfunctional Attitudes Scale [DAS])*[45] Dichotomous thinking was measured by summing the number of extreme responses (scores of 1 ["totally agree"] or 7 ["totally disagree"] on a 7-point likert scale) on the DAS, a 40-item questionnaire measuring depressive cognitive schemas (range of scores: 0–40).

Ambiguous Intentions and Hostility Questionnaire (AIHQ)[32] Participants were asked to rate the degree to which negative scenarios were committed on purpose (ie, intentionalising). Only accidental and ambiguous scenarios were included (range of scores: 10–60).

Participants and Procedure

The validation of the CBQp was carried out using 3 groups: individuals with psychosis, individuals with depression, and healthy controls. They were recruited from 2 main sites: South London and Maudsley (SLaM) National Health Service Foundation Trust (Psychological Interventions Clinic for outpatients with Psychosis [PICuP] and inpatient wards for psychosis, and the Affective Disorders Unit for depression) based in United Kingdom and the Medical Center Hamburg-Eppendorf in Germany (psychosis individuals and healthy controls). Nineteen individuals with psychosis were recruited from St Olav University Hospital in Trondheim, Norway. All psychosis patients had ICD-10 "schizophrenia-spectrum disorder" (F20-29) diagnoses, and the depressed patients had "mood and affective disorder" (F30-39) diagnoses. None had suffered from brain injury or neurological disease nor had a substance misuse primary diagnosis.

The CBQp was translated into German by SM and RV and into Norwegian by RH, and it was back-translated by fluent English and Norwegian/German speakers who were clinical psychologists. Respondents were administered the CBQp alongside the battery of other measures. Ethical permission was provided by the SLaM/Institute of Psychiatry Ethical Committee (Reference 243/03).

Information on participants is reported in table 1. The full sample (available for scale structure and concurrent validity analyses) consisted of 265 individuals with psychosis, 34 with depression, and 33 healthy controls. Subsample 1, consisting of 30 psychosis patients and 30 controls, was available for the test-retest reliability. Subsample 2, consisting of 42 psychosis individuals, was available for the construct validity analyses.

Statistical Overview

The psychometric properties of the CBQp were ascertained by looking at (1) scale structure, (2) reliability, and (3) validity.

1. Confirmatory Factor Analysis (CFA) was used to evaluate 3 a priori measurement models, providing individual factor loadings for items on the alternative models, plus the overall fit of the data to the hypothesized structure. CFA is the method of choice to examine the factor structure given the strong theoretical underpinning of the scale. Results are expressed in 2 ways: (1) overall model χ^2 to test the fit of the hypothesized model against the data, which should be nonsignificant (although the other indices are usually favored as χ^2 can be overconservative); (2) fit indices: comparative fit index in robust form using the Satorra-Bentler correction can range from 0 to 1, with values above 0.9 indicating acceptable models, and root mean square error of approximation should be below 0.05.
2. Internal consistency and test-retest correlations were used to demonstrate reliability.
3. The criteria for 3 main types of validity must be satisfied in order to establish the validity of a scale.[46] The first is *face validity*, to ensure the items sample adequately the different aspects of the construct being measured. The face validity of the CBQp was established by the construction of items originating from expert clinicians and the feasibility study.

Table 1. Demographic Information for the Samples

	Full Sample (Scale Structure; Internal Consistency; Concurrent Validity)			Subsample 1 (Test-Retest Validity)		Subsample 2 (Construct Validity)
Groups	Psychosis	Depression	Controls	Psychosis	Controls	Psychosis
N (country: G = Germany N = Norway)	265 (158 UK; 88 G; 19 N)	34 (UK)	33 (G)	30 (UK)	30 (G)	42 (UK)
Gender	158 M 107 F	7 M 27 F	17 M 16 F	19 M 11 F	15 M 15 F	28 M 14 F
Age, mean (SD)	37 (10.6)	44.9 (10.2)	32.7 (10.7)	37.5 (9.3)	33.0 (10.9)	38.2 (11.6)
N (%) with hallucinations	106[a] (49%)	—	—	15 (50%)	—	—[b]
PSYRATS-voices	22.7 (10.9)	—	—	27.8 (7.5)	—	—[b]
N (%) with delusions	176[c] (68%)	—	—	20 (67%)	—	42 (100%)
PSYRATS-delusions	15.0 (4.4)	—	—	14.9 (5.2)	—	15.7 (3.6)
BDI, mean (SD)	26.4[d] (15.1)	26.4 (12.7)	—	27.9 (14.3)	—	—[b]
BAI, mean (SD)	20.9[d] (13.3)	18.7 (12.2)	—	18.9 (11.6)	—	—[b]

Note: PSYRATS, Psychotic Symptoms Ratings Scales; BDI, Beck depression; BAI; Beck anxiety inventories.
[a]48 individuals (UK) had missing data on PSYRATS-Voices.
[b]PSYRATS-Voices, BDI and BAI scores were not available for this subsample.
[c]7 individuals (UK) had missing data on PSYRATS-Delusions.
[d]There were available data on the BDI and BAI for 109 (UK) psychotic patients.

Table 2. Goodness of Fit for the Confirmatory Factor Analysis (CFA) (Full Sample, Psychosis Group Only)

	Comparative Fit Index	Root Mean Square Error of Approximation	χ^2	*P Value*	Intercorrelations Between Factors
5-factor model; Independent factors	0.464	0.083 (0.077–0.088)	1133.99	<.001	—
5-factor model; Related factors	0.933	0.030 (0.019–0.038)	485.90	.001	0.89–0.98
2-factor model; Independent factors	0.779	0.061 (0.054–0.067)	677.21	<.001	—
2-factor model; Related factors	0.969	0.022 (0.001–0.024)	92.44	.201	0.77
1-factor model	0.934	0.029 (0.019–0.037)	494.09	.002	—

Construct validity (or *convergent validity*) is the degree to which an instrument measures the targeted construct and is met by the demonstration that the scale is related to validated, equivalent measures of the same or similar construct. This was investigated by correlating CBQp total and theme scores with the CST,[1] and each of the 5 cognitive biases with its equivalent task/questionnaire (see Measures).

Concurrent validity can be established in 2 ways: whether the scale is correlated with a current criterion (eg, clinical ratings) or whether a scale can separate 2 criterion groups (eg, clinical and healthy samples). Both methods were employed; 2 clinical samples (psychotic and depressed) were compared with a healthy sample, and symptomatic individuals with psychosis were compared with their non-symptomatic counterparts. Lastly, CBQp total and theme scores were correlated with psychotic symptom scores, covarying out emotional disorders scores.

Result

Scale Factor Structure

Based on the theoretical assumptions of its construction, CFA was carried out to test 3 competing models of the hypothetical underlying structure of the scale. The first model was a 5-factor model, each factor hypothesized to represent a separate bias. The second was a 2-factor model, each factor hypothesized to represent a vignette theme (AP and TE). The third was a 1-factor model, hypothesized to represent 1 general thinking bias underlying the 5 types of cognitive distortions. The 5- and 2-factor models were tested twice, once assuming the independence of the factors and once assuming they were correlated. The results are presented in table 2.

There was no fit for either the 5- or 2-factor models if factor independence was assumed. If the factors were allowed to correlate, there was a reasonable fit for the 5-factor model on the fit indices but not χ^2. There were high factor intercorrelations (all >0.89), indicating that they do not really separate. Similarly, the 1-factor model showed a reasonable fit on the fit indices but not χ^2. The 2-factor model provided the best fit, with a nonsignificant χ^2 value and fit indices above accepted thresholds, but the correlation between the 2 factors was still substantial.

Table 3 provides the item factor loadings in each of the 3 models (with related factors). Only 1 item had a factor loading <0.3 (item 19) but was not removed from the scale because it would have imbalanced the number of items per theme. This was supported by the Cronbach's Alpha

Table 3. Cognitive Biases Questionnaire for Psychosis (CBQp) Factor Loadings From the CFA (Full Sample, Psychosis Group Only)

		2 Factors (Themes)		5 Factors (Biases)				
	1 Factor	1 (TE)	2 (AP)	1 (Int)	2 (Cat)	3 (DT)	4 (JTC)	5 (ER)
CBQ1	0.360	0.357	—	0.365	—	—	—	—
CBQ2	0.377	—	0.396	—	0.371	—	—	—
CBQ3	0.544	—	0.562	0.565	—	—	—	—
CBQ4	0.322	0.330	—	—	0.324	—	—	—
CBQ5	0.416	0.424	—	—	—	0.424	—	—
CBQ6	0.336	—	0.323	—	—	—	0.359	—
CBQ7	0.432	0.426	—	—	0.433	—	—	—
CBQ8	0.458	—	0.477	—	—	—	—	0.469
CBQ9	0.512	0.529	—	—	—	—	0.541	—
CBQ10	0.558	—	0.577	—	0.560	—	—	—
CBQ11	0.604	0.621	—	—	—	0.620	—	—
CBQ12	0.692	0.704	—	—	0.686	—	—	—
CBQ13	0.530	0.542	—	—	—	—	—	0.548
CBQ14	0.480	—	0.496	—	—	0.486	—	—
CBQ15	0.622	0.630	—	—	—	0.632	—	—
CBQ16	0.408	—	0.419	—	—	—	—	0.415
CBQ17	0.308	—	0.322	—	—	—	0.325	—
CBQ18	0.607	0.607	—	—	—	—	0.627	—
CBQ19	0.289	0.285	—	—	—	—	—	0.304
CBQ20	0.633	—	0.656	0.670	—	—	—	—
CBQ21	0.473	—	0.485	—	—	—	0.484	—
CBQ22	0.606	0.615	—	0.619	—	—	—	—
CBQ23	0.397	—	0.382	0.419	—	—	—	—
CBQ24	0.656	0.671	—	—	—	—	—	0.669
CBQ25	0.536	—	0.540	—	0.534	—	—	—
CBQ26	0.401	—	0.395	—	—	—	—	0.413
CBQ27	0.473	—	0.462	—	—	0.484	—	—
CBQ28	0.426	0.412	—	0.443	—	—	—	—
CBQ29	0.560	0.581	—	—	—	—	0.596	—
CBQ30	0.341	—	0.348	—	—	0.346	—	—

Note: TE, threatening events; AP, anomalous perceptions; Int, intentionalising; Cat, catastrophising; DT, dichotomous thinking; JTC, jumping to conclusions; ER, emotional reasoning.

if-item-deleted analysis, which produced highly consistent coefficients (between 0.892 and 0.899 for all items).

Reliability

Internal Consistency. Cronbach's Alpha of the total CBQ was 0.89, showing good internal consistency. The item-total correlations ranged from 0.32 to 0.65.

Test-Retest Reliability. Sixty individuals were administered the CBQp at 2 time-points (average of 11.5 weeks [SD = 9.3] between administrations). The intraclass correlation between CBQp total scores at Times 1 and 2 was 0.96 (95% CI: 0.93–0.98; $P < .001$; psychosis group = 0.94, CI = 0.88–0.97; $P < .001$; healthy controls = 0.70, CI = 0.36–0.86; $P = .001$), indicating good test-retest reliability.

Validity

Construct Validity. Construct validity was investigated in 42 psychotic patients by correlating the total and theme CBQp scores with the CST.

The relationships between individual CBQp biases and the 5 tasks/questionnaires described above were also investigated (Validity analyses involving total CBQp and individual bias scores were carried out since both 1- and 5-related factor models showed reasonable, if not perfect, fit.): catastrophising scores were correlated with number of catastrophising steps on the catastrophising interview; intentionalising scores were correlated with "purpose" ratings on the AIHQ scenarios; emotional reasoning scores were correlated with self-based scenarios scores on the CST; JTC scores of individuals who showed a data-gathering bias (requesting 1 or 2 beads) on the Beads task were compared with those who did not; dichotomous thinking scores were correlated with the number of extreme responses on the DAS. A significance level of $P < .01$ was adopted to account for multiple testing.

Total CBQp scores ($r = .85$, $P < .001$) and both themes (AP: $r = .77$, $P < .001$; TE: $r = .85$, $P < .001$; $N = 35$; 7 individuals had missing data on the CST) were highly correlated with CST scores.

None of the CBQp individual bias scores were related to its task equivalent, apart from "emotional reasoning"

Table 4. Comparisons of CBQp scores (SDs in Parentheses) Between Groups

CBQp	Psychosis, $N = 265$	Depression, $N = 34$	Control, $N = 33$	H, $N = 106$	NH, $N = 111$	D, $N = 176$	ND, $N = 82$
Total scores	47.3 (10.4)	45.5 (9.4)	36.5 (2.7)	49.0 (11.3)	44.8 (8.8)	48.7 (10.4)	44.2 (10.1)
TE scores	24.6 (6.0)	24.7 (5.9)	19 (1.7)	25.6 (6.6)	23.6 (5.1)	25.4 (6.0)	23.1 (5.7)
AP scores	22.7 (5.1)	20.8 (4.2)	17.5 (1.6)	23.4 (5.3)	21.2 (4.4)	23.4 (5.1)	21.2 (4.8)

Note: H, hallucinating group; NH, nonhallucinating group; D, deluded group; ND, nondeluded group.

Table 5. Comparisons of CBQp Individual Biases (SDs in Parentheses) Between Groups

CBQp Biases	Psychosis, $N = 265$	Depression, $N = 34$	Control, $N = 33$	H, $N = 106$	NH, $N = 111$	D, $N = 176$	ND, $N = 82$
Int	8.8 (2.4)	7.7(2.4)	7.3(1.1)	9.0 (2.4)	8.3 (2.0)	9.2 (2.5)	8.1 (2.0)
Cat	9.5 (2.4)	9.1 (2.1)	7.1 (0.9)	10.0 (2.7)	8.9 (2.1)	9.8 (2.4)	9.0 (2.6)
DT	8.8 (2.6)	9.5 (2.9)	6.5 (0.7)	9.3 (2.9)	8.3 (2.2)	9.1 (2.6)	8.3 (2.6)
JTC	10.7 (2.5)	10.9 (1.9)	8.5 (1.3)	10.9 (2.8)	10.4 (2.3)	10.9 (2.4)	10.2 (2.7)
ER	9.4 (2.5)	8.3 (2.1)	7.2 (1.1)	9.9 (2.6)	8.8 (2.2)	9.8 (2.6)	8.7 (2.3)

Note: H, hallucinating group; NH, nonhallucinating group; D, deluded group; ND, nondeluded group.

and CST self-based items ($r = .62$, $P < .001$); however, all biases were also significantly related to both self-based items and total CST scores ($r = .60$–$.85$).

Concurrent Validity.

Comparison Among Psychotic, Depressed, and Healthy Samples Means and SDs for the CBQp total scores in the 3 groups are shown in table 4. A significance level of $P < .01$ was adopted to account for multiple testing.

A one-way ANOVA showed a significant group effect ($F(2,329) = 17.8$, $P < .001$). Post hoc LSD tests revealed that the healthy controls scored significantly lower than both the depressed and the psychotic groups (both $P < .001$), which did not differ from each other ($P = .31$).

The same pattern of results was obtained for TE, and for catastrophising, dichotomous thinking, and JTC (see tables 4 and 5 for means and SDs). The psychosis group scored higher than the depressed group on Emotional Reasoning ($P = .009$), and Intentionalising ($P = .006$), and at trend level on AP ($P = .03$). Intentionalising was the only bias where the depressed group did not differ from the healthy controls ($P = .5$).

Comparison Between Symptomatic and Nonsymptomatic Individuals With Psychosis Means and SDs for the CBQp total and theme scores in the symptomatic and nonsymptomatic groups are shown in table 4. A significance level of $P < .01$ was adopted to account for multiple testing.

T tests showed that patients presenting with hallucinations scored significantly higher on the total CBQ than those who scored 0 on the PSYRATS-Voices ($t(215) = 3.1$, $P = .002$). The same pattern was found for PSYRATS-Delusions ($t(256) = 3.3$, $P = .001$).

The symptomatic groups scored significantly higher on both the TE and AP scores and significantly higher (6 comparisons at $P < .01$) or at trend level (3 at $P < .05$) on all individual biases apart from JTC, where both groups scored equally highly for hallucinations ($t(215) = 1.4$, $P = .18$; see table 5 for means and SDs).

Correlations Between CBQp Scores and Psychotic Symptom Scores CBQp scores were correlated with PSYRATS scores in patients with hallucinations/delusions, partialling out BDI and BAI scores. Because numbers were lower (BDI/BAI scores were not available for all participants), this was done for theme and total scores only.

Hallucination scores were modestly but significantly correlated with all CBQp scores (total CBQp: $r_p = .35$, $P = .01$; AP: $r_p = .33$, $P = .02$; TE: $r_p = .33$, $P = .02$; $N = 50$); delusion scores were correlated with AP theme score ($r_p = .26$, $P = .036$), at trend level with total scores ($r_p = .24$, $P = .055$), but not with TE ($r_p = .19$; $P = .14$; $N = 64$).

Discussion

The aim of this study was to construct a new scale assessing the thinking errors commonly seen in psychosis and hypothesized to play a role in the formation and maintenance of the disorder. A 30-item measure was designed, entitled the Cognitive Biases Questionnaire for Psychosis (CBQp).

The scale showed good internal consistency and test-retest reliability, with scores remaining stable over time in both healthy controls and psychosis patients. CFA showed that 2- and 5-factor models (representing the 2 themes of TE and AP and of the 5 individual biases, respectively) did not fit the data if the factors were assumed to be independent. With related factors, the 2-factor model was the best fit of the underlying structure

of the scale, suggesting that the separate theme scores of the CBQp can be used meaningfully. The 1- and 5-factor models displayed reasonable but less good fits, and both the 2- and 5-factor models showed that the factors had high intercorrelations.

These findings are concordant with similar scales for use in affective disorders,[1,33–38] where it has been consistently reported that the different biases overlap. Therefore, it seems likely that the CBQp assesses a general thinking style that underlies the cognitive distortions originally reported by Beck,[22] with some variation according to the type of situation. Particular biases may be more likely to be brought online depending on the circumstance (an ambiguous, potentially threatening social situation such as seeing people laughing may elicit an intentionalising bias, while an ambiguous, internal feeling of discomfort may elicit an emotional reasoning style), but overall, the different biases seem to represent a general tendency to process information in a distorted and alarming way. The significant relationships found between the CST and all 5 CBQp biases would support this conclusion. A distinction has recently been put forward[47] between 4 key cognitive processes studied in the affective disorders literature, namely "interpretation," "judgment," "decision making," and "reasoning." The cognitive distortions assessed by the CBQp can be subsumed under their interpretation biases category, whereby they all represent pathology-congruent information-processing biases, ie, the tendency to consistently interpret ambiguous information in a negative or threatening manner.

The finding that depressed and psychotic populations could not be differentiated from each other in terms of total CBQp scores also supports the notion of a generalized, pathological thinking style across situations and clinical populations. However, interestingly, the psychosis group scored marginally higher than the depressed group for AP items but not TE items, suggesting that they may be particularly susceptible to a biased interpretation of AP. What distinguishes clinical outcome, to some degree, is the presence of other pathological processes with which thinking errors are likely to interact, such as negative schemas about the self in depression, or abnormal perceptual events in psychosis.

Nevertheless, the psychosis group scored higher than the depressed group on intentionalising and emotional reasoning, suggesting that these specific distortions may be particularly pertinent to psychosis. Intentionalising was the only bias where the depressed group did not differ from healthy controls, intimating that it may be a thinking style distinguishing individuals with psychosis from other clinical populations. This conclusion is in line with previous findings showing that a "paranoid" worldview differentiated individuals reporting psychotic experiences with and without a "need for care."[6,7]

Although there was strong convergent validity between the CST and both total and theme CBQp scores, none of the measures used for the construct validity was related to the CBQp individual biases. One possibility is that the tasks employed were all examples of the other cognitive domains delineated above,[47] such as "judgment," "reasoning," or "decision making"; for instance, the beads task assesses "data-gathering" style (how many items of information are required before a decision is made) and as such may be a measure of either reasoning or decision making but not interpretation. It also uses neutral material, as opposed to the pathology-congruent information-processing biases hypothesized to underlie the CBQp. The catastrophising interview is also likely to tap into reasoning processes, representing the way an individual persistently iterates problematic features of a worry topic. In addition, there were problems identified with this task because the number of catastrophising steps did not capture the qualitative leaps made between steps; some psychosis respondents obtained low scores but only because they reached catastrophic conclusions very quickly. Overall, the demonstration of the construct validity of the individual CBQp biases was, to some degree, hampered by the lack of appropriate measures available in the literature.

A further, important consideration is that psychosis patients often lack metacognitive awareness for cognitive deficits and biases,[48,49] so that a dissociation between subjective (as measured by self-report on the CBQp) and objective (as assessed by task performance) biases may, on reflection, not be entirely unexpected. Further research is needed to determine which of these may be more pertinent to the formation and maintenance of psychotic experiences, or whether they are related to different factors. For instance, it is possible that "subjective" JTC may be more closely associated with emotional processes, while "objective" JTC may be more closely related to cognitive factors (such as belief flexibility).[8]

The concurrent validity of the CBQp, on the other hand, was established conclusively. Two clinical populations, psychotic and depressed samples, scored higher than a healthy control group, and currently symptomatic psychosis patients, or psychosis patients with current symptoms, scored higher than their nonsymptomatic counterparts on almost all CBQp scores. However, once depression and anxiety scores were partialled out, CBQp total and theme scores were only modestly related to severity of hallucinations and delusions. Taken together, these findings suggest that while the CBQp is not merely a measure relating to emotional disorders, it is likely that there are intricate relationships between thinking biases, emotional processes, and psychotic symptoms, as would be predicted by cognitive models of psychosis.[2,23,50]

Limitations

We had limited demographic information on our samples, and unequal numbers between the sites, and were thus unable

to explore relationships between cognitive distortions and ethnicity, cultural background, and language differences. There was skewing of gender and nationality by diagnosis: the majority of the depressed sample was female, while there were more men than women with psychosis, and all the controls were German, while the majority of the other samples were from the United Kingdom. The numbers in the depressed group, and for the construct validity analyses, were low, and we were not able to establish the validity of the individual biases conclusively. We did not have data on the CST for our full sample, meaning we could not conduct analyses to demonstrate the statistical superiority of the CBQp over the CST, although it clearly has better face validity for a psychosis population.

Conclusions

The CBQp was shown to be reliable, and have good concurrent validity. It seems to assess a general thinking bias rather than distinct cognitive errors, and AP and TE theme scores can be used separately. It may be specifically related to a bias of interpretation rather than reasoning, judgment, or decision-making processes. Both psychotic and depressed populations scored higher than healthy controls, and symptomatic psychosis patients scored higher than their nonsymptomatic counterparts, with modest relationships between CBQp scores and severity of symptoms. AP theme scores and intentionalising bias scores showed some specificity to psychosis.

Overall, the CBQp shows promise in its utility in both research and clinical settings. It provides a valid and user-friendly measure of self-reported cognitive distortions in psychosis patients, a construct not captured by existing cognitive tasks. Total scores or individual theme scores can be used separately although further research is needed before the value of individual bias scores is established conclusively. Clinically, the role of cognitive biases in the formation and maintenance of psychotic symptoms is particularly pertinent to psychological interventions. Cognitive behavior therapy (CBT) consists of changing current patterns of thinking and how people evaluate the evidence for their beliefs rather than merely disputing the veracity of thoughts. In psychosis, challenging delusions and the reality of people's experiences is contraindicated, and much work is done on process rather than content. New approaches have advocated specific training procedures for cognitive distortions (eg, metacognitive, and reasoning, training),[49,51,52] as a complement to CBT for psychosis. The CBQp is likely to be an important outcome measure to assess change in thinking style following therapy.

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Appendix 1

Cognitive Biases Questionnaire for Psychosis (Peters et al., 2013)

Instructions

In this questionnaire you will find a number of descriptions of everyday events. After each situation are different ways that people might react, labeled A, B, or C. *Please imagine yourself in each situation as vividly as possible*.

Once you have imagined that the event is happening to you, *please choose the option that best describes how you might think about the situation*. If none of the options matches completely how you might react, choose the one which is the closest. If more than 1 option applies, choose the one which would run through your mind most often. When you have decided which option you are most likely to think, put a circle around the letter next to it.

There are no right or wrong answers. Work through the questions fairly quickly, making sure you pick the option that is nearest to what your *immediate* reaction might be.

1. Imagine you receive a letter and you notice it is not sealed. *I am most likely to think: (please circle A, B, or C)*	A: Someone has deliberately opened this letter already B: I wonder if this may have been opened again after it was written C: I don't think anything of it
2. Imagine that you are walking down the street when you hear your name being called, but when you look around you don't see anybody. *I am most likely to think: (please circle A, B, or C)*	A: Something strange is going on B: There is something really dangerous about this C: I must be imagining things
3. Imagine your food tastes different from usual. *I am most likely to think: (please circle A, B, or C)*	A: Someone may have done something to my food on purpose B: This food must have been prepared with a different ingredient today C: Someone has deliberately spiked my food
4. Imagine that on your way to work you notice that all the traffic lights turn red as you approach them. *I am most likely to think: (please circle A, B, or C)*	A: It's going to take me longer to get in this morning B: That's all I need, I'm going to be really late now C: My day is going to be ruined
5. Imagine you are standing at a bus stop when the bus you have been waiting for drives past half empty without stopping. *I am most likely to think: (please circle A, B, or C)*	A: People are always so nasty B: People aren't very nice sometimes C: The driver must be in a bad mood today
6. Imagine you have a really bad pain in your head. *I am most likely to think: (please circle A, B, or C)*	A: There must be something wrong with me B: There's lots of different reasons why I might have this pain C: I must have something really serious, like a brain tumour
7. Imagine that while on the bus you notice a stranger staring at you. *I am most likely to think: (please circle A, B, or C)*	A: The way this person is staring at me is a bit worrying B: This person must mean me harm to be staring at me that way C: This person is being really rude to be staring at me in that way
8. Imagine you are sitting at home and suddenly you feel very odd. *I am most likely to think: (please circle A, B, or C)*	A: I wonder why I feel odd, could something sinister be going on somewhere B: This feeling is proof that there is something bad happening somewhere to someone I know C: I must be overtired or something
9. Imagine you applied for a job and did not get it. *I am most likely to think: (please circle A, B, or C)*	A: Perhaps I can get some feedback about why I did not get the job B: I wonder if I did not do very well at the interview C: I'll never be able to get a job
10. Imagine that you are on a train when you suddenly have a strong feeling you have been there before. *I am most likely to think: (please circle A, B, or C)*	A: This is some kind of premonition that something awful has happened or will happen B: I wonder whether this is some kind of premonition C: This is a weird, but common experience

11. Imagine you get turned down to go out by someone you like or a friend. *I am most likely to think: (please circle A, B, or C)*	A: I quite often get rejected in this situation B: You win some, you lose some C: I always get rejected for anything I try
12. Imagine that one day you enter a shop and you hear people laughing. *I am most likely to think: (please circle A, B, or C)*	A: They must be laughing at me B: I wonder if they are laughing at me C: The laughing is probably nothing to do with me
13. Imagine there are police cars outside your house. You suddenly realise you feel uncomfortable. *I am most likely to think: (please circle A, B, or C)*	A: Funny how just seeing the police has this unsettling effect on people B: I wonder why I feel so uncomfortable, could the cars be something to do with me C: I must have done something wrong to feel so uncomfortable, they've come to get me
14. Imagine you are watching television, and suddenly the screen goes blank. *I am most likely to think: (please circle A, B, or C)*	A: Weird things are always happening B: This sort of thing seems to happen quite a lot C: There must be something wrong with the TV today
15. Imagine two people in a queue at a supermarket both look your way at the same time and then immediately start to talk to each other. *I am most likely to think: (please circle A, B, or C)*	A: This is not the first time this has happened B: This sort of thing can happen in queues C: This always happens wherever I go
16. Imagine you are waiting in a café for an acquaintance to arrive, and you suddenly feel a strange shivery feeling inside. *I am most likely to think: (please circle A, B, or C)*	A: Feeling shivery is a bad omen, I don't think I should meet this person B: I must be nervous about meeting this person C: I wonder if feeling shivery means something bad might happen
17. Imagine you think you see a shadowy figure moving across the wall of an empty room. *I am most likely to think: (please circle A, B, or C)*	A: I wonder what that was B: My eyes must be playing tricks on me C: There must have been someone or something there
18. Imagine that the phone rings. When you answer, the other party hangs up. *I am most likely to think: (please circle A, B, or C)*	A: I wonder if there's something suspicious about this B: Somebody is definitely checking up on me C: Someone's probably got the wrong number
19. Imagine you are watching the news on TV about a recent disaster, and you find yourself feeling guilty. *I am most likely to think: (please circle A, B, or C)*	A: If I feel guilty I must be responsible in some way B: It's normal to feel guilty when a disaster has happened to someone else C: I wonder why I feel guilty, maybe I'm unwittingly responsible in some way
20. Imagine you are listening to the radio and suddenly there is crackling interference. *I am most likely to think: (please circle A, B, or C)*	A: Someone has deliberately tampered with my radio so that it is no longer tuned properly B: I wonder if someone has been fiddling with my radio C: There is some sort of interference on the radio waves
21. Imagine that you are sitting on a train, and you think you can hear two people behind you talking about you. When you look round they are reading their papers and not talking to each other. *I am most likely to think: (please circle A, B, or C)*	A: They were definitely talking about me, they're just pretending to be reading their paper B: I'm sure I heard them talking about me, maybe I was wrong C: I should find out if anyone else ever has this kind of experience before deciding what really happened
22. Imagine you are at home; everything is quiet when you hear a sudden fast banging on the walls. *I am most likely to think: (please circle A, B, or C)*	A: The neighbours are doing this deliberately to upset me B: The neighbours could be doing some kind of home improvements C: The neighbours might be trying to tell me something

23. Imagine you a reading a newspaper or magazine, and you read an article which has some special relevance to you. *I am most likely to think: (please circle A, B, or C)*	A: This article seems to have been written with people like me in mind B: I wonder if someone may have written this article for me C: Someone has definitely written this article for me specifically
24. Imagine you notice that a person you don't know is looking at you. You suddenly find yourself feeling unsettled. *I am most likely to think: (please circle A, B, or C)*	A: Feeling this unsettled means this person intends to do me harm B: I wonder why I feel this unsettled, could this mean this person is thinking bad things about me C: Being looked at can make people feel unsettled, I don't worry about it
25. Imagine that one evening you are sitting at home alone when a door suddenly slams by itself in another room. *I am most likely to think: (please circle A, B, or C)*	A: Someone or something must have got into the house B: I wonder if somebody or something's there C: It's probably a draught
26. Imagine someone you know calls you just as you were thinking about them. As you pick up the phone you suddenly realise you are feeling upset. *I am most likely to think: (please circle A, B, or C)*	A: It's odd that I should feel upset, but I don't read too much into it B: I wonder why I feel upset, could there be something peculiar about this call C: Feeling upset means something, it must be bad news
27. Imagine you are walking down the road when you suddenly notice a careers poster which seems to stand out from your surroundings. *I am most likely to think: (please circle A, B, or C)*	A: I wonder why my eyes seem so drawn to that poster B: Maybe I'm noticing it because my career isn't such a success C: It's a sign that my life is such a failure
28. Imagine you are on a bus; the driver keeps stopping abruptly, so that you stumble each time. *I am most likely to think: (please circle A, B, or C)*	A: I wonder if he's doing it on purpose to wind people up B: This bus driver can't drive properly C: He's doing it on purpose to humiliate me
29. Imagine you hear that a friend is having a party and you have not been invited. *I am most likely to think: (please circle A, B, or C)*	A: I wonder if they don't like me as much as I thought they did B: Perhaps I can try to find out a bit more about the situation before making any assumptions C: They obviously don't like me
30. Imagine you are dozing on the sofa in front of the TV and you suddenly wake up startled. *I am most likely to think: (please circle A, B, or C)*	A: I tend to always wake up startled when I'm dozing B: The TV must have woken me C: I can never get any sleep

Thank you for taking the time to complete the questionnaire.

Scoring

The questionnaire consists of 30 statements, covering 2 separate themes of vignettes: 15 relating to *AP* and 15 relating to *TE*. Each group of statements covers 5 cognitive biases: *intentionalising*; *catastrophising; dichotomous thinking; jumping to conclusions*; and *emotional reasoning*. There are 3 statements per bias for each theme, ie, 6 statements per bias in total. The statements and responses are randomly listed. Each statement is rated on a 3-point scale ranging from 1 to 3 (1 = absence of bias; 2 = presence of bias with some qualification; and 3 = presence of bias). The maximum total score for each theme is 45, with a total overall score of 90.

1. TE/I A = 3 B = 2 C = 1	2. AP/C A = 2 B = 3 C = 1	3. AP/I A = 2 B = 1 C = 3	4. TE/C A =1 B = 2 C = 3
5. TE/DT A = 3 B = 2 C = 1	6. AP/JTC A = 2 B = 1 C = 3	7. TE/C A = 2 B = 3 C = 1	8. AP/ER A = 2 B = 3 C = 1
9. TE/JTC A = 1 B = 2 C = 3	10. AP/C A = 3 B = 2 C = 1	11. TE/DT A = 2 B = 1 C = 3	12. TE/C A = 3 B = 2 C = 1
13. TE/ER A = 1 B = 2 C = 3	14. AP/DT A = 3 B = 2 C = 1	15. TE/DT A = 2 B = 1 C = 3	16. AP/ER A = 3 B = 1 C = 2
17. AP/JTC A = 2 B = 1 C = 3	18. TE/JTC A = 2 B = 3 C = 1	19. TE/ER A = 3 B = 1 C = 2	20. AP/I A = 3 B = 2 C = 1
21. AP/JTC A = 3 B = 2 C = 1	22. TE/I A = 3 B = 1 C = 2	23. AP/I A = 1 B = 2 C = 3	24. TE/ER A = 3 B = 2 C = 1
25. AP/C A = 3 B = 2 C = 1	26. AP/ER A = 1 B = 2 C = 3	27. AP/DT A = 1 B = 2 C = 3	28. TE/I A = 2 B = 1 C = 3
29. TE/JTC A = 2 B = 1 C = 3	30. AP/DT A = 2 B = 1 C = 3	— — — —	— — — —

Key: TE, threatening event; AP, anomalous perception; I, intentionalising; C, catastrophising; DT, dichotomous thinking; JTC, jumping to conclusions; ER, emotional reasoning.

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