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ORIGINAL ARTICLE

Cognitive biases and auditory verbal hallucinations in healthy and clinical individuals

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Background. Several cognitive biases are related to psychotic symptoms, including auditory verbal hallucinations (AVH). It remains unclear whether these biases differ in voice-hearers with and without a 'need-for-care'.

Method. A total of 72 healthy controls, 72 healthy voice-hearers and 72 clinical voice-hearers were compared on the Cognitive Biases Questionnaire for psychosis (CBQp), which assesses 'intentionalizing', 'jumping to conclusions', 'catastrophizing', 'dichotomous thinking' and 'emotional reasoning' in vignettes characterized by two themes, 'threatening events' and 'anomalous perceptions'.

Results. Healthy voice-hearers scored intermediately on total CBQp between the control and clinical groups, differing significantly from both. However, on four out of five biases the scores of the healthy voice-hearers were comparable with those of the healthy controls. The only exception was 'emotional reasoning', on which their scores were comparable with the clinical group. Healthy voice-hearers demonstrated fewer biases than the psychotic patients on the 'threatening events', but not the 'anomalous perceptions', vignettes. CBQp scores were related to both cognitive and emotional, but not physical, characteristics of voices.

Conclusions. Most cognitive biases prevalent in clinical voice-hearers, particularly with threatening events themes, are absent in healthy voice-hearers, apart from emotional reasoning which may be specifically related to the vulnerability to develop AVH. The association between biases and both beliefs about voices and distress/emotional valence is consistent with the close links between emotions and psychotic phenomena identified by cognitive models of psychosis. The absence of reasoning biases might prevent the formation of threatening appraisals about anomalous experiences, thereby reducing the likelihood of distress and 'need for care'.

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Key words: Auditory verbal hallucinations, cognitive biases, healthy voice-hearers, psychosis, voices.

Introduction

Although auditory verbal hallucinations (AVH) are a characteristic symptom of psychotic disorders, they are also found in healthy individuals in the general population, with a prevalence of approximately 10–15% (Tien, 1991; Van Os *et al.* 2000; Verdoux & van Os, 2002; Johns *et al.* 2004; for a review, see Beavan *et al.* 2011). This includes individuals who report hearing voices quite regularly as well as those who report hearing a voice once in their lifetime. Therefore, AVH have been proposed to form a continuum, ranging from rare occurrences in healthy individuals at one end, through individuals high on 'schizotypal' traits, to psychotic patients with frequent occurrence at the other end. Since Romme & Escher's (1993) seminal work, which first challenged the view of voices necessarily being characteristic of psychiatric illness, a growing body of work has been devoted to the study of hallucinations across this continuum (Larøi *et al.* 2012). While AVH in these groups show considerable overlap in characteristics such as loudness, number of voices, perceived location of voices and personification (Daalman *et al.* 2011), as well as in brain activity (Diederen *et al.* 2011), it remains unclear why some voice-hearers remain psychologically healthy (and even perceive their lives to be enriched by their experiences) while others suffer considerable distress and make a transition to psychosis. While it is becoming increasingly accepted that there is a causal link

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between trauma and psychosis, and hearing voices in particular (Bebbington *et al.* 2011; Varese *et al.* 2012), both clinical and non-clinical samples with AVH report equally high rates of trauma (Andrew *et al.* 2008; Lovatt *et al.* 2010), and childhood trauma was not found to be predictive of need for care status or emotional valence of the voices content in a large study comparing healthy and distressed voice-hearers (Daalman *et al.* 2012).

Cognitive models of psychosis suggest that it is not solely the presence of anomalous experiences, such as AVH, which lead to full-blown psychotic symptoms, but rather the appraisals that individuals hold about these experiences (Chadwick & Birchwood, 1994; Birchwood & Chadwick, 1997; Morrison, 2001; Garety *et al.* 2001, 2007; Barkus *et al.* 2010). For example, an AVH might be considered as a phenomenon originating from one's own brain, as a message coming from the benevolent spirit of a deceased grandparent, or it might be perceived as an evil force from another dimension. These appraisals are likely to lead to different emotional consequences, with the more malign interpretations being associated with fear and distress, which in turn renders a person more vulnerable to developing psychosis and a 'need for care' (Van Os *et al.* 2009). There is emerging evidence to support this view; for instance, Escher *et al.* (2002) found that persistence of voices in a sample of children over a 3-year period was predicted by negative voice appraisals and associated anxiety and depression.

Cognitive biases have been proposed to be instrumental in shaping these appraisals (Garety *et al.* 2005; Freeman *et al.* 2012). A cognitive bias is a way in which an individual habitually interprets his or her experiences, gathers information about the world, and develops and maintains beliefs. Typical biases commonly observed in people with emotional disorders include 'jumping to conclusions', emotionally based reasoning, and dichotomous thinking (the so-called 'Beckian' biases; Beck, 1979), which are also present in people with psychosis (Peters *et al.* 2013). For example, the typical bias of 'dichotomous thinking' leads to an absolute or black-and-white view of things: when a small mistake is made, someone might judge himself or herself as totally useless and worthless. There is now a large body of work demonstrating that cognitive biases, especially jumping to conclusions, play a key role in the formation and maintenance of delusions (for a review, see So *et al.* 2010), but few studies have investigated their role in AVH, or, more precisely, the beliefs people hold about their voices. It remains unclear whether cognitive biases differ between individuals experiencing AVH with and without a 'need for care'. Ascertaining the extent to which cognitive biases are present in healthy voice-hearers may further clarify the relationship between biases, appraisals about voices and the transition to psychosis, as proposed by cognitive models of positive symptoms. Potentially the absence of cognitive biases in the healthy group may prevent the formation of malign appraisals, in turn reducing the chances that hearing voices becomes problematic for the individual and leads to a 'need for care'.

The Cognitive Biases Questionnaire for psychosis (CBQp) was recently developed to assess cognitive biases in patients with a psychotic disorder (Peters *et al.* 2013). In all, five types of cognitive biases, all believed to be important in psychosis, were incorporated in the questionnaire: jumping to conclusions, intentionalizing, catastrophizing, emotional reasoning and dichotomous thinking. The aim of the current study was to compare the presence of cognitive biases with the CBQp in three groups: patients with AVH who had been diagnosed with a psychotic disorder, healthy voice-hearers, and healthy controls. Based on the cognitive model of psychosis, we hypothesized that the healthy voice-hearers would not show the cognitive biases found in the clinical group.

Method

Participants

A total of 72 patients with AVH and a diagnosis of a psychotic disorder, 72 healthy voice-hearers and 72 healthy controls without AVH were included. The healthy voice-hearers did not meet criteria for a DSM-IV diagnosis, as defined by a psychiatrist using the Comprehensive Assessment of Symptoms and History (CASH) interview (Andreasen *et al.* 1992) and the Structured Clinical Interview for Personality Disorder (SCID-II; First *et al.* 1995). Depressive disorder in complete remission was not an exclusion criterion.

An exclusion criterion for all groups was alcohol and drug abuse. The healthy controls and voice-hearers were screened for alcohol abuse (more than 20 units per week) and drug abuse (using cannabis more than once a month and/or the use of other illicit substances) by telephone and later with the help of urine samples. In the patient group, alcohol and drug abuse was screened for by an independent psychiatrist with the help of the CASH interview.

For the healthy voice-hearers, the minimum frequency to experience AVH for inclusion in the study was once every 3 months and the minimum duration since onset of AVH was 1 year.

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Table 1. *Demographic and clinical characteristics of participants: clinical and healthy voice-hearers and healthy controls*

	Group			
	Clinical voice-hearers	Healthy voice-hearers	Healthy controls	Difference and significance
Subjects, *n*	72	72	72	
Male, *n* (%)	33 (45.8)	22 (30.6)	20 (27.8)	χ^2=6.01, df=2, p=0.050
Female, *n* (%)	39 (54.2)	50 (69.4)	52 (72.2)	
Age, years (S.D.)	39.71 (11.9)	47.58 (11.2)	45.13 (14.5)	F=7.38, p=0.001
Duration of education, years (S.D.)	12.85 (2.6)	13.25 (2.3)	13.99 (2.4)	F=3.94, p=0.021
Past history of depression, *n* (%)[a]	42 (58.3)	22 (30.6)	6 (8.3)	χ^2=41.26, df=2, p<0.001
Married/living together, *n* (%)	20 (27.8)	43 (59.7)	43 (59.7)	χ^2=19.60, df=2, p<0.001
Divorced, *n* (%)	10 (13.9)	29 (40.3)	11 (15.3)	χ^2=17.85, df=2, p<0.001
Ethnicity, *n* (%)				
Caucasian	69 (95.8)	71 (98.6)	72 (100)	χ^2=3.57, df=2, p=0.168
Other	3 (4.2)	1 (1.4)	–	
Asian	–	1 (1.4)	–	
Arabic	2 (2.8)	–	–	
African American	1 (1.4)	–	–	

df, Degrees of freedom; S.D., standard deviation.
[a] Number of cases with missing data: three in the group of clinical voice-hearers.

Both the controls and healthy voice-hearers were recruited with the help of a Dutch website called 'explore your mind' (www.verkenuwgeest.nl) and selected on the basis of low and high scores, respectively, in the items of the Launay and Slade Hallucinations scale (Larøi *et al.* 2004) tapping into AVH. For more details about the selection and assessment procedure, see Sommer *et al.* (2010) and Daalman *et al.* (2011).

The patients with a psychotic disorder were all outpatients from the Voices Clinic of the University Medical Center Utrecht. These patients visited our clinic for regular treatment for psychosis or as a second opinion for intractable psychosis. In this group, clinical diagnoses were confirmed by an independent psychiatrist using the CASH interview. A total of 42 patients (58.3%) were diagnosed with paranoid schizophrenia, 18 (25%) with psychosis not otherwise specified, 10 (13.9%) with schizo-affective disorder and two (2.8%) with disorganized schizophrenia. Demographic and clinical details are provided in Table 1.

The study was approved by the Human Ethics Committee of the University Medical Center Utrecht. After a complete description of the study was provided to the participants, written informed consent was obtained.

Measurements

The CBQp was developed by Peters *et al.* (in press) to assess cognitive biases relevant to patients with psychosis. It consists of 30 vignettes grouped under two themes: 'anomalous perception' (e.g. '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') and 'threatening events' (e.g. 'Imagine you receive a letter and you notice it is not sealed'). In all, five types of cognitive biases are assessed: 'intentionalizing', 'catastrophizing', 'dichotomous thinking', 'jumping to conclusions' and 'emotional reasoning'. There are three vignettes per bias for each theme (six vignettes per bias in total). Each vignette is rated on a three-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 bias is 18, and for each theme 45, with a total overall score of 90. The minimum total overall score is 30. The scale has good psychometric properties; both internal consistency and test–retest reliability are high (Peters *et al.* 2013). In addition to the total score, all subscales as well as both themes were compared between the three groups. A Dutch translation by T. Bastiaens *et al.* (unpublished) was used for this study.

The Psychotic Symptom *Rating Scales* (PSYRATS) auditory hallucination rating subscale (AHRS; Haddock *et al.* 1999) was used to map the phenomenological characteristics of the AVH. This questionnaire describes 11 characteristics of AVH. Each item is evaluated on a five-point Likert scale ranging from 0 to 4. For the use of this questionnaire in healthy voice-hearers, the range of the frequency scale was extended

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to 0–6 (also covering options 'at least once every month' and 'at least once every three months' since AVH are experienced less often than once per week, the original minimum score of this item). This questionnaire was administered by trained psychologists.

The items of the PSYRATS AHRS can be extrapolated into three dimensional subscales (Haddock *et al.* 1999; Morrison *et al.* 2004): (1) an emotional characteristics factor (i.e. amount and intensity of distress, amount and degree of negative content items); (2) a physical characteristics factor (i.e. descriptions of the voice: items frequency, duration, location and loudness); and (3) a cognitive interpretation factor (i.e. beliefs regarding the origin and attributions of control: items origin, disruption and control).

Statistics

The primary outcome measure was the total score on the CBQp. Between-group comparison (i.e. psychotic patients with AVH, healthy voice-hearers, and controls) of this measure was achieved through univariate analysis of covariance (ANCOVA), applying a general linear model procedure. In addition, the five cognitive biases subscales of the CBQp (intentionalizing, catastrophizing, dichotomous thinking, jumping to conclusions and emotional reasoning) as well as both themes (anomalous perceptions and threatening events) were analysed in multivariate ANCOVA. Age was entered as a covariate since this variable differed significantly between the three groups and showed small but significant relationships to both intentionalizing (r −0.195, p=0.004) and catastrophizing (r −0.234, p=0.001). Gender, total years of education, past history of depression, being married, being divorced and ethnicity were not associated with the CBQp total score or the subscales.

The relationship between cognitive biases and AVH characteristics was investigated with a hierarchical regression analysis. The total CBQp score was the dependent variable. The three PSYRATS factors (cognitive, emotional, and physical) and group membership (i.e. patients *versus* healthy voice-hearers) were entered stepwise as predictors.

All data were analysed with SPSS (IBM, USA).

Missing values

In the complete sample of 216 participants, four items of the CBQp were missing, and a multiple imputation procedure based on linear regression was used to estimate these values based on the other observed variables.

Results

Description of AVH characteristics

Table 2 illustrates the characteristics of the voices in both AVH groups and the total scores on the three subscales of the PSYRATS. Mean scores are given as well as the description of its closest anchor.

Differences in cognitive biases between the three groups

Total score of the CBQp

The total score of the CBQp differed significantly between the groups ($F_{2,213}$=37.51, p<0.001). Pairwise comparisons (mean difference significant at p<0.05, Bonferroni adjusted) showed that the healthy controls scored significantly lower than both the healthy voice-hearers (p<0.01) and the clinical group (p<0.001). Both AVH groups also differed significantly from each other (p<0.001), with lower scores in the healthy voice-hearers.

The mean total and theme scores on the CBQp in the three groups are illustrated in Fig. 1.

Individual cognitive biases

There was a statistically significant difference between the three groups on the combined dependent variables ($F_{10,418}$=11.94, p<0.001; Pillai's trace 0.44), after correcting for age. When the results for the dependent variables were considered separately the three groups differed significantly on all subscales of the CBQp after correction for multiple testing (0.05/5=0.01): intentionalizing ($F_{2,213}$=14.32, p<0.001), catastrophizing ($F_{2,213}$=28.06, p<0.001), dichotomous thinking ($F_{2,213}$=20.74, p<0.001), jumping to conclusions ($F_{2,213}$=36.26, p<0.001) and emotional reasoning ($F_{2,213}$=21.89, p<0.001).

Further analyses (again, mean difference significant at p<0.05, Bonferroni adjusted) revealed that healthy controls and healthy voice-hearers scored significantly lower than patients with AVH on four out of the five subscales: intentionalizing (p<0.001 and p<0.001, respectively), catastrophizing (p<0.001 and p<0.001), dichotomous thinking (p<0.001 and p<0.001) and jumping to conclusions (p<0.001 and p<0.001), but did not differ significantly from each other. However, on emotional reasoning the healthy controls scored significantly lower than both AVH groups (p<0.001 and p<0.001 respectively), which did not differ from each other. The mean scores of the cognitive biases in the three groups are presented in Fig. 2.

Themes of the CBQp

There was a statistically significant difference between the groups on the combined dependent variables

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Table 2. *Characteristics of auditory verbal hallucinations in healthy and clinical groups*

	Clinical voice-hearers: mean (S.D.)	Description of closest anchor	Healthy voice-hearers: mean (S.D.)	Description of closest anchor
Frequency (0–6)	5.07 (0.92)	Voices at least once per h	3.47 (1.28)	Voices at least once per week
Duration (0–4)	2.69 (1.21)	Voices last for at least 1 h	1.63 (0.80)	Voices last for several min
Location (0–4)	2.13 (1.16)	Outside head, close to ears and inside head	2.38 (1.23)	Outside head, close to ears and inside head
Loudness (0–4)	2.04 (0.84)	Same loudness as own voice	1.9 (0.56)	Same loudness as own voice
Beliefs origin (0–4)	2.25 (1.22)	<50% conviction that voices have external cause	3.01 (1.07)	⩾50% conviction that voices have external cause
Amount negative content (0–4)	2.96 (1.08)	Majority voices is unpleasant or negative	0.38 (0.90)	No unpleasant content
Degree negative content (0–4)	2.96 (1.01)	Personal verbal abuse relating to self concept	0.39 (0.93)	Not unpleasant or negative
Amount distress (0–4)	3.04 (1.0)	Majority of voices is distressing	0.46 (0.92)	Voices not distressing at all
Intensity distress (0–4)	2.53 (0.80)	Voices are very distressing	0.26 (0.61)	Voices not distressing at all
Disruption life (0–4)	2.36 (0.95)	Moderate amount of disruption	0.21 (0.60)	No disruption to life
Controllability (0–4)	3.15 (1.11)	Occasional control over voices	2.03 (1.66)	Majority of occasions control over voices
Emotional subscale	11.49 (3.20)		1.49 (3.09)	
Physical subscale	11.99 (2.64)		9.38 (1.95)	
Cognitive subscale	7.76 (2.26)		5.25 (1.86)	

S.D., Standard deviation.

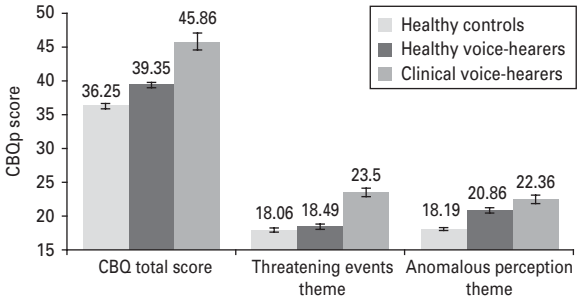

Fig. 1. Total scores on the Cognitive Biases Questionnaire for psychosis (CBQp) (potential range of scores: 30–90), and on the threatening events and anomalous perception themes (potential range of scores: 15–45) in the three groups. Values are means, with their standard errors represented by vertical bars. AVH, Auditory verbal hallucinations.

($F_{4,424}$=26.07, p<0.001; Pillai's trace 0.40), after correcting for age. When the results for the dependent variables were considered separately the three groups differed significantly on both themes after correction for multiple testing. The total score on threatening events showed a significant main effect for group, after correcting for age ($F_{2,213}$=41.80, p<0.001). Pairwise comparisons (mean differences significant at p<0.05, Bonferroni adjusted) showed that the patients with a psychotic disorder and AVH scored significantly higher than both the healthy controls (p<0.001) and healthy voice-hearers (p<0.001). No difference was observed between healthy voice-hearers and healthy controls (p=1.000).

The total score on anomalous perception also showed a significant main effect for group, after correcting for age ($F_{2,213}$=24.98, p<0.001). Pairwise comparisons (mean differences significant at p<0.05, Bonferroni adjusted) showed that the healthy controls scored significantly lower than both the healthy voice-hearers (p<0.001) and the clinical group (p<0.001). Unlike the threatening event theme, no difference was observed between the two AVH groups (p=0.075).

Mean scores on the threatening events and anomalous perception themes in the three groups are presented in Fig. 1.

Relationships between AVH characteristics and the presence of cognitive biases

A regression analysis showed that both the emotional (i.e. high and intense distress, and negative emotional valence of the voices) and the cognitive interpretation (i.e. belief in the external origin of voices, having little control over the voices and high disruption to life) factors were significant predictors of the presence of cognitive biases. The physical factor was not a significant predictor of CBQp total scores. The results are presented in Table 3.

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Table 3. *Multiple regression model: predicting the presence of cognitive biases (CBQ total)*

Model	B	S.E.	*β*	*t*	*p*	95% CI
Emotional factor	0.51	0.12	0.38	4.34	<0.001	0.28–0.75
Cognitive interpretation factor	0.61	0.29	0.18	2.09	0.039	0.03–1.18

CBQ, Cognitive Biases Questionnaire; S.E., standard error; CI, confidence interval.

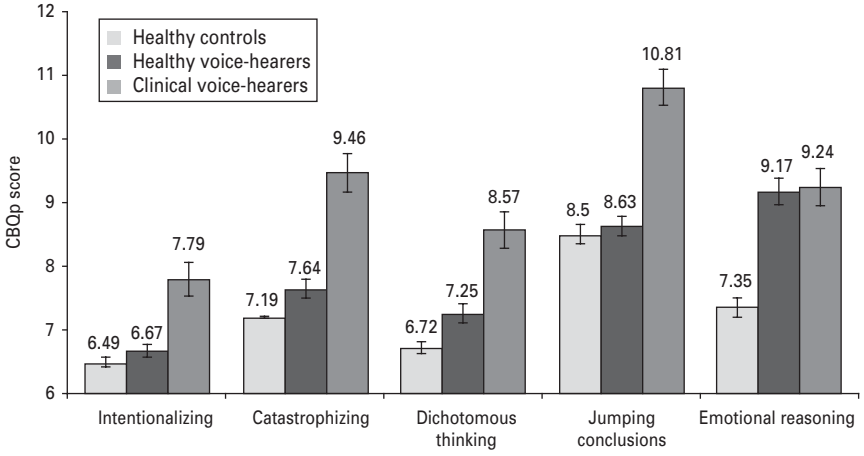

Fig. 2. Cognitive Biases Questionnaire for psychosis (CBQp) scores of the three groups on the five cognitive bias subscales (potential range of scores: 6–18). Values are means, with their standard errors represented by vertical bars. AVH, Auditory verbal hallucinations.

Discussion

This study investigated the differences in the presence of cognitive biases in voice-hearers with and without a 'need for care' and healthy controls. Healthy voice-hearers obtained intermediate total scores between controls and the clinical group on the CBQp (Peters *et al.* 2013), measuring several cognitive biases prevalent in psychosis. Although these results suggest that the healthy voice-hearers lie mid-way on the psychosis continuum, further analyses of the CBQp subscales showed that the healthy voice-hearers had the same profile as the healthy controls on four out of the five cognitive biases, differing significantly from the controls on only one subscale that accounted for most of the difference between these two groups on the total CBQp score. These results are consistent with Lawrence & Peters (2004), who found that reasoning biases were limited to people who reported a belief in, rather than experience of, paranormal phenomena.

Emotional reasoning was the only bias where scores were comparable in both AVH groups. This cognitive style, i.e. reasoning based on emotions, feeling or instinct instead of 'logic', therefore is the only bias that appears to be related to the presence of, or vulnerability to experience, AVH, rather than to a 'need for care'. An emotional reasoning bias is perhaps the least psychosis specific, and is not only highly prevalent in other psychiatric disorders, such as anxiety disorders (Clark, 1999), but is also arguably the most culturally accepted of the five biases assessed by the CBQp. The remaining biases, namely intentionalizing, catastrophizing, dichotomous thinking and jumping to conclusions, were all significantly higher in the clinical group than in the healthy voice-hearers, suggesting that they may potentially be instrumental in developing unhelpful and distressing appraisals of their AVH, as proposed by cognitive models of psychosis (Chadwick & Birchwood, 1994; Morrison, 2001; Garety *et al.* 2001, 2007).

The findings comparing the groups on the two themes of the case vignettes of the CBQp ('anomalous perceptions' and 'threatening events') were intriguing, and suggest that cognitive biases, similarly to broad reasoning style, are domain specific (Evans *et al.* 1993; see also Lawrence & Peters, 2004). Both healthy and clinical voice-hearers scored higher than healthy controls on the 'anomalous perceptions' theme: biases were therefore more pronounced in both the AVH groups when they were presented with information related to unusual perceptual experiences. In contrast, healthy voice-hearers and healthy controls scored

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lower than the clinical group on the 'threatening events' theme: healthy voice-hearers had comparable scores to controls when presented with potential threatening scenarios. These results are in line with previous findings that paranoid (but not necessarily external) appraisals differentiate individuals with psychotic experiences with and without a 'need for care' (Brett *et al.* 2007; Lovatt *et al.* 2010), and that healthy voice-hearers do not show delusional symptoms (Sommer *et al.* 2010). Indeed, healthy voice-hearers tend to hold appraisals about their voices that are non-threatening, such as benign spiritual explanations (Cottam *et al.* 2011; Daalman *et al.* 2011), potentially protecting them from developing a 'need for care'.

The relationship between cognitive biases and AVH factors

Cognitive and emotional, but not physical, characteristics of AVH were found to be related to CBQp scores. The presence of cognitive biases was associated with higher distress and negative emotional valence of voice content, as well as appraisals of the voices as external in origin, of having little control over the voices, and of a high disruption to life. These relationships also provide further support for cognitive models of psychosis, which emphasize the strong links between emotional processes and thinking biases in shaping maladaptive appraisals of psychotic phenomena (Garety *et al.* 2001; Freeman & Garety, 2003; Freeman *et al.* 2012).

Limitations

The healthy voice-hearers and controls in our study were recruited with the help of a website. This sampling strategy could have led to a selection bias, as suspicious individuals may not have completed the questionnaires on the website or rejected our invitation to visit our research laboratory. In addition, the healthy voice-hearers who participated may represent a specific subgroup within the voice-hearing population, i.e. those who are not distressed or whose functioning is not affected upon by additional (sub)clinical symptoms. However, since we set out to investigate possible protective factors in voice-hearers who are not in need for care, we aimed to specifically include this subgroup. The potential biases inherent in our recruitment strategy is therefore not a serious limitation for the research questions posed in this particular study, although we cannot conclude that our sample is representative of voice-hearers in the general population. Nevertheless, anomalous experiences without distress are twice as common (prevalence of approximately 8%) than those with distress (prevalence of approximately 4%) (van Os *et al.* 2009).

We have tentatively suggested that these findings support cognitive models of psychosis, which propose that cognitive biases may be causally implicated in the formation of appraisals, which in turn may determine the trajectory to health or ill-health. However, no causal claims can be made from our data, since it is also possible that appraisals are affected by a need-for-care status (including the impact of receiving a psychosis diagnosis) rather than the other way round. The relationship between the specific content of voices and thinking biases was not investigated, although a negative emotional valence of content was associated with the presence of cognitive biases.

Other relevant factors, such as experience of trauma, were not included in this study. For instance, a number of studies have suggested that there is a cognitive route between interpersonal trauma and psychosis, i.e. the link between abuse and psychotic experiences may be mediated by appraisals (Gracie *et al.* 2007; Lovatt *et al.* 2010). It would be interesting to determine whether cognitive biases, especially in relation to appraisals of threat, are related to traumatic experiences earlier in life, especially abuse and other interpersonal traumas such as discrimination (Janssen *et al.* 2003), and how this may make an impact on the content and appraisals of voices in both healthy and clinical voice-hearers.

Clinical implications

The assessment of cognitive biases in individuals with AVH may shed more light on individuals' vulnerability to make the transition to full-blown psychosis. Furthermore, it can help identify the tendency to make unhelpful appraisals, which can then be targeted in cognitive behavioural therapy (CBT), in turn alleviating the accompanying distress. New adjunctive interventions to CBT have also recently been developed to target reasoning processes specifically, for instance, metacognitive training (Moritz & Woodward, 2007; Moritz *et al.* 2011) or the Maudsley Review Training Programme (Waller *et al.* 2011), which focuses specifically on 'jumping to conclusions' and belief flexibility. The results of this study support this recent trend in focusing explicitly on cognitive and reasoning biases, rather than the anomalous experiences themselves.

In conclusion, most cognitive biases associated with psychosis, particularly with themes of threatening events, were absent in healthy voice-hearers, with the exception of emotional reasoning. Cognitive biases were associated with both emotional and cognitive characteristics of voices. These findings overall are consistent with the cognitive model of psychosis, which proposes a central role for appraisals of psychotic

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experiences. The absence of cognitive biases may therefore prevent the formation of malign appraisals and delusions in healthy voice-hearers, keeping them on the safe end of the psychosis continuum.

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Declaration of Interest

None.

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