

Cognitive processes in auditory hallucinations: attributional biases and metacognition

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ABSTRACT

Background. Cognitive models suggest that auditory hallucinations are experienced when mental events are misattributed to an external source; therefore, this study was designed to examine attributional biases in patients experiencing auditory hallucinations. The study also examined the role of metacognitive beliefs in the experience of auditory hallucinations, as some theories have implicated metacognition in the development and maintenance of auditory hallucinations.

Methods. Fifteen participants with a diagnosis of schizophrenia experiencing auditory hallucinations were compared with 15 non-hallucinating schizophrenics and 15 non-psychiatric control subjects on several measures, including an immediate source monitoring task and a questionnaire assessing metacognitive beliefs.

Results. Results indicated that patients experiencing hallucinations exhibited the predicted bias towards misattributing internal events to an external source, as measured by ratings of internality of responses in a word association task. All groups had lower perceived levels of internality and control for emotionally salient words, which provides further evidence for the importance of emotional content in hallucinations. Patients experiencing hallucinations were found to score higher than the other two groups on metacognitive beliefs about uncontrollability and danger and positive beliefs about worry. In addition, a logistic regression analysis showed that beliefs about uncontrollability and danger were predictive of whether subjects experienced auditory hallucinations or not.

Conclusions. These results offer considerable support to cognitive bias models of auditory hallucinations, particularly those that implicate metacognition.

INTRODUCTION

Auditory hallucinations (typically hearing voices) are the most common symptom experienced in schizophrenia (World Health Organization, 1973; Slade & Bentall, 1988). Various studies have investigated the processes involved in auditory hallucinations, and it is generally agreed that such hallucinations are accompanied by sub-vocalization (Gould, 1948, 1949, 1950; Green & Preston, 1981), as is most normal 'inner speech' (Cacioppo & Petty, 1981). These findings, in addition to

studies which show that hallucinations are blocked by concurrent verbal activity (Margo *et al.* 1981; James, 1983), offer support to this link between sub-vocalization and auditory hallucinations. Thus, there is a general consensus that such experiences are the result of private mental events being misattributed to an external source.

Although it is largely accepted that auditory hallucinations occur when internal events are misattributed to an external source, there is less agreement about the cognitive processes involved in such misattribution. Some theorists suggest that hallucinations (and other positive symptoms) are due to a cognitive deficit (Hoffman, 1986; Frith, 1992; Hemsley, 1993; David, 1994) while others propose that such

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experiences are related to a cognitive bias (Bentall, 1990; Morrison *et al.* 1995).

Cognitive bias models of auditory hallucinations

Bentall (1990) suggests that people who experience auditory hallucinations have a problem discriminating between self-generated and external events. Bentall claims that this is influenced by top-down processes (e.g. beliefs and expectations about the self and the world) in addition to bottom-up processes (such as neuropsychological deficits). He suggests that the influence of top-down processes can explain the findings that psychotic experiences can be influenced by cultural factors, such as religious beliefs and expectations about 'normal' behaviour (Bourgignon, 1970; Al-Issa, 1979). Bentall (1990) also argues that the misattribution of internal events to an external source may be maintained by anxiety reduction that is associated with externally attributing hostile thoughts.

A similar account has been proposed by Morrison *et al.* (1995) who suggest that auditory hallucinations are linked to normal intrusive thoughts, and in support of this they point out that there are marked similarities between the two phenomena. They suggest that the attribution of such thoughts to an external source is maintained by the reduction of cognitive dissonance (which Festinger (1957) suggests occurs when an individual has two incompatible cognitions, resulting in an aversive state of arousal, from which the individual is driven to escape) that occurs when intrusive thoughts are incompatible with an individual's beliefs about their thinking (metacognitive beliefs). They also suggest that the cognitive, behavioural, emotional and physiological responses to the voice, which are mediated by the appraisal of the hallucinatory experience, can be implicated in the maintenance of such experiences.

Factors related to auditory hallucinations

There have been a number of studies examining whether such cognitive biases are observed in patients experiencing auditory hallucinations. In addition, there are several factors implicated by specific theories of auditory hallucinations that may affect such cognitive biases and, therefore, should be considered in studies of such phenomena. These will be discussed below.

External attributional biases

Reality monitoring (or source monitoring) skills are clearly a factor that is implicated in models of auditory hallucinations. Reality monitoring refers to the 'set of processes involved in making attributions about the origins of memories, knowledge, and beliefs' (Johnson *et al.* 1993, p. 3). Such attributions are thought to be based on both perceptual cues and information stored in memory, and a number of experimental studies have compared the source monitoring skills of hallucinating patients with non-hallucinating subjects. The findings of these studies are generally consistent with a cognitive bias account of auditory hallucinations.

Bentall & Slade (1985) found that when compared with non-hallucinators, patients experiencing hallucinations have a bias towards believing stimuli to be present when given ambiguous signals, although they do not differ in perceptual sensitivity. Heilbrun (1980) offers further support to the theory that patients experiencing hallucinations are more likely than non-hallucinators to misattribute their thoughts to an external source, as they were worse at identifying their own thoughts a week later. Patients experiencing hallucinations were also found to give more rapid and erroneous responses when asked to guess the meanings of words presented with white noise (Heilbrun *et al.* 1983). Similarly, in a study conducted by Bentall *et al.* (1991) it was found that participants in the hallucinating group misattributed their self-generated high cognitive effort words to the experimenter more frequently than subjects in the other two control groups, although there was no overall group effect. Rankin & O'Carroll (1995) compared normal subjects with high scores on the Launay-Slade Hallucinations Scale with a group with low scores and found that high scorers have a bias towards believing a signal to be present. It was also demonstrated that although overall accuracy on a reality monitoring task was similar for the two groups, those highly disposed to hallucinations were more likely to misattribute their own imagined words to an external source (the experimenter) than the control group. In a study by Morrison & Haddock (1997), the source monitoring performance of hallucinating schizophrenics was compared to that of non-hallucinating schizo-

phrenics and non-psychiatric controls. Participants were required to generate words in a word association task, and rate their responses on perceived internality, control and involuntariness. As in other studies, the results indicated that hallucinating schizophrenics were significantly more likely than non-hallucinating schizophrenics or normal controls to misattribute the source of self-generated words to the experimenter.

Morrison & Haddock (1997) also found that patients experiencing hallucinations generated significantly lower internality scores than subjects in the other two groups, and that this effect was somewhat more marked for emotionally salient words (e.g. 'crazy' or 'relaxed' as opposed to 'carpet'). This effect of emotional salience on source monitoring style supports the role of emotional content in auditory hallucinations.

Intrusive thoughts

Another factor which has been linked to auditory hallucinations, and which is implicated in Morrison *et al.*'s (1995) heuristic model, is the phenomenon of intrusive thoughts. It has been suggested that as the two phenomena have various similarities, knowledge regarding intrusive thoughts may contribute greatly to an understanding of hallucinations. Intrusive thoughts are typically experienced as unacceptable and unwanted (e.g. sudden urge to kill a family member or engage in personally unacceptable sexual behaviour), and tend to cause concern or discomfort, and interrupt current mental activity (Rachman, 1978, 1981). Intrusive thoughts may take the form of repetitive images, impulses or verbal thoughts, which like auditory hallucinations may be of a bizarre nature, and which can bring about feelings of mental pollution (Rachman, 1981, 1994). Intrusive thoughts have also been distinguished from negative automatic thoughts characteristic of depression and worry (see Salkovskis, 1985; Wells & Morrison, 1994). Given the hypothesized link between such thoughts and auditory hallucinations, it would appear necessary to consider the intrusive nature of any thoughts in a source monitoring task.

Metacognitive beliefs

According to Morrison *et al.*'s (1995) heuristic

model, auditory hallucinations are experienced when intrusive thoughts are attributed to an external source, in order to reduce cognitive dissonance. They speculate that this dissonance is caused by the incompatibility of certain intrusive thoughts and metacognitive beliefs (in particular, beliefs about controllability). Bentall (1990) also implicates metacognitive beliefs as a top-down factor that may influence the occurrence of auditory hallucinations.

Wells (1995) states that metacognitive beliefs include beliefs about thought processes (e.g. 'I have a poor memory'), the advantages and disadvantages of various types of thinking (e.g. 'My worrying could make me go mad'), and beliefs about the content of thoughts (e.g. 'It is bad to think about death'). Such beliefs about cognition have been implicated as vulnerability factors for emotional dysfunction (Wells & Matthews, 1994). Discussing such beliefs with reference to generalized anxiety disorder and obsessive-compulsive disorder, Wells (1995) argues that in these patients, it is their appraisal of and response to their cognitive processes that distinguishes them from non-clinical samples, as opposed to the content of their cognitions. Wells & Matthews' (1994) self-referent executive function (S-REF) model would also suggest that the occurrence of hallucinations may be influenced by such metacognitive beliefs, as hallucinations would be conceptualized as low-level intrusions that are mediated by self-beliefs (for instance, the allocation of attentional resources and the selection of control strategies would be determined by metacognitive beliefs).

This study seeks to replicate and extend the findings of Morrison & Haddock (1997) by comparing patients experiencing auditory hallucinations with control groups on an immediate source monitoring task that will use stimuli relevant to concerns of schizophrenic patients. This task will allow for examination of attributional biases, the emotional salience of stimuli and intrusive nature of responses and metacognitive factors in relation to auditory hallucinations, and will, therefore, test some of the predictions of Morrison *et al.* (1995). In this study, it is hypothesized that participants in the hallucinating group will score lower than those in the psychiatric and non-psychiatric control groups, on perceived internality, control and 'wantedness' of responses given in a word

association task, and that participants in all groups will score lower on ratings of internality, control and 'wantedness' when emotionally salient stimuli are used (both positive and negative), compared with neutral stimuli. It is also hypothesized that participants in the hallucinating group will score higher than the two control groups on measures of metacognitive beliefs (beliefs about one's own thought processes), indicating that they hold such beliefs more strongly than other participants, and that high scores on measures of metacognitive beliefs will be associated with lower internality scores on the word association task and predict whether subjects hear voices.

METHOD

Participants

Hallucinating group

This group consisted of 15 participants who met DSM-IV (APA, 1994) criteria for schizophrenia, and who were currently experiencing auditory hallucinations. Ages of participants in this group ranged from 28 to 65, with a mean of 43.93 years (s.d. = 9.90) and there were 11 males and 4 females. All participants were being treated with neuroleptic medication.

Non-hallucinating psychiatric control group

Fifteen participants who met DSM-IV (APA, 1994) criteria for schizophrenia, but had not heard voices for at least 3 years were recruited into this group. Ages ranged from 25 to 64, the mean age being 42.93 years (s.d. = 10.53), and there were 12 males and three females. All participants were currently receiving neuroleptic medication.

Non-psychiatric control group

The non-psychiatric control group consisted of 15 participants, who reported that they had not experienced any psychiatric illness in the previous 3 years, and had never experienced auditory hallucinations. Participants were aged between 25 and 65 years, and the mean age was 38.73 years (s.d. = 14.85). There were 10 males and five females.

Materials and questionnaires

The following measures were administered to participants.

National Adult Reading Test (NART: Nelson, 1982)

The NART is used to estimate intelligence quotient (IQ), and has been shown to have high levels of reliability and validity, when used with general population samples (Nelson & McKenna, 1975; Crawford *et al.* 1989) and with schizophrenic patients (O'Carroll *et al.* 1992).

Hospital Anxiety and Depression Questionnaire (HAD: Zigmond & Snaith, 1983)

The HAD was selected as the most appropriate measure, as it does not assess symptoms which could have a physical cause, such as headaches and dizziness (Zigmond & Snaith, 1983), which can also be linked to side effects of medication.

Metacognitions Questionnaire (MCQ: Cartwright-Hatton & Wells, 1997)

This scale measures metacognitive beliefs using 65 items. The questionnaire generates scores for the following five subscales: positive beliefs about worry (typical items include 'Worrying helps me to get things sorted out in my mind' and 'Worrying helps me cope'); negative beliefs about the controllability of thoughts and corresponding danger (typical items include 'Worrying is dangerous for me' and 'I cannot ignore my worrying thoughts'); cognitive confidence (typical items include 'I have a poor memory' and 'I have difficulty knowing if I have actually done something, or just imagined it'); negative beliefs about thoughts in general, including responsibility, punishment and superstition (typical items include 'Not being able to control my thoughts is a sign of weakness' and 'If I did not control a worrying thought, and then it happened, it would be my fault'); cognitive self-consciousness (typical items include 'I think a lot about my thoughts' and 'I pay close attention to the way my mind works'). Items are scored from 1 to 4, whereby 1 = 'do not agree', 2 = 'agree slightly', 3 = 'agree moderately' and 4 = 'agree very much'.

Word association task

For the word association task, Kinderman's (1994) 15-item word list, consisting of words rated by schizophrenic subjects for emotional

salience, was selected as containing the most appropriate stimuli. The list is made up of five 'emotionally salient positive' words (e.g. 'wise'), five 'emotionally salient negative' words (e.g. 'lazy') and five 'neutral' words (e.g. 'ripe'), which are matched for length and frequency of occurrence in the language, using Thorndike & Lorge's (1944) word book. It was hoped that these words would be more salient to the psychiatric participants than those used in the previous study (Morrison & Haddock, 1997), which had been selected on the basis of emotionality ratings from normal and anxious rather than psychotic subjects.

A structured clinical interview (KGV-R; Krawiecka et al. 1977; modified by Lancashire, 1994)

This is a standardized psychiatric assessment scale for rating chronic psychotic patients' affect, positive and negative symptoms. The subscales (all scored 0–4) used in this study were those for delusions and hallucinations that were based upon responses to interview. Also rated were the subscales for flattened affect, incongruity, over-activity and pressure of speech, psychomotor retardation, incoherence or irrelevance, poverty of speech and abnormal movements or postures, all of which were based upon behavioural observations made by the interviewer.

Procedure

In order to control for any priming effects of the questionnaire items on the word association task, and vice versa, two orders of presentation were used. For half of the participants in each group, the NART, HAD and MCQ were administered before the word association task, while the other half of the participants completed the word association task first. For the word association task, each subject was required to generate words in response to those read aloud from Kinderman's (1994) list using the procedure of Morrison & Haddock's (1997) immediate source monitoring task. After each response, the subject was asked to rate their perceived level of control ('How much control did you have over the word that came to mind?'), internality ('How much was the word that came to mind your own?') and 'wantedness' ('How much did you want to think of that word rather than another one?') of the word, using 0–100

visual analogue scales. Finally, patients were rated using the structured clinical interview. As all the data was normally distributed, parametric statistics were used to analyse the results.

RESULTS

Subject characteristics

The sex ratios appeared similar for the three groups. Independent *t* tests indicated that the only significant difference between Groups 1 and 2 on the KGV-R was the 'hallucinations' score ($t = 17.0$, $df = 28$, $P < 0.01$). The group means were identical for 'delusions' scores, and for ratings of negative symptoms. These results indicate that as planned, the 'hallucinating' and 'non-hallucinating' psychiatric groups were comparable on symptoms other than hallucinations. All descriptive data showing subject characteristics are summarized in Table 1.

Comparative data

Source monitoring experiment (word association task)

Having established that the data was normally distributed, using residual plots and visual inspection, these results were analysed using three 3×3 mixed analyses of variance. The mean ratings of internality, control and wantedness for the three groups for each word type are shown in Table 2.

Ratings of internality

Analysis of variance indicated that there was a highly significant main effect of group ($F(2, 42) = 12.99$, $P < 0.01$). Visual inspection and examination of confidence intervals for parameter estimates revealed that this difference was accounted for by the lower scores of the hallucinating group, compared with the other two groups. These results indicate that the patients experiencing hallucinations had lower perceived levels of internality for self-generated words, than psychiatric and non-psychiatric control participants.

There was also a significant main effect of word type ($F(2, 84) = 4.12$, $P < 0.05$). Visual inspection and examination of confidence intervals for parameter estimates revealed that this difference was accounted for by the higher

Table 1. *Subject characteristics*

Variable	Hallucinators	Psychiatric controls	Normal controls	<i>F</i> (2, 42)	<i>P</i>
Age	43.93 (9.90)	42.93 (10.53)	38.73 (14.85)	0.80	NS
Sex ratio (M:F)	11:4	12:3	10:5		
Anxiety	10.27 (4.64)	8.20 (4.28)	7.33 (3.79)	1.89	NS
Depression	7.6 (5.40)	5.27 (4.71)	4.0 (3.89)	2.26	NS
NART IQ	107.20 (5.81)	105.20 (7.90)	110.27 (8.92)	1.67	NS
KGV-R Subscales					
Hallucinations	3.87 (0.35)	0.33 (0.72)	—		
Delusions	2.53 (1.59)	2.53 (1.25)	—		
Behavioural observations	2.87 (2.32)	2.87 (2.32)	—		

Table 2. *Means (and standard deviations) for ratings of internality, control and wantedness, for each word type*

Ratings	Word type	Hallucinators	Psychiatric controls	Normal controls
Internality	Positive	48.12 (22.71)	73.43 (29.82)	84.40 (15.10)
	Neutral	53.94 (21.30)	79.11 (23.35)	88.27 (12.69)
	Negative	47.44 (26.51)	75.17 (20.98)	84.47 (13.09)
	All words	49.83 (23.51)	75.90 (24.72)	85.71 (13.63)
Control	Positive	52.24 (26.29)	68.40 (19.36)	72.13 (22.95)
	Neutral	51.38 (21.98)	81.49 (27.59)	75.47 (23.17)
	Negative	44.82 (26.81)	73.43 (19.88)	68.07 (24.62)
	All words	49.48 (25.00)	74.44 (22.27)	71.90 (23.57)
Wantedness	Positive	56.27 (29.94)	62.47 (27.31)	74.93 (19.87)
	Neutral	47.78 (21.42)	71.73 (29.42)	74.20 (24.44)
	Negative	49.16 (25.31)	67.17 (17.22)	71.47 (21.50)
	All words	51.07 (25.56)	67.12 (24.72)	73.53 (21.91)

scores for the neutral words, as compared with both positive and negative words. These results indicate that for all groups, levels of perceived internality were higher when neutral stimuli were used, as opposed to emotionally salient positive or negative stimuli. There was no group \times word interaction effect ($F(4, 84) = 0.14$, NS).

Ratings of control

Analysis of variance indicated that there was a highly significant main effect of group ($F(2, 42) = 5.96$, $P < 0.01$). Visual inspection and examination of confidence intervals for parameter estimates indicated that this difference was accounted for by the lower ratings of the hallucinating group, compared with the psychiatric and non-psychiatric control groups. This difference indicates that patients experiencing hallucinations felt less control than the other two groups over their responses in the word association task.

A main effect of word type was also found ($F(2, 84) = 4.68$, $P < 0.05$). Visual inspection and examination of confidence intervals for parameter estimates indicated that this difference was accounted for by the higher ratings for emotionally neutral words, compared with both positive and negative words. These results indicate that all participants felt more in control of words given in response to neutral stimuli, compared with emotionally salient positive or negative stimuli. There was no group \times word type interaction ($F(4, 84) = 1.70$, NS).

Ratings of wantedness

Analysis of variance indicated that there was a main effect of group ($F(2, 42) = 4.40$, $P < 0.05$). Visual inspection and examination of confidence intervals for parameter estimates indicated that this difference was accounted for by the lower scores of the hallucinating group compared with the psychiatric and non-psychiatric control groups. These results indicate that compared

Table 3. Results of analysis of variance comparing mean MCQ scores (and standard deviations) for the three groups

MCQ factor	Hallucinators	Psychiatric controls	Normal controls	F (2, 42)	P*
Positive beliefs about worry	41.13 ^a (11.11)	31.73 ^b (7.63)	29.73 ^b (7.81)	6.87	< 0.05
Negative beliefs about uncontrollability/danger	52.60 ^a (8.30)	33.27 ^b (10.62)	28.80 ^b (7.11)	30.99	< 0.01
Cognitive confidence	26.53 ^a (6.30)	21.80 ^a (6.92)	13.60 ^b (3.27)	19.61	< 0.01
Negative beliefs including responsibility and superstition	33.87 ^a (4.76)	29.13 ^a (5.29)	19.80 ^b (5.73)	27.59	< 0.01
Cognitive self-consciousness	20.27 (4.56)	16.73 (4.41)	15.47 (5.07)	4.22	NS

* The *P* values shown have been adjusted according to Bonferroni's correction rule (Dunn, 1961).

^{a, b} Indicates location of significant differences as revealed using *post hoc* multiple comparisons.

Table 4. Correlation coefficients for association between internality ratings and metacognitive variables

Variable	Correlation with internality ratings for	
	Entire sample (N = 45)	Hallucinators only (N = 15)
Positive beliefs about worry	-0.31	0.36
Negative beliefs about uncontrollability/danger	-0.73**	-0.71*
Cognitive confidence	-0.47**	-0.52
Negative beliefs including responsibility and superstition	-0.49**	-0.22
Cognitive self-consciousness	-0.39	0.34
Controllability ratings	0.82**	0.96**
Wantedness ratings	0.81**	0.93**

** *P* < 0.01; * *P* < 0.05 (the *P* values shown have been adjusted according to Bonferroni's correction rule (Dunn, 1961)).

with two control groups, patients experiencing hallucinations perceived their responses to be less wanted. For wantedness, unlike internality and control, there was no main effect of word type ($F(2, 42) = 0.28$, NS).

Metacognitions questionnaire

Before analysing the MCQ data, the internal reliability of the scale was assessed using Cronbach's alpha statistic, as this measure had not been used with hallucinating populations before. The scale was found to have good reliability (Cronbach $\alpha = 0.95$). Having established that the MCQ data was normally distributed, using residual plots and visual inspection, one way analyses of variance were used to measure differences between the groups on the five subscales. *Post-hoc* Scheffé tests were then used to establish between which groups the differences were significant. The MCQ scores and corresponding analyses of variance and Scheffé tests are shown in Table 3.

As can be seen in Table 3, there are significant differences on MCQ scores, with the hallucinating group scoring significantly higher than the non-psychiatric control group on all factors except cognitive self-consciousness. For 'beliefs about controllability', the difference between the scores of the hallucinating group and those of the other two groups was highly significant. The hallucinating group also scored significantly higher than both other groups on 'positive beliefs about worry'. For 'cognitive confidence' and 'negative beliefs including responsibility, punishment and superstition', the two psychiatric groups scored significantly higher than the non-psychiatric control group. No significant differences were found between the groups on 'cognitive self-consciousness'.

Metacognition and attribution of source

In order to investigate the relationship between metacognitive beliefs and attributions of source, Pearson's correlation coefficients were examined

for each of the MCQ subscales and the ratings of controllability and wantedness of thoughts with ratings of internality. This was performed on both the entire sample and for the patients experiencing hallucinations alone. The correlations can be seen in Table 4.

Metacognition and hallucinator status

In order to investigate further the links between metacognition and hearing voices, a logistic regression analysis was performed using whether or not a person heard voices (hallucinator status: 0 for control groups, 1 for patients experiencing hallucinations) as the dependent variable. The independent variables used in the analysis were selected on a theoretical basis, and consisted of negative beliefs about uncontrollability and danger, mean internality ratings from the source monitoring task (as all theories of hallucination agree that they are the result of externally attributed mental events), anxiety (as it is implicated in maintenance accounts of hallucinations, such as Bentall, 1990) and IQ (as certain theories suggest that positive symptoms reflect a cognitive deficit). The equation generated by this analysis correctly classified 93.3% of the non-hallucinators and 80% of the hallucinators (the overall correct classification was 88.9%). This logistic regression analysis was highly significant ($\chi^2 = 33.34$, $df = 4$, $P < 0.0001$). The only significant predictor was negative beliefs about uncontrollability and danger ($r = 0.34$, $P < 0.01$; odds ratio = 1.24, 95% confidence interval = 1.07–1.42) showing that a higher score on the negative beliefs about uncontrollability and danger subscale is associated with experiencing auditory hallucinations.

DISCUSSION

The results of the word association task support the prediction that the patients experiencing hallucinations would have a bias towards misattributing self-generated words to an external source. In the source monitoring task, patients experiencing hallucinations scored significantly lower on internality than the other two groups. This main effect of group is consistent with the results of Morrison & Haddock's (1997) study, and offers support for the bias models of

auditory hallucinations (Bentall, 1990; Morrison *et al.* 1995). Similarly, patients experiencing hallucinations were found to have lower perceived levels of control over their responses in the word association task, than the psychiatric and non-psychiatric control groups. This finding substantiates the non-significant trend reported by Morrison & Haddock (1997). Patients experiencing hallucinations were also found to have lower levels of 'wantedness' for their responses in the word association task, in comparison with the two control groups.

The differences between the hallucinating group and the psychiatric control group on scores of internality, control and wantedness are inconsistent with the cognitive deficit models (Frith, 1992; Hemsley, 1993) in which single global deficits are thought to be the cause of auditory hallucinations and other positive symptoms such as delusions. Such models would predict that hallucinating and deluded patients would score similarly on source monitoring tasks, due to their shared deficit. It seems, therefore, that these results are more consistent with the cognitive bias models of Bentall (1990) and Morrison *et al.* (1995); however, it is possible that this bias could be influenced by neuro-psychological factors speculated to be related to hallucinations alone (David, 1994; McGuire & Frith, 1996) in addition to the top-down processes studied here. The finding that hallucinating patients experience their thoughts as more unwanted is consistent with Morrison *et al.*'s (1995) suggestion that intrusive thoughts may be particularly prone to misattribution.

The significant main effects of word type on internality and control ratings indicate that neutral stimuli were related to higher ratings of internality and control than emotionally salient positive or negative stimuli. For all groups, therefore, it seems that any cognitive bias towards external misattribution is magnified when emotionally salient stimuli are used. As auditory hallucinations are thought to be experienced when such misattribution occurs, these results suggest that their content is an important factor in the misattribution process. As the internality scores of the two control groups were also lower when emotionally salient stimuli were used, it would seem that the cognitive processes involved in this misattribution can be understood within a framework of normal functioning.

This would seem to offer support to the view that hallucinations lie on a continuum with normal experience.

Patients experiencing hallucinations were found to score higher than the non-psychiatric control group on all subscales of the MCQ, except cognitive self-consciousness. Patients experiencing hallucinations scored significantly higher than both control groups on negative beliefs about controllability and positive beliefs about worry. It seems, therefore, that patients experiencing hallucinations feel less in control of their thoughts (as shown in the source monitoring task) and are more inclined to believe that thoughts should be controlled and that intrusions are dangerous (which would be expected to result in cognitive dissonance). Positive beliefs about worry measured beliefs such as 'worrying helps me to get things sorted out in my mind', while beliefs about uncontrollability and danger assessed beliefs such as 'my worrying could make me go mad'. By holding both beliefs, it would again seem that the likelihood of cognitive dissonance would be increased. These findings offer some support for Morrison *et al.*'s (1995) account that implicates cognitive dissonance in the experience of auditory hallucinations. However, such results are also somewhat consistent with theoretical accounts that implicate faulty self-knowledge; in particular, Wells & Mathews (1994) S-REF model, which would suggest such beliefs would influence selection of strategies for self-regulation that may increase intrusions, and Frith & Corcoran's (1996) theory of mind hypothesis which suggests that positive symptoms may reflect a lack of knowledge regarding mental states.

The hallucinating and psychiatric control groups both scored higher than the non-psychiatric control group on the subscales measuring beliefs about 'cognitive confidence', using items such as 'I have difficulty knowing if I have actually done something or just imagined it', and 'negative beliefs including responsibility, punishment and superstition', using statements such as 'If I did not control my worrying thoughts they could come true'. These results are interesting in relation to recent models of anxiety that suggest such metacognitive beliefs are also implicated in generalized anxiety disorders (Wells, 1995) and obsessive-compulsive disorder (Salkovskis, 1985; Wells, 1997). It may

be the case therefore, that beliefs about 'metacognitive efficiency' and 'responsibility and superstitious beliefs' are general vulnerability factors, which are related to several psychiatric disorders.

The finding that ratings of controllability and wantedness and negative beliefs about uncontrollability and danger were associated with source monitoring attributions provides further support for Morrison *et al.*'s (1995) hypothesis that metacognitive beliefs and intrusive thoughts are involved in the misattribution process. The fact that these associations were found for both the patients experiencing hallucinations alone and the entire sample also provides further support for the view that hallucinations are on a continuum of normal experience. In addition, the finding that negative beliefs about uncontrollability and danger predicted hallucinator status suggests that this type of metacognitive belief has a crucial role in the development and/or maintenance of auditory hallucinations, again providing support for bias theories that implicate metacognition.

Future research should examine the role of metacognition in psychotic symptoms in greater detail. It would be useful to examine these cognitive processes in parallel with other psychological factors hypothesized to contribute to the experience of auditory hallucinations and other psychotic symptoms, such as theory of mind deficits, attentional biases and biases in reasoning. This research would also benefit from anxious control groups. Further research would also be able to infer stronger conclusions if it was carried out in combination with functional neuroimaging, to allow a comparison of the relative contributions of cognitive processes and neuropsychological deficits to the misattributions observed.

The results of this study have several implications for clinical practice when working with clients who experience auditory hallucinations. In particular, it would seem important to address identified attributional biases, metacognitive beliefs (especially negative beliefs about uncontrollability and danger) and intrusive thoughts in treatment, using cognitive challenging, psycho-education and behavioural experiments, in addition to cognitive-behavioural techniques that facilitate reattribution such as 'focusing' (Slade & Bentall, 1988).

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