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Reality monitoring and psychotic hallucinations

Richard P. Bentall*, Guy A. Baker and **Sue Havers**

Department of Clinical Psychology, Whelan Building, University of Liverpool, PO Box 147, Liverpool L69 3BX, UK

Hallucinating psychiatric patients, patients with delusions but without a history of hallucinations and normal controls were compared on a reality-monitoring task in which they were first required to generate answers to easy or difficult clues and to listen to low-probability or high-probability paired associates. After an interval of one week, the subjects were presented with a list in which their answers to the clues were mixed with the associates and with words not previously presented, and they were required to identify the source of each item (self-generated, presented by the experimenter or new). The psychiatric patients were generally less accurate in identifying the source of the items in comparison with the normal controls. However, hallucinators more often misattributed high cognitive effort self-generated items (answers to difficult clues) to the experimenter than either the psychiatric or the normal controls. The results are interpreted as consistent with the hypothesis that hallucinations are self-generated events misattributed to an external source.

Traditional research designs aimed at elucidating the causes of psychotic phenomena have usually employed psychiatric diagnosis as an independent variable (Sarbin & Mancuso, 1980). In recent years, however, the value of investigating particular behavioural manifestations of psychosis (known as 'symptoms' in the psychiatric literature) has become evident. This is partly because these manifestations are interesting in their own right, and no science of psychopathology can be complete without an account of them (Persons, 1986), but also because persisting doubts about the scientific validity of psychiatric diagnoses (Bannister, 1968; Bentall, Jackson & Pilgrim, 1988) call into question the value of the traditional research paradigm.

Hallucinations are normally considered to be evidence of underlying pathology (Asaad & Shapiro, 1986; Slade & Bentall, 1988) and, in the absence of evidence of physical disorder, are usually classified as first-rank symptoms of schizophrenia (Schneider, 1959). However, there is abundant evidence that a substantial minority of people who consider themselves to be normal, and who have not wished to seek psychiatric advice, have a history of hallucinatory experiences (Bentall & Slade, 1985*a*; Posey & Losch, 1983; Sidgewick, 1894; West, 1948; Young, Bentall, Slade & Dewey, 1987*a*). Furthermore, there is evidence of cultural variation in the frequency and form of hallucination reports in both individuals regarded as normal (Bourguignon, 1970) and those deemed in need of psychiatric help (Al-Issa, 1978; Sartorius *et al.*, 1986).

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A number of variables have been found to influence whether or not a person will hallucinate. The observation that hallucinations occur during periods of stress (Slade, 1972, 1973) is consistent with psychophysiological evidence linking the onset of hallucinations to changes in arousal (Cooklin, Sturgeon & Leff, 1983). There is also evidence that auditory hallucinations are more likely to be experienced under conditions of unpatterned stimulation such as white noise (Margo, Hemsley & Slade, 1980). Suggestions have also been shown to influence the reporting of hallucinations in both normal subjects (Barber, 1970) and hallucinating psychiatric patients (Mintz & Alpert, 1972; Young *et al.*, 1987*b*); as information about what kinds of events are likely to be experienced is presumably encoded in cultural practices and beliefs, this latter observation is consistent with the evidence of cross-cultural differences in hallucination reports.

There have been a number of attempts to provide integrative accounts which explain hallucinatory experiences. Although some authors have suggested that abnormal mental imagery is implicated (Horrowitz, 1975; Sietz & Malholm, 1947), the results of attempts to assess imagery in hallucinators have not yielded consistent findings (Bentall, 1990). The observation that subvocalization accompanies auditory hallucinations (Inouye & Shimizu, 1970; McGuigan, 1966) has led some authors to suggest that abnormalities of inner speech might be involved (F. Johnson, 1979); however, no coherent account of how inner speech abnormalities may cause hallucinations has been proposed and, in any case, such a proposal would only have implications for hallucinations in the auditory modality. A more promising hypothesis suggested by some authors states that hallucinations result from a failure of reality discrimination and occur when internal, private events are misattributed to an external source (Bentall, 1990; Heilbrun, 1980; Hoffman, 1986; Sarbin, 1967). This hypothesis can account for the observed relationship between the occurrence of hallucinations and stress (which may impair the processing of semantic information: Schwartz, 1975), or under conditions of unpatterned stimulation (when the difficulty in discriminating between an internal and an external stimulus will be greater), and why auditory hallucinations are accompanied by subvocalization (which accompanies normal inner speech: McGuigan, 1978).

Although the reality discrimination hypothesis accounts for much of the available data on hallucinations, there have been few attempts to test it directly. From the perspective of signal detection theory the hypothesis leads to the prediction that hallucinators should exhibit increased bias towards detecting external stimuli, but should not differ from controls on measures of perceptual sensitivity. Collicut & Hemsley (1981), using a method of deriving measures of internal noise from Weber fractions, were unable to find differences between hallucinating and non-hallucinating patients, and interpreted their results as indicating that perceptual sensitivity is not implicated in hallucinations. Bentall & Slade (1985*b*) subsequently carried out two auditory signal detection experiments in which both sensitivity and bias were measured – the first comparing 'normal hallucinators' (students scoring highly on a hallucination questionnaire) with normal non-hallucinators, and the second comparing hallucinating and non-hallucinating psychiatric patients. In both experiments the hallucinators differed from their respective controls on the measure of bias but not on the measure of perceptual sensitivity.

The hypothesis also leads to the prediction that hallucinators should perform abnormally on tasks in which they are required to discriminate between memories of their own thoughts and memories of events. When performing on reality-monitoring tasks of this sort, normals are typically more accurate when attributing source to their own thoughts than when attributing source to a perceived event, a finding which M. K. Johnson & Raye (1981) have termed 'the generation effect'. Johnson and her associates have also shown that the failure to discriminate between memories of self-generated events and memories of external events is more likely to occur if the self-generated events are overt rather than covert, i.e. spoken aloud rather than thought (M. K. Johnson, Taylor & Raye, 1977), and less likely to occur if the self-generated events require cognitive effort (M. K. Johnson, Raye, Foley & Foley, 1981).

Heilbrun (1980) carried out the only reality-monitoring study with hallucinators published to date. Hallucinating and non-hallucinating psychiatric patients were asked to identify their own verbatim statements of opinion from a selection of similar statements after a one-week interval. As predicted, the hallucinators performed poorly on this task when compared with the controls. However, only overall accuracy scores were reported and variables known to affect reality-monitoring in normal individuals were not manipulated.

In the study reported here, the reality-monitoring performance of currently hallucinating patients and psychiatric and normal controls was investigated. Reality-monitoring errors were studied for self-generated events presumed to require both high and low cognitive effort. This variable was included in an attempt to determine whether or not hallucinators, like non-hallucinators, are able to use cognitive effort as a cue when discriminating between internally generated and externally generated events. Particular attention was given to the types of errors made by the subjects in the experiment, as it was predicted that, in comparison with the controls, the hallucinating subjects would be more likely to misattribute self-generated items (their thoughts) to an external source.

Method

Subjects

Three groups were studied. The experimental group consisted of 18 male and four female psychiatric patients currently suffering from auditory hallucinations as determined by case notes and an informal interview about the nature of their symptomatology. Most were receiving out-patient treatment at the time of testing and most were receiving neuroleptic medication. All met the criteria for a DSM–IIIR diagnosis of schizophrenia. The mean age of the group was 38.7 years (SD = 11.0).

The psychiatric controls were chosen because their symptoms were in the psychotic domain. They consisted of 11 male and five female patients currently suffering from delusions but who had never been known to suffer from hallucinations as determined by case-note and informal interview data. With the exception of two subjects whose diagnoses were uncertain, all met the DSM–IIIR criteria for either schizophrenia or delusional disorder. The mean age of the group was 39.75 years (SD = 10.03). Most were receiving neuroleptic medication.

Normal controls were also tested; this group consisted of 10 males and 12 females (mean age = 35.4 years, SD = 10.84), mainly nursing staff. There was no significant difference between the mean ages of the three groups ($F(2, 57) = 0.89$, $p = .416$).

Procedure

The procedure used was taken from M. K. Johnson *et al.* (1981). During the presentation phase, the experimenters read the subjects a list of 16 clues, each consisting of a category and a letter, mixed with 16 paired associates, each consisting of a category and a particular. The items were constructed using norms for responses to category cues (Battig & Montague, 1969) so that eight of the clues and eight of the associates generated, or were associated with, low probability responses presumed to require high cognitive effort (e.g. 'Think of a fruit beginning with T...', 'A country – Norway'), and eight of each generated or were associated with high probability responses presumed to require low cognitive effort (e.g. 'Think of a type of dwelling beginning with H...', 'A type of footwear – shoe'). The items were in a pseudo-random order. Subjects were instructed to answer each clue and repeat each associate. If an answer was not provided to a clue within 10 seconds, the experimenter proceeded to the next item. Subjects were eliminated from the study if they failed to generate three or more answers to the clues; in practice, two patients were excluded from the group of hallucinators on these grounds.

Exactly one week after being presented with the items each subject was presented with a surprise source-identification task, in which the experimenter read a list consisting of the answers the subject had supplied to the clues (self-generated items), the 16 associates (previously read to the subject by the experimenter) and eight items not previously presented or generated by the subject. The items were in pseudo-random order and the subjects were required to classify each as self-generated ('mine'), 'given' by the experimenter, or not previously presented ('new'), according to whether and in what form they had occurred during the presentation phase. Subjects were instructed to guess if uncertain.

Source attributions were recorded for each type of item (low probability self-generated, low probability experimenter-generated, high probability self-generated, high probability experimenter-generated and new words). Following the procedure of M. K. Johnson *et al.* (1981), the proportion of each item type attributed to each source was calculated and subsequent analyses were carried out on these proportion scores. This method allowed the inclusion of the data for those subjects who had failed to generate one or two answers to clues.

Results

As already indicated, two subjects were not included in the hallucination group because they failed to generate answers to three or more clues. For the subjects who completed the study, the mean number of clues to which they failed to provide answers, broken down by group, are given in Table 1. Although there was a

Table 1. Mean number of failures to provide answers to clues for hallucinators, psychiatric controls and normal controls

	Hallucinators	Psychiatric controls	Normal controls
Mean	.546	.438	.227
SD	.596	.629	.528

tendency for the psychiatric patients to fail to generate answers more often than the normal controls, no significant difference was observed between the groups in this regard ($F(2, 57) = 1.69$, $p = .193$). Mean scores (proportion of items from each source attributed to each source) for each of the three groups are given in Table 2.

Table 2. Mean scores for hallucinators, psychiatric controls and normal controls

	Attributed source		
Items	Self	Given	New
Hallucinators			
Low prob. self	.49 (.33)	.26 (.24)	.25 (.23)
Low prob. given	.07 (.09)	.35 (.19)	.59 (.22)
High prob. self	.38 (.25)	.31 (.23)	.30 (.22)
High prob. given	.18 (.20)	.35 (.28)	.48 (.24)
New	.10 (.13)	.20 (.20)	.69 (.20)
Psychiatric controls			
Low prob. self	.60 (.25)	.10 (.10)	.29 (.26)
Low prob. given	.05 (.06)	.32 (.25)	.63 (.25)
High prob. self	.34 (.25)	.26 (.21)	.39 (.32)
High prob. given	.08 (.15)	.31 (.29)	.60 (.28)
New	.04 (.08)	.12 (.16)	.84 (.20)
Normal controls			
Low prob. self	.81 (.14)	.08 (.11)	.10 (.12)
Low prob. given	.06 (.08)	.47 (.27)	.47 (.26)
High prob. self	.61 (.23)	.26 (.19)	.13 (.14)
High prob. given	.09 (.14)	.52 (.25)	.39 (.22)
New	.03 (.07)	.22 (.22)	.74 (.22)

Note. Each cell shows the mean proportion of each type of item attributed to each source (standard deviations are given in parentheses).

Many psychiatric and normal subjects anticipated difficulty in recalling the source of items. However, all the subjects were able to complete the source-identification task. Mean recognition accuracies (proportion of items correctly attributed to source) for low and high probability items for each group are shown in Fig. 1. It can be seen that subjects generally performed better on the low-probability items than on the high probability items, and that the normal subjects generally performed better than the psychiatric subjects. A three-way ANOVA [groups × source (self- vs. experimenter-generated) × probability (high vs. low)] was carried out on the proportions of self-generated items (answers to clues) and experimenter-generated items (associates) correctly attributed to source. Significant main effects were found for group ($F(2,57) = 14.32$, $p < .001$), accounted for by the relatively poor performance of both psychiatric groups; for high vs. low probability items ($F(1,57) = 14.29, p < .001$), confirming that recognition was easier for all subjects on the high cognitive effort items; and for source ($F(1,62) = 13.79$, $p < .001$), confirming the generation effect in all subjects. There was also a significant interaction between source and cognitive effort ($F(1,57) = 18.89$, $p = .001$). Inspection of the data revealed that this was because self-generated items were more likely to be correctly

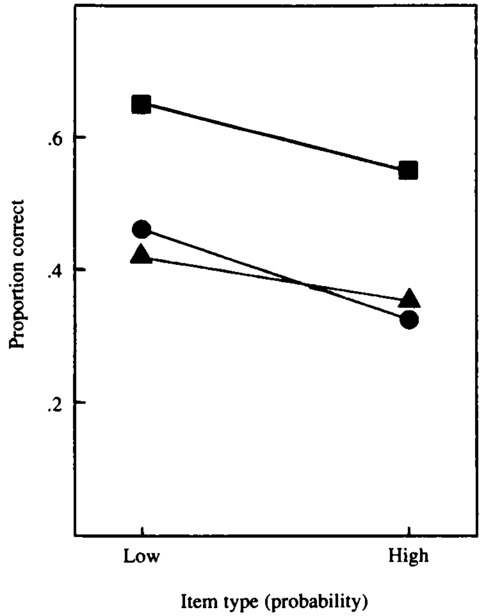

Figure 1. Proportion of items (self- and experimenter-generated combined) correctly attributed to source after one week. Scores for low and high probability items are shown separately. ▲——▲, hallucinators; ●——●, psychiatric controls; ■——■, normals.

attributed to source if they required cognitive effort, whereas little difference was observed in the correct identification of the low probability and high probability associates. As no interactions involving the groups factor were significant, these findings replicate those obtained by M. K. Johnson *et al.* (1981) with normal subjects.

A second analysis focused on the type of errors made by the subjects, as it was predicted that hallucinators would excessively attribute self-generated items to the experimenter (i.e. mistake their own answers to clues for associates read out to them). The relevant data are shown in Fig. 2. A two-way ANOVA (group × high vs. low probability items) was carried out on the proportion of errors of this type. Although there was a tendency for the hallucinators to make more errors of this type overall, the main group effect just failed to reach significance ($F(2, 57) = 2.51, p = .063$). The high vs. low probability main effect was significant ($F(1, 57) = 36.67, p < .001$) and the interaction also reached significance ($F(2, 57) = 3.62, p = .003$). Tests for simple effects showed that both control groups (p at least $= .001$) but not the hallucinators ($p = 0.22$) made less self-to-experimenter misattributions on the low probability items than on the high probability items, and that the hallucinators made significantly more self-to-experimenter misattributions than the controls on these items ($p < .001$).

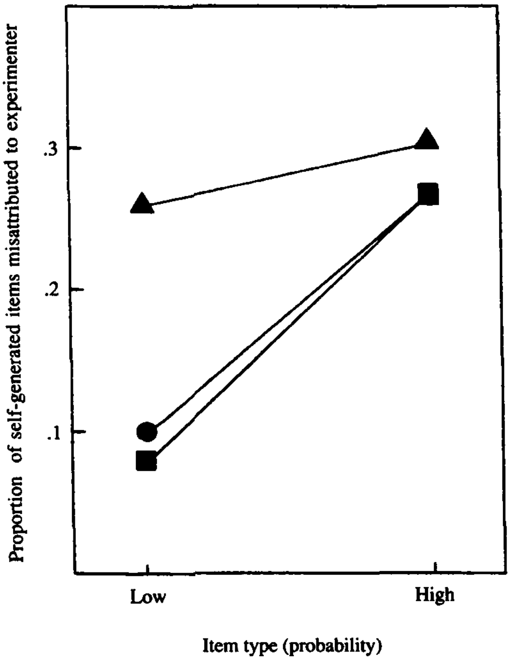

Figure 2. Proportion of self-generated items (answers to clues) incorrectly attributed to the experimenter after one week. Scores for low and high probability items are shown separately. ▲——▲, hallucinators; ●——●, psychiatric controls; ■——■, normals.

Discussion

In this study an attempt was made to assess hallucinating and control subjects on a reality-monitoring task, which required subjects to discriminate between self-generated events (thoughts) and events generated by the experimenter. It was predicted that hallucinators would exhibit specific impairments on this task and, in particular, would misattribute more of their thoughts (the answers supplied to the clues in the presentation phase) to the experimenter than the control subjects.

The findings of M. K. Johnson *et al.* (1981) were broadly replicated in that all subjects demonstrated greater accuracy when discriminating the source of low probability as opposed to high probability items. This result is consistent with the hypothesis that cognitive effort is used as a cue when a subject determines whether a stimulus is self-generated or external to themselves. The generation effect was also replicated: all subjects were more accurate when determining the source of their own answers to the clues than when determining the source of the experimenter-presented associates. The discovery of an interaction between source and low vs. high probability items was to be expected as cognitive effort is only likely to be a factor in the identification of self-generated items. No difference was found between the hallucinators and the psychiatric controls in the overall accuracy with which they were able correctly to attribute previously self-generated and experimenter-presented words to source.

On first examination, this result is disappointing as it implies that hallucinators are no more impaired than non-hallucinating psychotic patients in their ability to discriminate between self-generated events and external stimuli. However, when the errors made by the subjects were examined, the hallucinators attributed more self-generated high cognitive effort words to the experimenter than the psychiatric or normal controls. This observation supports the hypothesis that hallucinators, when uncertain about the source (internal or external) of a perceived event, have a bias towards attributing that event to a source external to themselves. This is therefore consistent with the signal detection results of Bentall & Slade (1985*b*).

In response to these findings, it might be objected that the results reflect general cognitive impairment, rather than a specific reality-monitoring abnormality in the hallucinators. However, were this so, comparable overall accuracy scores for the hallucinators and the non-hallucinating psychiatric controls would not have been expected. The results show that, on the particular reality-monitoring task employed, hallucinators in comparison with non-hallucinating psychiatric patients produce a specific pattern of errors predicted by the hypothesis that hallucinations are thoughts misattributed to an external source.

A more serious difficulty of interpretation is posed by the fact that the observed attributional bias was only significant for the low probability/high cognitive effort items. It might be argued that the fact that a difference between hallucinators and controls was found only for the high cognitive effort items is evidence that the hallucinators failed to use effort as a cue when determining the source of their experiences. However, it must be noted that the hallucinators, like the controls, made more errors overall on the high probability items. It is therefore possible that the failure to obtain a significant difference between hallucinators and non-hallucinators on the low cognitive effort items is a statistical artifact caused by the high number of errors made by all subjects on these items. It is notable that there was a non-significant tendency for the hallucinators to make more self-to-experimenter misattributions even on the high probability items, and that the group main effect of the ANOVA carried out on the misattribution data approached significance, Further research is clearly required to explore in more detail the role of cognitive effort in the hallucinator's decision about the source of experiences.

It seems likely that the reality-monitoring performance of hallucinators will be affected by a number of variables, both at presentation and at recognition. For example, given that auditory hallucinations are more likely to occur under conditions of noise (Margo *et al.*, 1981), it seems probable that the addition of random noise at the presentation stage would increase error rates at testing and so increase the opportunities for hallucinators to misattribute self-generated items to an external source. The manipulation of presentation and test variables in reality-monitoring tasks is therefore likely to prove a useful way of studying the cognitive processes involved in hallucinations.

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