Psychological Bulletin
1990, Vol. 107, No. 1, 82-95

0033-2909/90/$00.75

The Illusion of Reality: A Review and Integration of Psychological Research on Hallucinations

R. P. Bentall
Sub-department of Clinical Psychology, Department of Psychiatry, New Medical School, Liverpool, England

Hallucinations are among the most severe and puzzling forms of psychopathology. Although usually regarded as first-rank symptoms of schizophrenia, they are found in a wide range of medical and psychiatric conditions. Moreover, a substantial minority of otherwise normal individuals report hallucinatory experiences. The purpose of this article is to review the considerable research into the cognitive mechanisms underlying (particularly psychotic) hallucinations that has been carried out and to integrate this research within a general framework. The available evidence suggests that hallucinations result from a failure of the metacognitive skills involved in discriminating between self-generated and external sources of information. It is likely that different aspects of these skills are implicated in different types of hallucinatory experiences. Further research should focus on specific metacognitive deficits associated with different types of hallucinations and on treatment strategies designed to train hallucinators to reattribute thoughts to themselves.

Although first differentiated from other disorders of perception by Esquirol (1832), hallucinatory experiences have been referred to in medical texts since Biblical times (Preuss, 1975). One author has claimed that hallucinations may have been more common in the distant past and has argued that the gods of the ancient Greeks were hallucinatory (Jaynes, 1979). In more recent times, hallucinations have been viewed as exclusively pathological phenomena, although this opinion has become widely accepted at least in part because "Since the 1920s textbooks of general psychology have differentiated hallucinations from errors of perception by the simple expedient of locating them in separate chapters" (Sarbin & Juhasz, 1967, p. 353).

Attempts to define the distinctive features of hallucinations have drawn attention to the variety of hallucinatory phenomena and the difficulty in distinguishing between these phenomena and other normal or abnormal mental states. For Esquirol (1832, p. 7), the person hallucinating "ascribes a body and an actuality to images that the memory recalls without the intervention of the senses." This idea has been retained in subsequent definitions. The *Diagnostic and Statistical Manual for the Mental Disorders: Third Edition, Revised* (*DSM-III-R;* American Psychiatric Association [APA], 1987), for example, defines a hallucination as a "sensory perception without external stimulation of the relevant sensory organ" (p. 398). However, some qualification has become necessary. Thus, *DSM-III-R* observes that, although hallucinations may have the immediate sense of reality of true perceptions, "In some instances the source of the hallucination may be perceived as within the body (e.g. an auditory hallucination may be experienced as coming from within the head rather than through the ears)" (p. 398). Some authors have attempted to differentiate between different types of hallucinatory experiences, reserving the name *true hallucination* for those experiences that are perceived as real and outside the body and the term *pseudohallucination* to denote either hallucinationlike experiences perceived as occurring within the body (Jaspers, 1911) or hallucinationlike experiences known to be nonveridical by the percipient (Sedman, 1966). As Kraupl-Taylor (1981) has pointed out, these two uses of the term *pseudohallucination* may become confused. Furthermore, the clinical significance of these distinctions remains to be established (APA, 1987). For these reasons, Slade and Bentall (1988, p. 23) have advocated a broader definition of hallucination, namely, "any percept-like experience which (a) occurs in the absence of an appropriate stimulus, (b) has the full force or impact of the corresponding actual (real) perception and (c) is not amenable to direct and voluntary control by the experiencer." This definition has a number of advantages. First, as some hallucinatory experiences are more likely to occur when the percipient is exposed to certain kinds of stimulation (see following sections), this definition requires only the absence of *appropriate* stimulation. Second, the definition draws attention to the fact that most hallucinatory phenomena are experienced as being beyond the percipient's control. Finally, by defining hallucinations as perceptlike experiences that have the full force of an actual perception, the definition draws attention to the illusion of reality that is the sine qua non of all hallucinatory experiences, while at the same time avoiding the apparently self-contradictory notion of a sensory perception without a stimulus (appropriate or otherwise).

There can be no doubt that hallucinations are sometimes associated with physical disorders such as progressive sensory loss (causing "release hallucinations"; cf. Hammeke, McQuillen, & Cohen, 1983; T. Miller & Crosby, 1979; Ross, 1978) and a variety of medical and neurological conditions (Asaad & Shapiro, 1986; Slade & Bentall, 1988). In one study, Hall, Popkin, and Faillace (1978) carried out careful medical and biochemical examinations on more than 650 psychiatric admissions and esti-

Correspondence concerning this article should be addressed to R. P. Bentall, Sub-department of Clinical Psychology, Department of Psychiatry, New Medical School, Ashton Street, Post Office Box 147, Liverpool L69 3 BX, England.

mated that in 9.1% of the cases the symptoms experienced by the patients were a consequence of medical disorder. Of these, 18% presented with auditory hallucinations and a further 12% presented with visual hallucinations. In a more recent study along similar lines, Johnstone, MacMillan, and Crowe (1987) examined 268 cases of first-episode schizophrenia as defined by Present State Examination criteria. Of these, 15 patients (5.6%) were found to suffer from organic disorders. Ten of these patients were found to suffer from auditory hallucinations, 6 of whom also experienced nonauditory (visual, olfactory, gustatory, or tactile) hallucinations. No patients were found who experienced nonauditory hallucinations in the absence of auditory hallucinations.

When no clear evidence of physical pathology is present, hallucinations are usually considered first-rank symptoms of schizophrenia (K. Schneider, 1959). It has been estimated that more than 70% of those diagnosed as suffering from a core schizophrenia psychosis experience hallucinations (Sartorius, Shapiro, & Jablensky, 1974). However, hallucinations have also been reported in association with a number of other psychiatric diagnoses, such as the affective psychoses (Goodwin, Alderson, & Rosenthal, 1971) and mania (Taylor & Abrams, 1975). Although phenomenological data clearly indicate that the hallucinations experienced by schizophrenic patients are usually in the auditory modality (Sartorius et al., 1974), the best available evidence suggests that modality is a relatively poor predictor of diagnosis (Goodwin et al., 1971; Lowe, 1973). Not surprisingly, therefore, the importance of the apparent association between hallucinations and schizophrenia has been questioned by some authors, either because hallucinations are present in such a wide range of medical and psychiatric conditions (Asaad & Shapiro, 1986) or because of general doubts about the scientific validity of the schizophrenia concept (Bentall, 1986; Bentall, Jackson, & Pilgrim, 1988; Sarbin & Manusco, 1980). On the latter point, for example, Bentall et al. (1988) have reviewed the available psychiatric data on the symptoms, course, and outcome of psychotic disorders and have concluded that there is no evidence that the diagnosis of schizophrenia identifies a meaningful syndrome distinct from other psychotic states. One implication of this analysis is that particular symptoms rather than syndromes should be the focus of research into psychopathology, a view shared by other authors (e.g., Persons, 1986).

Some authors have questioned whether hallucinations need always be considered indicative of pathology, either mental or physical. Galton (1880) argued that there exists a continuum between normal mental imagery and hallucinations. Consistent with this hypothesis, Strauss (1969) observed that many psychiatric patients present with experiences intermediate between normal images and hallucinations. Psychometric data also provide evidence for such a continuum. Launay and Slade (1981), in research designed to develop and validate a scale measuring disposition toward hallucination (the Launay–Slade Hallucination Scale, or LSHS), found a significant relation between reports of hallucinations and reports of vivid but nonpathological experiences (e.g., vivid daydreams).

Further evidence that hallucinations need not always be considered indicative of pathology comes from cross-cultural studies that suggest that hallucinations may be a relatively common and positively valued experience in some societies (Al-Issa, 1978, 1979; Bourguignon, 1970; McDonald & Oden, 1977). The importance of culture in hallucinations is also suggested by studies that show a substantial geographical and historical variation in the type and incidence of hallucinations reported to psychiatrists (Al-Issa, 1978, 1979). For example, a recent study carried out by the World Health Organization showed a greater incidence of visual hallucinations among first-admission psychotic patients in developing nations than among similar patients in developed countries (Sartorius et al., 1986). An analysis of psychiatric records from Vienna also indicated a greater incidence of visual hallucinations reported to European psychiatrists in the past than at present (Leinz, 1964).

Even when large numbers of people from the developed nations have been questioned, approximately 10% have reported experiencing hallucinations (Bentall & Slade, 1985b; McKellar, 1968; Posey & Losch, 1983; Sidgewick, 1894; D. West, 1948; Young, Bentall, Slade, & Dewey, 1986). Furthermore, a small minority of normal subjects will report hallucinatory experiences following simple suggestions (Barber, 1970; Barber & Calverley, 1964; Bowers, 1967; Spanos & Barber, 1968); it is notable that these results have been obtained in the absence of elaborate hypnotic induction procedures. Given the doubts that this kind of evidence raises about the pathognomic status of hallucinations, it seems reasonable to regard them as objects of research in their own right, rather than as mere symptoms of various types of mental or physical disorder.

Any scientific theory of hallucinations must explain the experiences of the hallucinator in terms of underlying cognitive mechanisms and the variables that affect those mechanisms. During the past 2 decades in particular, a considerable amount of data have been collected pertaining to this problem. In the remaining sections of this article, I review and integrate this evidence.

The scope of this review and attempted integration is limited to the hallucinations reported by psychiatric patients and normal subjects; data pertaining to organically based hallucinations, particularly those elicited by alcohol or drugs, are largely excluded. This is because the relation between such hallucinations and the hallucinations experienced by normal or psychotic individuals is unclear on both phenomenological (Siegel & Jarvik, 1975) and etiological grounds (Slade & Bentall, 1988); moreover, most of the evidence collected on organic hallucinations is of a biochemical nature, and little relevant cognitive data are available at present.

I argue that the available research findings on psychiatric and normal hallucinations can be accounted for within a model that makes reference to recent findings about metacognitive processes in normal individuals. Before presenting the model, however, I examine some of the relevant evidence and consider some theories of psychotic hallucination that have already been proposed by other authors.

Variables Affecting Hallucination

Any model of psychotic hallucinations must explain the relation between hallucinatory experiences and any variables that are known to influence their occurrence. A number of variables have in fact been found to affect the probability that an individual will hallucinate. Slade (1976b) proposed a functional analy-

sis of hallucinations that identified four such variables: psychological stress, degree of hallucinatory predisposition, environmental stimulation, and reinforcement.

Stress-Induced Arousal

A number of authors have pointed to the role of stress-induced arousal in psychosis. Birley and Brown (1970) found a significant association between stressful life events and schizophrenic breakdown, a result generally replicated in subsequent studies, although J. Rabkin (1980) has noted a number of methodological weaknesses in this kind of work. The role of interpersonal stress in the form of familial expressed emotion has also been emphasized in studies of schizophrenic relapse (Barrowclough & Tarrier, 1984; Leff, Kuipers, Vaughn, & Sturgeon, 1983; Vaughn & Leff, 1976). Not surprisingly, there is evidence linking hallucinatory experiences to specific stressful events such as loss of a spouse (Alroe & McIntyre, 1983; Matchett, 1972; Reese, 1971; Wells, 1983) and potentially life-threatening situations, for example, mining accidents (Comer, Madow, & Dixon, 1967), sustained military operations (Belensky, 1979), and terrorist attacks (Siegel, 1984). The importance of ongoing moderate stress has also been highlighted by case studies of hallucinating psychiatric patients (Slade, 1972, 1973). Consistent with these observations, experimental evidence suggests that the onset of hallucinations may be associated with stress-induced arousal. Allen and Argus (1968) found that they could induce hallucinations in patients through hyperventilation. Toone, Cooke, and Lader (1981) found that hallucinating patients had higher levels and greater fluctuations of skin resistance than did controls. More recently, Cooklin, Sturgeon, and Leff (1983) were able to demonstrate a direct relation between changes in skin conductance and the onset of hallucinations.

Predisposing Factors

Evidence pertaining to a specific predisposing constitution is more ambiguous, although there clearly are individual differences in vulnerability to hallucinations. Although psychotic traits are often regarded as being under partial genetic control (Gottesman & Shields, 1982), some recent reviews have questioned the validity of the relevant twin- and adoption-study evidence (Lidz & Blatt, 1983; Lidz, Blatt, & Cook, 1981; Marshall, 1984; Rose, Kamin, & Lewontin, 1984). Berenbaum, Oltmanns, and Gottesman (1985) have advocated research into the genetics of specific symptoms as a way of resolving these disputes. However, the only attempt to do this with respect to hallucinations, involving the examination of psychotic monozygotic quadruplets (Rosenthal & Quinn, 1977), is unconvincing because of the anecdotal nature of the evidence and because environmental factors might account for the symptoms reported.

Research gives at least some indication that intellectual deficits, particularly with respect to descriptive language skills, may be associated with vulnerability to hallucinations (Heilbrun & Blum, 1984; R. L. Johnson & Miller, 1965; M. K. Miller, Johnson, & Richmond, 1965), although the possibility that verbally unsophisticated individuals are sometimes misdiagnosed as hallucinating cannot be ruled out (Sarbin, 1967; R. Rabkin, 1970). Not surprisingly, the Psychoticism (*P*) scale of the Eysenck Personality Inventory has been found to correlate with vulnerability to hallucinations as assessed clinically (Ramamathan, 1982; Slade, 1976a) and by means of a questionnaire (Launay & Slade, 1981), although the latter result has not been replicated with the revised (and less overtly psychotic) *P* Scale of the Eysenck Personality Questionnaire (Young et al., 1986). However, an association between hallucinations and the Neuroticism (*N*) scale of the Eysenck Personality Questionnaire has been established in both clinical (Ramamathan, 1986) and normal (Bentall, Claridge, & Slade, 1989; Young et al., 1986) populations. As Claridge and Broks (1984) have pointed out, the reporting of psychotic experiences such as hallucinations might be expected to reflect the kind of emotional instability measured by the *N* Scale.

A possible relation between hallucinations and responsiveness to suggestions has been explored by a number of investigators. Sarbin, Juhasz, and Todd (1971), in an early study of this type, found hallucinating psychiatric patients to be less responsive to suggested taste and auditory stimuli than were psychiatric or normal controls. However, subsequent research has generally indicated that hallucinators are more responsive to suggestions than nonhallucinators. Mintz and Alpert (1972) found hallucinators to be more responsive to Barber and Calverley's (1964) "White Christmas" test (subjects are asked to close their eyes and listen to a recording of "White Christmas," which is not in fact played), a result replicated by Young, Bentall, Slade, and Dewey (1987). Alpert (1985) also found hallucinators to be more responsive than controls when given suggestions to hear voices while listening to white noise. Jakes and Hemsley (1986) found a significant association between the Launay–Slade Hallucination Scale scores of normal individuals and their responsiveness to suggestions to see objects in a visual noise (random-dot) display. Whether hallucinators are highly suggestible for all kinds of tasks or are only suggestible in the domain of perceptual judgment remains questionable. In a poorly controlled study, Bliss, Larson, and Nakashima (1983) reported that 60% of a sample of hallucinating patients made excellent hypnotic subjects. On the other hand, Young et al. (1987), using standardized measures of hypnotic and interrogative suggestibility, found no difference either between hallucinating and nonhallucinating psychiatric patients or between normal subjects scoring high or low on the Launay–Slade Hallucination Scale.

A final area of research indicating factors that may predispose individuals to hallucinations involves the use of cognitive measures. Although much of this literature pertains to specific theories and is therefore described later, the work of Heilbrun and his colleagues must be considered in the present context. Hypothesizing that hallucinators misattribute self-generated experiences to an external agent, Heilbrun (1980) argued that they should be relatively poor at recognizing their own thoughts. Hallucinating and nonhallucinating psychiatric patients were asked to identify their own verbatim statements of opinion from a selection of similar statements after a 1-week interval. As predicted, the hallucinators performed poorly on this task when compared with controls. In a second study, Heilbrun, Blum, and Haas (1983) investigated the ability of hallucinating and nonhallucinating subjects to detect the spatial location of sounds; hallucinating patients diagnosed as reactive (but

not process) schizophrenics were significantly impaired on this task when compared with controls. Subsequently, Heilbrun and Blum (1984) required subjects to guess the meaning of monosyllabic words spoken against decreasing levels of white noise; hallucinators responded rapidly on this task, but made more errors than controls. This result is particularly interesting, as it is consistent with results obtained in other studies. Mintz and Alpert (1972) found a poor relation between hallucinating patients' accuracy when listening to voices against white noise and their confidence in their judgments. More recently, Alpert (1985) found that hallucinators were inappropriately confident when guessing the contents of brief phrases played through a low-pass filter. Finally, S. Schneider and Wilson (1983) found that auditory hallucinators showed fast reaction times on a simple auditory discrimination task in comparison with psychotic patients who were not hallucinating. Taken together, these results indicate that hallucinators make rapid and overconfident judgments about the nature of their perceptions. On a simple task such as that used by Schneider and Wilson, this is not at the expense of accuracy; however, on more complex verbal tasks, such as that used by Heilbrun, accuracy may suffer.

In a final, less-satisfactory study, Heilbrun, Diller, Fleming, and Slade (1986) investigated disattentional strategies (means of avoiding aversive stimulation) in schizophrenics who were either process hallucinators, reactive hallucinators, or nonhallucinating (reactive and process combined). Subjects listened to a series of adjectives on a tape while assigned to one of three conditions: switching (concentrating on a visual stimulus), holding (concentrating on the first word on the tape and ignoring all subsequent words), or control (no disattentional strategy). The efficacy of the two disattentional strategies was later assessed by using a recognition task; it was assumed that subjects who successfully avoided attending to the adjectives on the tape would find it more difficult to recognize them on subsequent testing. A Condition × Groups interaction was found to be significant, with recognition most impaired by the switching strategy in the case of the process hallucinators and by the holding strategy in the case of the reactive hallucinators. Heilbrun et al. suggested that the efficacy of these strategies may reflect the extent to which patients use them in everyday life. Thus, according to this argument, some schizophrenics (process) tend to avoid aversive auditory stimulation by attending to other modalities, whereas others (reactives) tend to focus exclusively on some portions of the auditory input to the exclusion of others. Heilbrun et al. further argued that both strategies may result in increased vulnerability to hallucinations. Thus, it was argued that increased attention to the visual modality at the expense of the auditory modality might result in a lack of familiarity with the sensory properties of lexical thought, leading to a failure to recognize thoughts as thoughts. On the other hand, reactive schizophrenics, according to this argument, would be more likely than nonschizophrenics to perceive their thoughts as real because their increased attention on their lexical thoughts would make those thoughts seem more real. Unfortunately, although the control group of nonhallucinating schizophrenics showed no significant effects as a result of either disattentional strategy, the fact that they were patients of both reactive and process premorbid status prevents the drawing of firm conclusions; differences in performance may have reflected process versus reactive status rather than the presence or absence of hallucinations. Moreover, this theory has the unparsimonious (although by no means impossible) implication that hallucinations have different cognitive causes in different subgroups of schizophrenics. Nonetheless, further research in this area is clearly warranted.

Environmental Stimulation

In several of the studies described in the preceding section, relative sensory isolation in addition to stress appeared to precipitate hallucinations (Comer et al., 1967; Siegel, 1984). Research into sensory deprivation also gives grounds for hypothesizing an association between hallucinations and environmental stimulation, although it now seems clear that the reporting of hallucinations during sensory deprivation is influenced by suggestion (Jackson & Kelley, 1962; Schaefer & Bernick, 1965) and was overemphasized by early researchers (Slade, 1984; Zuckerman, 1969). The phenomenon of release hallucinations, observed during progressive but incomplete sensory loss, also implicates reduced stimulation in hallucinatory experiences (Hammeke et al., 1983; White, 1980).

Experimental evidence indicates a quite complex relation between environmental stimulation and the onset of hallucinations. Slade (1974) required two hallucinating subjects to shadow aurally presented sequences of letters and found that the frequency with which hallucinations were reported decreased as an orderly function of the rate at which the letters were presented. Auditory hallucinations were also reported less frequently during reading and (to a lesser extent) writing conditions. In a subsequent study, Margo, Hemsley, and Slade (1981) exposed seven hallucinating subjects to various conditions of auditory stimulation (including passages of prose judged to be boring or interesting, passages in a foreign language, music, and completely meaningless sounds). The rate at which hallucinations were reported decreased as the stimuli the subjects attended to became more meaningful. However, the rate of hallucinating *increased* during periods of sensory restriction or white noise. It is interesting to note that this effect of white noise appears to depend on the level of stimulation that the individual is exposed to. Fonagy and Slade (1982) found that hallucinations may be suppressed by high levels of white noise, and Alpert (1985) similarly noted that hallucinators experienced more hallucinations when exposed to moderate but not high levels of white-noise stimulation. These results are also consistent with recent data collected by Tarrier (1987), who questioned hallucinating and deluded patients about the antecedents of their symptoms. Social isolation and specific stimuli such as traffic noise were both reported as antecedents by some patients.

Reinforcement

The fourth variable hypothesized by Slade (1976b) to affect hallucinations was reinforcement. Consistent with this hypothesis, subjects in two case studies reported a reduction of anxiety following their hallucinations (Slade, 1972, 1973). On the other hand, Tarrier (1987) found that 18 out of 25 of his schizophrenic subjects reported feeling more disturbed following episodes of hallucinations or delusions than beforehand. Of

course, hallucinations may have different consequences for different patients. Interestingly, either an increase or a decrease in anxiety might be expected to lead to a persistence of hallucinations, the former because of the effects of increased arousal on hallucinations, the latter by means of the mechanism of reinforcement. Although the manipulation of contingencies has formed part of several successful treatment programs with hallucinating patients (Anderson & Alpert, 1974; Davis, Wallace, Liberman, & Finch, 1976; Haynes & Geddy, 1973; Heron & de Armond, 1978; Nydegger, 1972), the naturalistic contingencies governing these experiences remain a relatively neglected area of research.

One problem confronted by the investigator interested in this issue concerns the nature of the reinforcement that might affect hallucinating. Although behavior modifiers have usually been conceived of as reinforcement in terms of some kind of social consequence for the patient (e.g., attention from others), it is possible that much more complex consequences of hallucinations are reinforcing. One implication of the work of Heilbrun et al. (1986) on disattention is that hallucinators may find cognitive strategies that lead to hallucination reinforcing because such strategies allow the patient to avoid aversive stimulation. Some psychodynamic theorists, after Freud (1924), have drawn attention to the similarity between hallucinations and dreams, and have suggested that both express wishes that ordinarily may be unacceptable to the conscious mind. The fact that clinically observed hallucinations often express a particular theme (often hostile to the sufferer) certainly suggests that motivational issues may be important in their causation. Although there have been no empirical studies to date that address this issue, Forgus and DeWolfe (1969) found that hallucinators required to remember brief stories more readily recalled themes relating to their voices than they did neutral themes, suggesting that the contents of the hallucinations reflect dominant psychological concerns. The possible functional significance of hallucinations for the hallucinator is clearly a topic worthy of further investigation.

Mechanisms of Hallucination

A convincing theory of hallucination should not only specify variables that influence its occurrence, but should also explain the mechanisms that underlie the hallucinatory experience itself. A variety of psychological theories have been proposed in this respect. Such theories can be grouped under the rough taxonomy of conditioning theories, cognitive seepage theories, imagery theories, and subvocalization theories.

Conditioning Theories

Although evidence that hallucinations are maintained by *operant* reinforcement is lacking, a number of authors have proposed that hallucinations may result from a history of *classical* (Pavlovian) conditioning (Hefferline, Bruno, & Camp, 1971). Early studies by Seashore (1895) and Ellson (1941) used a procedure in which a classical conditioning paradigm was disguised as a perceptual task: The conditioned stimulus was described as a warning tone and the unconditioned stimulus was a near-threshold stimulus that the subject had to attempt to describe. Subjects exposed to this procedure reported the unconditioned stimulus on most of the trials on which it had been omitted. Hefferline et al.'s own procedure was somewhat different and less convincing because it was originally designed to demonstrate conditioning to a covert stimulus. Subjects were presented with a tone whenever they produced a covert thumb-twitch as monitored by an electromyograph. On hearing the tone, the subjects were required to press a key. When the tone was omitted, a fractional response of the muscles in the key-pressing finger was generally recorded. Given that the covert key-press could be regarded as a nonverbal report of the tone elicited by the thumb-twitch, Hefferline et al. argued that the subjects could be said to have hallucinated the tone; this is indeed what subjects reported at the end of the experiment.

More recent evidence that might be held to support a classical conditioning model of hallucinations has been collected by Davies and his colleagues, who were able to condition afterimages (Davies, 1974a, 1974b, 1976) and subsequently more complex visual sensations (Davies, Davies, & Bennett, 1982) in college students. Whether psychotic hallucinations can be accounted for in terms of conditioning theory seems doubtful, however. On the one hand, a conditioning model gives no indication of why hallucinations should vary with stress or environmental noise. On the other hand, research indicates that higher cognitive processes usually play a role in human classical conditioning and that responding is heavily influenced by subjects' expectancies about the experiment (Brewer, 1974).

Seepage Theories

A number of authors have proposed that hallucinations result from the seepage of normally preconscious material into consciousness. This hypothesis has mainly been inspired by research into sensory deprivation. Thus L. J. West (1962, 1975), basing his theory on the neurologist Hughlings Jackson's proposal that insanity might result from the elimination of disinhibitory processes, suggested that the reduction of sensory input controlling conscious scanning might lead to the release of engrams relating to memory, thought, imagination, or fantasy. As West argued that conscious scanning would be impaired by abnormally high or low levels of cortical arousal (regulated by the ascending recticular activating system), he was therefore able to draw a parallel between hallucinations and dreaming while at the same time maintaining that psychotic hallucinations might result from overarousal. A theory similar to West's was more recently proposed by Frith (1979), who suggested that all schizophrenic symptoms result from disorders of consciousness. Frith's account followed Shallice's (1972) argument that consciousness could be considered a limited-channel-capacity processor with executive functions. In this view, the perception of a stimulus begins with the generation of preconscious "hypotheses" that are progressively filtered out until only the most likely hypothesis reaches consciousness. According to Frith, hallucinations might result when inappropriate hypotheses generated during auditory perception are not filtered out. A general problem with this kind of theory is that it suggests a model in which consciousness is simply a kind of box into which information may or may not flow. Furthermore, whereas West's theory suggests that hallucinations will occur during pe-

riods of low environmental stimulation, Frith's theory implies that stimulation will lead to an increase in the rate at which hallucinations are experienced, as it is under such circumstances that perceptual hypotheses are generated. Both these predictions appear too simple when compared with the observed relations between hallucinations and environmental stimulation that have been described.

Imagery Theories

Sietz and Malholm (1947) proposed that hallucinations might be the result of abnormally vivid mental imagery, a theory developed further by Mintz and Alpert (1972), who argued that defective reality testing was also required for hallucinations to occur. More recently, Horrowitz (1975) proposed that hallucinators might suffer from an imagery deficit, causing them to misattribute occasional vivid images to an external source. In attempts to find evidence for these theories, various types of imagery measures have been used to compare hallucinating and nonhallucinating psychiatric patients. The results of these endeavors have been inconsistent. Attempts to assess the preferred mode of imagery of hallucinators by questionnaire have produced conflicting findings (Cohen, 1938; Heilbrun et al., 1983; Roman & Landis, 1945; Sietz & Malholm, 1947; Snyder & Cohen, 1940), as have studies attempting absolute measures of imagery vividness (Brett & Starker, 1977; Catts, Armstrong, Norcross, & McConaghy, 1980; Slade, 1976a). Mintz and Alpert's attempt to address this issue by using the Barber and Calverley "White Christmas" test is difficult to interpret; although clear differences were found between the hallucinating and nonhallucinating subjects, with the hallucinators more readily reporting hearing the record and believing that it had been played, it is not clear that this result reflects differences in imagery as opposed to other possibly relevant variables such as suggestibility. The general failure to find a clear association between hallucinations and imagery vividness is not surprising when viewed in the light of research into normal mental imagery. As Neisser (1967) has observed, hallucinations sometimes seem very difficult to perceive to the patients who suffer from them, whereas individuals may experience very vivid mental images that they do not regard as real. In addition, recent research has indicated that questionnaire measures of imagery vividness may not be valid indicators of underlying cognitive processes and has challenged the view that imagery can be regarded simply as some kind of internal picture (Evans, 1980; Kosslyn, 1983; Pylyshyn, 1973). Future research into the relation between hallucinations and mental imagery is more likely to be informative if it uses nonphenomenological measures of imagery. For example, it would be interesting to study the performance of visual hallucinators on the kinds of mental rotation tasks used by Shepard and Metzler (1971) with normal subjects.

Subvocalization Theories

A fourth line of theorizing about hallucinations attempts to establish a link between auditory hallucinations and subvocalization. There is convincing evidence that "inner speech" is often, although perhaps not always, accompanied by subvocalization (Cacioppo & Petty, 1981; Garrity, 1977; McGuigan, 1978; Sokolov, 1972). In a series of studies, Gould (1948, 1949, 1950) was able to show that auditory hallucinations are also accompanied by subvocalization, a result replicated in subsequent investigations (P. Green & Preston, 1981; Inouye & Shimizu, 1970; McGuigan, 1966). However, attempts to explain this association have been unconvincing. Jaynes (1979) and P. Green, Hallett, and Hunter (1983) have proposed that auditory hallucinations reflect a defect in the interhemispheric transfer of information, so that "voices" originating in the right hemisphere (in right-handed patients) find expression via subvocalization mediated through the speech motor areas of the dominant hemisphere. As evidence that hallucinations may result from a disorder of hemispheric organization, Green pointed to his own research, which suggested that schizophrenics (not selected on the basis of hallucinations) show a left ear deficit on auditory perception tasks (P. Green & Kotenko, 1980). Green et al. made the further prediction that hallucinations would be reduced by placing an ear plug in the nondominant ear, thus blocking auditory input to the nondominant hemisphere. In fact, the rationale for such ear-plug therapy is far from clear and attempts to test it have not provided support for Green's theory (Done, Frith, & Owens, 1986; James, 1983; Morley, 1987), as successful results do not seem to have been specific to the nondominant ear. Moreover, Green's theory is not consistent with the limited neuropsychological data on auditory hallucinations. For example, Bahzin, Wasserman, and Tonkongii (1975) observed abnormally high *right*-ear tone thresholds in association with auditory hallucinations in schizophrenic patients. Similarly, Babkoff, Sutton, Zubin, and Har-Evan (1980) measured right-ear tone thresholds in a group of psychiatric patients and found that hallucinators had higher thresholds for very short-duration tones (but not long-duration tones) in comparison to other subjects. More recently, Stevens and Livermore (1982), using telemetered electroencephalograph measures, noted a significant association between auditory hallucinations and suppression of left temporal lobe alpha waves (indicating left temporal lobe activation).

In another attempt to explain the apparent link between subvocalization and hallucinations, F. Johnson (1979) proposed that hallucinators may suffer from an impairment of the neurological mechanisms involved in inner speech. The data on right-ear auditory perception deficits collected by Bahzin et al. (1975) and Babkoff et al. (1980), referred to earlier, provide some tentative support for this hypothesis, as they suggest that there may be abnormalities of the left hemisphere speech-processing regions of the brains of hallucinators. In another study that may have some bearing on this issue, McKay, Golden, and Scott (1981) gave the Luria-Nabraska neuropsychological battery to different groups of psychiatric patients and found that only those suffering from auditory hallucination showed evidence of left frontal lobe impairment.

A final hypothesis implicating subvocalization has been proposed by Hoffman (1986), who argued that auditory hallucinations might result from a disorder of discourse planning, causing hallucinators to experience their inner speech as unintended and therefore alien to themselves. Hoffman argued that there should be a statistical association between disordered speech and auditory hallucinations, a result he reported in a study of manic and schizophrenic patients (Hoffman, Stopek, & An-

dreasen, 1986). However, as noted in a number of critiques of Hoffman's theory (Bentall & Slade, 1986; Posey, 1986; Rund, 1986; Schwartz, 1986), this result was almost certainly achieved as an artifact of Hoffman's selection process. Indeed, Hoffman excluded his manic subjects (who showed considerable evidence of disordered speech but little evidence of hallucination) from his analysis. If he had studied patients suffering from psychotic depression, he may well have found a high prevalence of hallucinations but almost no thought disorder. Hoffman's account would therefore appear to be an object lesson in the perils of investigating syndromes rather than symptoms, although the hypothesis that hallucinations may follow from the experience of unintendedness (i.e., from a failure to perceive cognitive effort) is an interesting one that merits further study.

A more general problem facing theories linking auditory hallucinations to subvocalization is that they cannot account for hallucinations in the nonauditory modalities. Yet it appears that psychotic patients may experience hallucinations in visual, tactile, or olfactory modalities, or indeed in more than one modality at once.

Integration

It would seem that none of the theories I have outlined give a complete account of how the illusion of reality might result from an interaction between cognitive processes and the variables known to affect hallucinations. Furthermore, in addition to the problems peculiar to the particular theories, there are more general issues that none of the theories attempt to address, for example, the cultural and historical variation in the type and prevalence of hallucinatory experiences. Despite these difficulties, there is one fundamental assumption that all the theories have in common: that hallucinators mistake their own internal, mental, or private events for external, publicly observable events. This idea is particularly emphasized in the work of Sarbin (1967), Heilbrun and his colleagues (e.g., Heilbrun, 1980), and Hoffman (1986). Indeed, taking the ordinary language words *real* and *imaginary* to describe public and private events, respectively, it is almost true by definition that the act of hallucination involves mistakes of this kind. However, to mistake the imaginary for the real presupposes that, under normal circumstances, it is possible to tell these two types of stimuli apart. What is missing from existing accounts of hallucinations, then, is an explanation of how, under normal circumstances, most people are able to discriminate between imagined events and events in the real world.

Although it is tempting to assume that the ability to distinguish the real from the imaginary is innate or a priori, philosophers from before the time of Descartes have been troubled by the fact that human judgment in this respect can be sorely deficient (Williams, 1971). Both Skinner (1945) and the later Wittgenstein (1953), in analyses of the language of private events, argued that the ability to make subjective descriptions of mental processes may be limited and that such descriptions may be the result of inferences made from publicly available information (Bloor, 1983). Studies of emotion (Pennebaker, 1980; Schacter & Singer, 1962) and self-reports of mental processes (Nisbett & Wilson, 1978) provide empirical data that are consistent with this analysis. Abnormal psychology is particularly rich in phenomena in which there appears to be a desynchrony between perceived internal states and internal states as revealed by physiological or other measures, for example, in cases of mass psychogenic illness (Pennebaker, 1980), fear (Rachman & Hodgson, 1979), and chronic pain (Fordyce, 1981). On this account, it might be expected that people will infer whether an event is real or imaginary on the basis of a range of information, and that these kinds of judgments will tend to be in error when the available evidence is misleading. The skill of judging the source of a perceived event, which might most accurately be named *reality discrimination* (although it has sometimes been referred to as *reality testing*[1]), would therefore seem to fall into the general domain of knowledge about cognition, described by Flavell (1979) as *metacognition*. A dramatic failure of this skill might cause a person to misattribute internal events to an external source and thus bring about hallucinations. If the misattributed event is inner speech or verbal thought, then the hallucinations will be in the auditory modality; if it is visual imagery that is misattributed, then the hallucinations will be visual.

Experimental data pertaining to reality discrimination are available from a number of studies using normal subjects. For example, if individuals can sometimes mistake the imaginary for the real (as in hallucinations), it might be expected that they will also sometimes mistake the real for the imaginary. Perky (1910) was the first to demonstrate this kind of error. Trained introspectionists were required to imagine an object on a white screen. An image of the object was back-projected onto the screen and its brightness was gradually increased until it was clearly visible. All of Perky's 29 subjects reported their experience of the projection as imaginary; no doubt their willingness to do this was partly a function of their confidence in their ability to make accurate introspections. However, Perky's findings have subsequently been replicated by Segal (1970), using student subjects. Segal found that the Perky phenomenon was more likely to occur if the subjects were given a placebo tranquilizer (Segal & Nathan, 1964) or were lying down (Segal & Glicksman, 1967), circumstances under which the subjects presumably believed themselves likely to experience imaginary stimuli.

The role of contextual information in reality discrimination failures is also highlighted by the work of social psychologists interested in the power of suggestions, alluded to earlier. For example, Barber and Calverley (1964) performed their "White Christmas" test on normal subjects and found that approximately 5% of their sample reported hearing a record and believing that it had been played, a result replicated by other investi-

[1] The term *reality discrimination* is used in preference to *reality testing* for two reasons. First, this term emphasizes the fact that distinguishing between the real and the imaginary is a skill that, in principle, need not be thought of as different from other discriminative skills, with the exception that the stimuli being discriminated are private. This is a view consistent with the private language argument of Wittgenstein (1953). Second, the term *reality testing* is sometimes used in the context of testing out delusional beliefs (Winters & Neale, 1983). Although it is possible that similar mechanisms underlie both delusions and hallucinations, this cannot be determined a priori, especially in the light of persisting doubts about the validity of syndromes of psychosis (Bentall, Jackson, & Pilgrim, 1988).

gators (Bowers, 1967; Spanos & Barber, 1968). Although the reporting of hallucinatory experiences under these conditions is greatly influenced by the method of questioning, giving subjects a greater opportunity to describe the "imaginary" status of their experiences (by providing a wider range of questionnaire choices) does not eliminate hallucination reports entirely (McPeake & Spanos, 1973; Spanos, Ham, & Barber, 1973).

More recent research has demonstrated that normal individuals sometimes confuse real and imaginary events in a quite different way, mistaking memories of self-generated thoughts for memories of real events. M. K. Johnson and Raye (1981) have labeled the skill of discriminating between memories of thoughts and memories of events *reality monitoring.* In their simplest paradigm designed to investigate this phenomenon, M. K. Johnson, Taylor, and Raye (1977) required subjects to learn a series of paired associates, but independently varied the number of presentation and recall trials so that, for example, some pairs were presented often but recalled rarely, whereas others were presented on few occasions but recalled often. Following completion of the trials, the subjects were required (unforewarned) to guess how often they had seen each of the associates; the more often the items had been recalled, the more often the subjects guessed they had been presented. In subsequent experiments, Johnson and her colleagues demonstrated that this effect was more likely to occur if the items were recalled overtly rather than covertly (M. K. Johnson et al., 1977) and if they were recalled vividly (M. K. Johnson, Raye, Wang, & Taylor, 1979). On the other hand, the effect was less likely to occur if generation of the items required more rather than less cognitive effort (M. K. Johnson, Raye, Foley, & Foley, 1981). These findings indicate that individuals are more likely to judge a perceived stimulus as real rather than as self-generated if it shares the sensory properties of real events or if it is experienced without the feeling of intendedness. Together with data collected on the Perky phenomenon, then, research on reality monitoring provides strong evidence that inferential processes are involved in the skill of discriminating between real and imaginary events.

Direct evidence that hallucinations result from a failure of judgment comes from studies that can best be understood within the framework of signal detection theory. According to SDT (D. M. Green & Swetts, 1966; McNicol, 1972), a person's detection of a stimulus in the environment is a function of both signal sensitivity and response bias. Low signal sensitivity, caused by a poor ratio of signal to internal "noise," will be reflected in a general impairment of perceptual ability, whereas a high bias toward reporting signals will be reflected in a high rate of false positive (hallucinatory) reports relative to false negative reports. If hallucinations result from a sensory disorder, hallucinators should show poor signal sensitivity. Equally, as Segal and Fusella (1972) have shown that the generation of mental images (presumably causing an increase in internal noise) produces a reduction in signal sensitivity, abnormal mental imagery should also be reflected in an impairment of sensitivity. On the other hand, poor reality discrimination, resulting from the failure to take into account relevant information when making a reality judgment, should be reflected in an increased bias toward detecting signals.

Generally, research has supported the view that bias rather than signal sensitivity is critical in hallucinations. Although Babkoff et al. (1980) found that hallucinators had a high right-ear tone threshold, this was only the case for tones of very short duration. Using a method of deriving measures of internal noise from Weber fractions, Collicut and Hemsley (1981) were unable to find differences between hallucinating and nonhallucinating psychiatric patients; this result would seem to count against any explanation of hallucination that makes reference to either sensory disorders or abnormal imagery; Collicut and Hemsley therefore argued that hallucinations must result from increased bias (i.e., a judgmental error). In a more recent study that directly tested for bias, Bentall and Slade (1985a) used an auditory signal detection task with normal subjects who scored high or low on the Launay–Slade Hallucination Scale and hallucinating and nonhallucinating psychiatric patients. The high scorers in comparison to the low scorers and the hallucinating patients in comparison to the nonhallucinating patients showed a greater bias toward detecting signals; no differences in signal sensitivity were observed.

Other data are consistent with this interpretation. For example, if hallucinators are poor at judging the difference between real and imaginary events, it might also be expected that they would be deficient in the related skill of reality monitoring. Although this possibility has not been directly tested, Heilbrun's (1980) observation that hallucinators are relatively poor at recognizing their own thoughts suggests that this is indeed the case. The finding that hallucinators score highly on the Barber and Calverley "White Christmas" test (Mintz & Alpert, 1972; Young et al., 1987) is probably indicative of their willingness to describe imagined events as real (and of the extent to which their judgments are affected by contextual or verbal information), rather than of the vividness of their mental images. Similarly, as hallucinations appear to result from an error of judgment, it is not surprising to discover that hallucinators are overhasty and overconfident when performing on various kinds of perceptual tasks (Alpert, 1985; Heilbrun & Blum, 1984; Mintz & Alpert, 1972; S. Schneider & Wilson, 1983). Additional observations that can be readily understood within this general framework are as follows.

1. The evidence that hallucinations are associated with stress-induced arousal has already been described. Research on the effect of arousal on information processing suggests that abnormally high levels of arousal bias information search toward readily accessible forms of information (Eysenck, 1976), increase the selection of information pertaining to the physical characteristics of stimuli, and decrease the processing of semantic information (Schwartz, 1975). It is to be expected that this more superficial style of information processing will decrease the accuracy of reality discrimination by limiting the ability of the subject to access and use appropriate cognitive cues.

2. Various cognitive deficits that may be associated with hallucinations have also been described. These deficits require little additional comment here; in general, any trait or deficit that affects an individual's ability to make judgments about the source of perceptual experience will increase the likelihood that hallucinations will occur. Many of the theories of hallucination outlined in this article are in fact proposals that hallucinators are unable to use particular cues when attempting to discriminate between real and imaginary events. For example, Heilbrun

et al. (1983) have proposed that some hallucinators are unable to use spatial cues in order to locate the source of their experiences, whereas Hoffman (1986) has proposed that it is the hallucinator's failure to generate cognitive effort cues that makes the discrimination of the real from the imaginary so difficult. Imagery theories can presumably be restated as proposals about the importance of sensory cues in reality discrimination. It should be noted that many different types of cues are likely to be important in reality discrimination and that many different traits and deficits are therefore likely to be associated with hallucinatory experiences. The failure of reality discrimination in hallucinating patients might therefore be considered a final common pathway underlying their experiences, rather than the ultimate cause of their hallucinations. Moreover, it is probable that different kinds of cognitive deficits will be associated with different types of hallucinations. For example, although it seems likely that the inability to locate sounds in space will be implicated in true hallucinations, it is less likely that this deficit will be associated with those kinds of pseudohallucination that are characterized by the patients' (correct) identification of the physical location of their experiences.

3. Within this general framework, it is possible to understand the observed effects of perceptual attenuation (as in sensory deprivation or release hallucinations) and white noise (Margo, Hemsley, & Slade, 1981) that have both been found to precipitate an increase in the rate at which hallucinations are experienced. As the decision about whether an event is real or imaginary is likely to be more difficult when the individual is attempting to detect sensory information against a background of considerable sensory noise, it is under these circumstances that the hallucinator's tendency to mistake the source of perceptual experiences will become most evident.

4. This analysis also accounts for the effects of suggestion on the reporting of hallucinations (e.g., Barber & Calverley, 1964), the apparent sensitivity of hallucinators to contextual cues (Mintz & Alpert, 1972; Young et al., 1987), and the observed cultural differences in the type and prevalence of hallucinations (Al-Issa, 1978, 1979; Bourguignon, 1970). The decision about whether an event is real or imaginary is likely to be influenced by the perceived probability of the event, and knowledge about the probability of different kinds of events will be encoded in cultural practices. In this context it is interesting to note that Arieti (1974), on the basis of his psychotherapeutic work with schizophrenic patients, has argued that they tend to experience their hallucinations "only in particular situations, that is, when *the patient expects to hear them*" (p. 574).

5. This analysis also explains why hallucinations are sometimes experienced by non-mentally ill individuals, even in modern, industrialized nations (Bentall & Slade, 1985b; McKellar, 1968; Posey & Losch, 1983; Sidgewick, 1894; West, 1948; Young et al., 1986), and why there appears to be a continuum between hallucinatory and nonhallucinatory experiences (Launay & Slade, 1981; Strauss, 1969). Reality discrimination is presumably a skill admitting of greater or lesser accuracy, and reality discrimination failures can be experimentally demonstrated in normal individuals (Barber, 1970; M. K. Johnson & Raye, 1981; Segal, 1970).

6. Within this general framework, it is also possible to understand the observed relation between subvocal speech and auditory hallucinations (Gould, 1948, 1949, 1950; P. Green & Preston, 1981; Inouye & Shimizu, 1970; McGuigan, 1966), as subvocalization is a normal concomitant of the inner speech (Cacioppo & Petty, 1981; Garrity, 1977; McGuigan, 1978) that is misattributed to an external source by the hallucinator. (Note that this is not to suggest that subvocalization *causes* hallucinations. However, on this line of argument it might be expected that the psychophysiological correlates of visual imagery would be observed concurrently with visual hallucinations. In a recent case study of a woman who could call up a visual hallucination at will, Schatzman (1980) found that the hallucination blocked visual evoked potentials that were otherwise elicited by a strong light source, but had no effect on retinal activity as measured by an electroretinogram.)

7. Finally, it is possible to understand why reading, writing, or other verbal tasks (Margo, Hemsley, & Slade, 1981; Slade, 1974) block auditory hallucinations, as these tasks inhibit normal inner speech (Sokolov, 1972). Again, on this line of reasoning it might be predicted that visual imagery tasks (such as that described by Brooks, 1968) would block visual hallucinations.

Conclusions and Implications

Taken together, then, the available data would appear to suggest that the hallucinations of psychiatric patients result from an impairment of the skill or skills involved in discriminating between real and imaginary events. Hallucinators make hasty and overconfident judgments about the source of their perceptions and have a bias toward inappropriately attributing their perceptions to an external source. There is also evidence suggesting that their reality discrimination judgments may be more readily influenced by contextual information than the corresponding judgments of nonhallucinators. In this article, I have argued that the analysis of reality discrimination in normal individuals may prove to be a fruitful source of information for the psychopathologist interested in hallucinations. After all, it is difficult to see how the failure of a skill can be explained before the normal operation of that skill is at least partially understood.

Of course, the suggestion that hallucinations result from defective judgment does not imply that judgments about the real and the imaginary are made at the conscious level; many quite complex perceptual judgments are made below the level of awareness (Dixon, 1981). In this respect, the illusion of reality experienced when hallucinating may be similar to the kinds of ordinary visual illusions with which most people are familiar (Gregory, 1970). Nor does the hypothesis imply that biological factors are unimportant; it seems likely that a range of biological variables will affect the ability to discriminate between real and imaginary events, either by directly affecting the judgmental process or by affecting the information on which such judgments are made. A number of important questions remain to be answered.

First, there is the question of the type of reality discrimination errors associated with different kinds of hallucinatory experiences. Different kinds of hallucination will almost certainly reflect different causes of defective reality discrimination. It has already been suggested that an impairment of the ability to identify the spatial location of sounds, found in some groups of

hallucinating individuals, will not be found in persons who suffer from pseudohallucinations. Very little systematic research has been carried out into the cognitive and personality characteristics that underlie different kinds of hallucinations, although Judkins and Slade (1981) found that pseudohallucinators, when compared with hallucinators, tend to be intrapunitive, as measured by a hostility and direction of hostility questionnaire.

Second, there is the question regarding the content of hallucinations. Hallucinators do not hallucinate random events. Auditory hallucinators often experience threatening voices, and visual hallucinators see visions of dead ancestors or other persons of psychological significance to them. Presumably, the contents of patients' hallucinations are related in important ways to their personalities and to the stresses that precipitate their psychoses. Consistent with this idea, Forgus and DeWolfe (1969) found that their hallucinating subjects had an enhanced ability to recall story themes relating to their hallucinations. Judkins and Slade (1981) found that hallucinators experiencing abusive hallucinations tend to score higher on hostility than those experiencing hallucinations of a nonabusive nature. Clinically, it is difficult to avoid the impression that many hallucinators become very anxious when asked to reattribute their visions and voices to themselves, suggesting the possibility that their failure in reality discrimination may be motivated, at least in part, by a need to defend their own self-esteem. Further research into the life events precipitating hallucinations, the personality structure of hallucinators, and the reinforcing consequences of hallucinations is likely to elucidate this issue.

Finally, there is the question of treatment. In a detailed review of the available literature, Slade and Bentall (1988) have shown that a surprising range of psychological techniques may have a place in the treatment of hallucinations. Given that many psychotic patients remain unresponsive to medication (Warner, 1985), and given the worrying side-effects of neuroleptic drugs (Hill, 1986), there is a pressing need to further develop psychological techniques that are effective against the full range of psychotic symptoms.

References

Al-Issa, I. (1978). Social and cultural aspects of hallucinations. *Psychological Bulletin, 84,* 570–587.

Al-Issa, I. (1979). Socio-cultural factors in hallucination. *International Journal of Social Psychiatry, 24,* 167–176.

Allen, T. E., & Argus, B. (1968). Hyperventilation leading to hallucinations. *American Journal of Psychiatry, 125,* 632–637.

Alpert, M. (1985). The signs and symptoms of schizophrenia. *Comprehensive Psychiatry, 26,* 103–112.

Alroe, C. J., & McIntyre, J. N. (1983). Visual hallucinations: The Charles Bonnet syndrome and bereavement. *Medical Journal of Australia, 2,* 674–675.

American Psychiatric Association. (1987). *Diagnostic and statistical manual for the mental disorders: Third edition, revised.* Washington, DC: Author.

Anderson, L. T., & Alpert, M. (1974). Operant analysis of hallucination frequency in a hospitalised schizophrenic. *Journal of Behavior Therapy and Experimental Psychiatry, 5,* 13–18.

Arieti, S. (1974). *Interpretation of schizophrenia.* London: Crosby Lockwood Staples.

Asaad, G., & Shapiro, B. (1986). Hallucinations: Theoretical and clinical overview. *American Journal of Psychiatry, 143,* 1088–1097.

Babkoff, H., Sutton, S., Zubin, J., & Har-Evan, D. (1980). A comparison of psychiatric patients and normal controls on the integration of auditory stimuli. *Psychiatry Research, 3,* 163–178.

Bahzin, E. F., Wasserman, L. I., & Tonkongii, I. M. (1975). Auditory hallucinations and left temporal lobe pathology. *Neuropsychologia, 13,* 481–487.

Barber, T. X. (1970). Hypnosis, suggestions and auditory-visual hallucination. In W. Keup (Ed.), *Origins and mechanisms of hallucinations* (pp. 167–180). New York: Plenum Press.

Barber, T. X., & Calverley, D. S. (1964). An experimental study of "hypnotic" (auditory and visual) hallucinations. *Journal of Abnormal and Social Psychology, 63,* 13–20.

Barrowclough, C., & Tarrier, N. (1984). Psychosocial interventions with families and their effects on the course of schizophrenia: A review. *Psychological Medicine, 14,* 629–647.

Belensky, G. L. (1979). Unusual visual experiences reported by subjects in the British Army study of sustained operations, Exercise Early Call. *Military Medicine, 114,* 695–696.

Bentall, R. P. (1986). The scientific status of schizophrenia: A critical evaluation. In N. Eisenberg & D. Glasgow (Eds.), *Current issues in clinical psychology* (pp. 134–159). Aldershot, England: Gower Press.

Bentall, R. P., Claridge, G. S., & Slade, P. D. (1989). The multidimensional nature of schizotypal traits: A factor analytic study with normal subjects. *British Journal of Clinical Psychology, 28,* 363–375.

Bentall, R. P., Jackson, H. F., & Pilgrim, D. (1988). Abandoning the concept of schizophrenia: Some implications of validity arguments for psychological research into psychotic phenomena. *British Journal of Clinical Psychology, 27,* 303–324.

Bentall, R. P., & Slade, P. D. (1985a). Reality testing and auditory hallucinations: A signal detection analysis. *British Journal of Clinical Psychology, 24,* 159–169.

Bentall, R. P., & Slade, P. D. (1985b). Reliability of a scale measuring disposition towards hallucination. *Personality and Individual Differences, 6,* 527–529.

Bentall, R. P., & Slade, P. D. (1986). Verbal hallucinations, unintendedness and the validity of the schizophrenia diagnosis. *The Behavioral and Brain Sciences, 9,* 519–520.

Berenbaum, H., Oltmanns, T. F., & Gottesman, I. (1985). Formal thought disorder in schizophrenics and their twins. *Journal of Abnormal Psychology, 94,* 3–16.

Birley, J. L. T., & Brown, G. W. (1970). Crises and life changes preceding the onset or relapse of acute schizophrenia: Clinical aspects. *British Journal of Psychiatry, 116,* 327–333.

Bliss, E. L., Larson, E. M., & Nakashima, S. R. (1983). Auditory hallucinations and schizophrenia. *Journal of Nervous and Mental Disease, 171,* 30–33.

Bloor, D. (1983). *Wittgenstein: A social theory of knowledge.* London: Macmillan.

Bourguignon, E. (1970). Hallucinations and trance: An anthropologist's perspective. In W. Keup (Ed.), *Origins and mechanisms of hallucination* (pp. 183–190). New York: Plenum Press.

Bowers, K. S. (1967). The effect of demands for honesty on reports of visual and auditory hallucinations. *International Journal of Clinical and Experimental Hypnosis, 15,* 31–36.

Brett, E. A., & Starker, S. (1977). Auditory imagery and hallucinations. *Journal of Nervous and Mental Disease, 164,* 394–400.

Brewer, W. F. (1974). There is no convincing evidence of classical or operant conditioning in human adults. In W. B. Weimer & D. S. Palermo (Eds.), *Cognition and the symbolic processes* (pp. 1–42). New York: Wiley.

Brooks, L. (1968). Spatial and verbal components of the act of recall. *Canadian Journal of Psychology, 22,* 349–368.

Cacioppo, J. T., & Petty, R. E. (1981). Electromyograms as measures of extent and affectivity of information processing. *American Psychologist, 36,* 441–456.

Catts, S. V., Armstrong, M. S., Norcross, K., & McConaghy, N. (1980). Auditory hallucinations and the verbal transformation effect. *Psychological Medicine, 10,* 139–144.

Claridge, G., & Broks, P. (1984). Schizotypy and hemisphere function I: Theoretical considerations and the measurement of schizotypy. *Personality and Individual Differences, 5,* 633–648.

Cohen, L. H. (1938). Imagery and its relations to schizophrenic symptoms. *Journal of Mental Science, 84,* 284–346.

Collicut, J. R., & Hemsley, D. R. (1981). A psychophysical investigation of auditory functioning in schizophrenia. *British Journal of Clinical Psychology, 20,* 199–204.

Comer, N. L., Madow, L., & Dixon, J. J. (1967). Observations of sensory deprivation in a life-threatening situation. *American Journal of Psychiatry, 124,* 164–169.

Cooklin, R., Sturgeon, D., & Leff, J. (1983). The relationship between auditory hallucinations and spontaneous fluctuations of skin resistance in schizophrenia. *British Journal of Psychiatry, 142,* 47–52.

Davies, P. (1974a). Conditioned visual afterimages I. *British Journal of Psychology, 65,* 191–204.

Davies, P. (1974b). Conditioned visual afterimages II. *British Journal of Psychology, 65,* 377–393.

Davies, P. (1976). Conditioning afterimages: A procedure for minimizing the extinction effect of normal test trials. *British Journal of Psychology, 67,* 181–189.

Davies, P., Davies, G. L., & Bennett, S. (1982). An effective paradigm for conditioning visual perception in human subjects. *Perception, 11,* 663–669.

Davis, J. R., Wallace, C. J., Liberman, R. P., & Finch, B. E. (1976). The use of brief isolation to suppress delusional and hallucinatory speech. *Journal of Behavior Therapy and Experimental Psychiatry, 7,* 269–275.

Dixon, N. F. (1981). *Preconscious processing.* Chichester, England: Wiley.

Done, D. J., Frith, C. D., & Owens, D. C. (1986). Reducing persistent auditory hallucinations by wearing an ear plug. *British Journal of Clinical Psychology, 25,* 151–152.

Ellson, D. G. (1941). Hallucinations produced by sensory conditioning. *Journal of Experimental Psychology, 28,* 1–20.

Esquirol, J. E. D. (1832). Sur les illusions des sens chez alienés [On the sensory illusions of the insane]. *Archives Generales de Medicine, 2,* 5–23.

Evans, J. St. B. (1980). Thinking: Experimental and information processing approaches. In G. Claxton (Ed.), *Cognitive psychology: New directions* (pp. 275–299). London: Routledge and Kegan Paul.

Eysenck, M. (1976). Arousal, learning and memory. *Psychological Bulletin, 83,* 389–404.

Flavell, J. H. (1979). Metacognition and cognitive monitoring. *American Psychologist, 34,* 906–911.

Fonagy, P., & Slade, P. D. (1982). Punishment versus negative reinforcement in the aversive conditioning of auditory hallucinations. *Behavior Therapy, 20,* 483–492.

Fordyce, W. E. (1981). A behavioural perspective on chronic pain. *British Journal of Clinical Psychology, 21,* 313–320.

Forgus, R. H., & DeWolfe, A. S. (1969). Perceptual selectivity in hallucinatory schizophrenics. *Journal of Abnormal Psychology, 74,* 288–292.

Freud, S. (1924). The loss of reality in neurosis and psychosis. In J. Strachey (Ed. and Trans.), *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 19, pp. 181–187). London: Hogarth Press.

Frith, C. D. (1979). Consciousness, information processing and schizophrenia. *British Journal of Psychiatry, 134,* 225–235.

Galton, F. (1880). Statistics of mental imagery. *Mind, 5,* 300–318.

Garrity, L. (1977). Electromyography: A review of the current status of subvocal speech research. *Memory and Cognition, 5,* 615–622.

Goodwin, D. W., Alderson, P., & Rosenthal, R. (1971). Clinical significance of hallucinations in psychiatric disorders. *Archives of General Psychiatry, 24,* 76–80.

Gottesman, I., & Shields, J. (1982). *Schizophrenia: The epigenetic puzzle.* Cambridge, England: Cambridge University Press.

Gould, L. N. (1948). Verbal hallucinations and activity of vocal musculature. *American Journal of Psychiatry, 105,* 367–372.

Gould, L. N. (1949). Auditory hallucinations and subvocal speech. *Journal of Nervous and Mental Disease, 109,* 418–427.

Gould, L. N. (1950). Verbal hallucinations as automatic speech. *American Journal of Psychiatry, 107,* 110–119.

Green, D. M., & Swetts, J. A. (1966). *Signal detection by human observers.* New York: Wiley.

Green, P., Hallett, S., & Hunter, M. (1983). Abnormal interhemispheric specialisation in schizophrenics and high-risk children. In P. Flor-Henry & J. Gruzelier (Eds.), *Laterality and psychopathology* (pp. 448–470). Amsterdam: Elsevier.

Green, P., & Kotenko, V. (1980). Superior speech comprehension in schizophrenics under monaural versus binaural listening conditions. *Journal of Abnormal Psychology, 89,* 399–408.

Green, P., & Preston, M. (1981). Reinforcement of vocal correlates of auditory hallucinations by auditory feedback: A case study. *British Journal of Psychiatry, 139,* 204–208.

Gregory, R. L. (1970). *The intelligent eye.* New York: McGraw-Hill.

Hall, R. C., Popkin, M. K., & Faillace, L. A. (1978). Physical illness presenting as psychiatric disease. *Archives of General Psychiatry, 35,* 1315–1320.

Hammeke, T. A., McQuillen, M. P., & Cohen, B. A. (1983). Musical hallucinations associated with acquired deafness. *Journal of Neurology, Neurosurgery and Psychiatry, 46,* 570–572.

Haynes, S. N., & Geddy, P. (1973). Supression of psychotic hallucinations through time out. *Behavior Therapy, 4,* 123–127.

Hefferline, R. F., Bruno, L. J., & Camp, J. A. (1971). Hallucinations: An experimental approach. In F. J. McGuigan & R. A. Schoonover (Eds.), *The psychophysiology of thinking: Studies of covert processes* (pp. 299–337). New York: Academic Press.

Heilbrun, A. B. (1980). Impaired recognition of self-expressed thought in patients with auditory hallucinations. *Journal of Abnormal Psychology, 89,* 728–736.

Heilbrun, A. B., & Blum, N. A. (1984). Cognitive vulnerability to auditory hallucination: Impaired perception of meaning. *British Journal of Psychiatry, 144,* 508–512.

Heilbrun, A. B., Blum, N. A., & Haas, M. (1983). Cognitive vulnerability to hallucination: Preferred imagery mode and spatial location of sounds. *British Journal of Psychiatry, 143,* 294–299.

Heilbrun, A. B., Diller, R., Fleming, R., & Slade, L. (1986). Strategies of disattention and auditory hallucinations in schizophrenics. *Journal of Nervous and Mental Disease, 174,* 265–273.

Heron, D. P., & de Armond, D. (1978). The use of time out in controlling hallucinatory behavior in a mentally retarded adult. *Bulletin of the Psychonomic Society, 11,* 115–116.

Hill, D. (1986). Tardive dyskinesia: A world-wide epidemic of irreversable brain damage. In N. Eisenberg & D. Glasgow (Eds.), *Current issues in clinical psychology* (pp. 87–108). Aldershot, England: Gower Press.

Hoffman, R. E. (1986). Verbal hallucinations and language production processes in schizophrenia. *The Behavioral and Brain Sciences, 9,* 503–548.

Hoffman, R. E., Stopek, S., & Andreasen, N. C. (1986). A discourse

analysis comparing manic versus schizophrenic speech disorganization. *Archives of General Psychiatry, 43,* 831–838.

Horrowitz, M. (1975). Hallucinations: An information processing approach. In R. K. Siegel & L. J. West (Eds.), *Hallucinations: Behavior, experience and theory* (pp. 163–196). New York: Wiley.

Inouye, T., & Shimizu, A. (1970). The electromyographic study of hallucinations. *Journal of Nervous and Mental Disease, 151,* 415–422.

Jackson, C. W., & Kelley, E. L. (1962). Influence of suggestion and subject's prior knowledge in research on sensory deprivation. *Science, 135,* 211–212.

Jakes, S., & Hemsley, D. R. (1986). Individual differences in reaction to brief exposure to unpatterned stimulation. *Personality and Individual Differences, 7,* 121–123.

James, D. A. E. (1983). The experimental treatment of two cases of auditory hallucinations. *British Journal of Psychiatry, 143,* 515–516.

Jaspers, K. (1911). Zur analyse der trug wahrnehmunger (leibhaftigkeit und realitatsurteil) [On the analysis of deceptive perceptions (physicality and the judgment of reality)]. *Zeitschift für die gesamte Neurologie und Psychiatrie, 6,* 460–535.

Jaynes, J. (1979). *The origins of consciousness in the breakdown of bicameral mind.* London: Penguin.

Johnson, F. H. (1979). *The anatomy of hallucinations.* New York: Nelson Hall.

Johnson, M. K., & Raye, C. L. (1981). Reality monitoring. *Psychological Review, 88,* 67–85.

Johnson, M. K., Raye, C. L., Foley, H. J., & Foley, M. A. (1981). Cognitive operations and decision bias in reality monitoring. *American Journal of Psychology, 91,* 37–64.

Johnson, M. K., Raye, C. L., Wang, A. Y., & Taylor, T. H. (1979). Fact and fantasy: The role of accuracy and variability in confusing imaginations with perceptual experiences. *Journal of Experimental Psychology: Human Learning and Memory, 5,* 229–240.

Johnson, M. K., Taylor, T. H., & Raye, C. L. (1977). Fact and fantasy: The effects of internally generated events on the apparent frequency of externally generated events. *Memory and Cognition, 5,* 116–122.

Johnson, R. L., & Miller, M. D. (1965). Auditory hallucinations and intellectual deficits. *Journal of Psychiatric Research, 3,* 37–41.

Johnstone, E. C., MacMillan, J. F., & Crowe, T. J. (1987). The occurrence of organic disease of possible or probable aetiological significance in a population of 268 cases of first episode schizophrenia. *Psychological Medicine, 17,* 371–379.

Judkins, M., & Slade, P. D. (1981). A questionnaire study of hostility in persistent auditory hallucinators. *British Journal of Medical Psychology, 54,* 243–250.

Kosslyn, S. M. (1983). *Ghosts in the mind's machine: Creating and using images in the brain.* New York: Norton.

Kraupl-Taylor, F. (1981). On pseudohallucinations. *Psychological Medicine, 11,* 265–279.

Launay, G., & Slade, P. D. (1981). The measurement of hallucinatory predisposition in male and female prisoners. *Personality and Individual Differences, 2,* 221–234.

Leff, J. P., Kuipers, L., Vaughn, C., & Sturgeon, D. (1983). Life events, relative's expressed emotion and maintainence neuroleptics in schizophrenic relapse. *Psychological Medicine, 13,* 799–806.

Leinz, H. L. (1964). *Verleichende psychiatrie: Ein studie über die beziehung von kulture sociologie und psychopathologie* [Comparative psychiatry: A study of the relation between culture and psychopathology]. Vienna: Wilhelm Mandrich Verlag.

Lidz, T., & Blatt, S. (1983). Critique of the Danish-American studies of the biological and adoptive relatives of adoptees who became schizophrenic. *American Journal of Psychiatry, 140,* 426–431.

Lidz, T., Blatt, S., & Cook, B. (1981). Critique of the Danish-American studies of the adopted away offspring of schizophrenic parents. *American Journal of Psychiatry, 138,* 1063–1068.

Lowe, G. R. (1973). The phenomenology of hallucinations as an aid to differential diagnosis. *British Journal of Psychiatry, 123,* 621–633.

Margo, A., Hemsley, D. R., & Slade, P. D. (1981). The effects of varying auditory input on schizophrenic hallucinations. *British Journal of Psychiatry, 139,* 122–127.

Marshall, R. (1984). The genetics of schizophrenia revisited. *Bulletin of the British Psychological Society, 37,* 177–181.

Matchett, W. F. (1972). Repeated hallucinatory experiences as part of the mourning process among Hopi Indian woman. *Psychiatry, 35,* 185–194.

McDonald, W. S., & Oden, C. W. (1977). Aumakua: Behavioral direction visions in Hawaiians. *Journal of Abnormal Psychology, 86,* 189–194.

McGuigan, F. J. (1966). Covert oral behavior and auditory hallucinations. *Psychophysiology, 3,* 73–80.

McGuigan, F. J. (1978). *Cognitive psychophysiology: Principles of covert behavior.* Englewood Cliffs, NJ: Prentice-Hall.

McKay, S. E., Golden, C. J., & Scott, M. (1981). Neuropsychological correlates of auditory and visual hallucinations. *International Journal of the Neurosciences, 15,* 87–94.

McKellar, P. (1968). *Experience and behaviour.* London: Penguin.

McNicol, D. (1972). *A primer of signal detection theory.* London: George Allen & Unwin.

McPeake, J. D., & Spanos, N. P. (1973). The effects of the wording of rating scales on hypnotic subjects' descriptions of visual hallucinations. *American Journal of Clinical Hypnosis, 15,* 239–244.

Miller, M. D., Johnson, R. L., & Richmond, L. H. (1965). Auditory hallucinations and descriptive language skills. *Journal of Psychiatric Research, 3,* 43–56.

Miller, T. C., & Crosby, J. W. (1979). Musical hallucinations in a deaf elderly patient. *Annals of Neurology, 5,* 381–382.

Mintz, S., & Alpert, M. (1972). Imagery vividness, reality testing, and schizophrenic hallucinations. *Journal of Abnormal Psychology, 19,* 310–316.

Morley, S. (1987). Modification of auditory hallucinations: Experimental studies of headphones and earplugs. *Behavioural Psychotherapy, 13,* 240–251.

Neisser, U. (1967). *Cognitive psychology.* New York: Appleton-Century-Crofts.

Nisbett, R. E., & Wilson, T. (1978). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84,* 231–259.

Nydegger, R. V. (1972). The elimination of hallucinatory and delusional behavior by verbal conditioning and assertive training. *Journal of Behavior Therapy and Experimental Psychiatry, 3,* 225–227.

Pennebaker, J. W. (1980). Self-perception of emotion and internal sensation. In D. M. Wegner & R. R. Vallacher (Eds.), *The self in social psychology* (pp. 80–101). Oxford, England: Oxford University Press.

Perky, C. W. (1910). An experimental study of imagination. *American Journal of Psychology, 21,* 422–452.

Persons, J. B. (1986). The advantages of studying psychological phenomena rather than psychiatric diagnoses. *American Psychologist, 41,* 1252–1260.

Posey, T. B. (1986). Verbal hallucinations also occur in normals. *The Behavioral and Brain Sciences, 9,* 530.

Posey, T. B., & Losch, M. E. (1983). Auditory hallucinations of hearing voices in 375 normal subjects. *Imagination, Cognition and Personality, 2,* 99–113.

Preuss, J. (1975). Mental disorders in the Bible and Talmud. *Israeli Annals of Psychiatry and Related Disciplines, 13,* 221–238.

Pylyshyn, Z. (1973). What the mind's eye tells the mind's brain: A critique of mental imagery. *Psychological Bulletin, 80,* 1–24.

Rabkin, J. (1980). Stressful life events and schizophrenia: A review of the literature. *Psychological Bulletin, 87,* 407–425.

Rabkin, R. (1970). Do you see things that are not there?: Construct validity of the concept of hallucination. In W. Keup (Ed.), *The origins and mechanisms of hallucination* (pp. 115–123). New York: Plenum Press.

Rachman, S., & Hodgson, R. J. (1979). Synchrony and desynchrony in fear and avoidance. *Behaviour Research and Therapy, 12,* 311–318.

Ramamathan, A. (1982). Reality of auditory hallucinations in schizophrenia. *Indian Journal of Psychiatry, 24,* 55–60.

Ramamathan, A. (1986). An exploratory study on the relation between neuroticism and certain aspects of auditory hallucinations in schizophrenics. *Indian Journal of Psychiatry, 28,* 69–72.

Reese, W. D. (1971). The hallucinations of widowhood. *British Medical Journal, 210,* 37–41.

Roman, R., & Landis, C. (1945). Hallucinations and mental imagery. *Journal of Nervous and Mental Disease, 102,* 327–331.

Rose, S., Kamin, L., & Lewontin, R. (1984). *Not in our genes.* London: Penguin Press.

Rosenthal, D., & Quinn, O. W. (1977). Quadruplet hallucinations: Phenotypic variations of a schizophrenic genotype. *Archives of General Psychiatry, 34,* 817–827.

Ross, E. D. (1978). Musical hallucinations in deafness revisited. *Journal of the American Medical Association, 240,* 716.

Rund, B. V. (1986). Verbal hallucinations and information processing. *The Behavioral and Brain Sciences, 9,* 531–532.

Sarbin, T. R. (1967). The concept of hallucination. *Journal of Personality, 35,* 359–380.

Sarbin, T. R., & Juhasz, J. B. (1967). The historical background of the concept of hallucination. *Journal of the History of the Behavioral Sciences, 3,* 339–358.

Sarbin, T. R., Juhasz, J. B., & Todd, P. (1971). The social psychology of hallucinations. *Psychological Record, 21,* 87–93.

Sarbin, T. R., & Manusco, J. C. (1980). *Schizophrenia: Medical diagnosis or moral verdict?* New York: Pergamon.

Sartorius, N., Jablensky, A., Korten, A., Ernberg, G., Anker, M., Cooper, J. E., & Day, R. (1986). Early manifestations and first contact incidence of schizophrenia in different cultures. *Psychological Medicine, 16,* 909–928.

Sartorius, N., Shapiro, R., & Jablensky, A. (1974). The international pilot study of schizophrenia. *Schizophrenia Bulletin, 1,* 21–35.

Schacter, S., & Singer, J. E. (1962). Cognitive, social, and physiological determinants of emotional state. *Psychological Review, 69,* 379–399.

Schaefer, T., & Bernick, N. (1965). Sensory deprivation and its effects on perception. In P. H. Hock & J. Zubin (Eds.), *Psychopathology of perception* (pp. 203–221). New York: Grune & Stratton.

Schatzman, M. (1980). *The story of Ruth.* London: Penguin Press.

Schneider, K. (1959). *Clinical psychopathology.* New York: Grune & Stratton.

Schneider, S. J., & Wilson, C. R. (1983). Perceptual discrimination and reaction time in hallucinatory schizophrenics. *Psychiatry Research, 9,* 243–253.

Schwartz, S. (1975). Individual differences in cognition: Some relationships between personality and memory. *Journal of Research in Personality, 9,* 217–225.

Schwartz, S. (1986). Hallucinations, rationalizations and response set. *The Behavioral and Brain Sciences, 9,* 532–533.

Seashore, C. E. (1895). Measurement of illusions and hallucinations in normal life. *Studies of the Yale Psychology Laboratory, 3,* 1–67.

Sedman, G. (1966). A comparative study of pseudohallucinations, imagery and true hallucinations. *British Journal of Psychiatry, 112,* 9–17.

Segal, S. J. (1970). Imagery and reality: Can they be distinguished? In W. Keup (Ed.), *Origins and mechanisms of hallucinations* (pp. 103–113). New York: Plenum Press.

Segal, S. J., & Fusella, V. (1972). Influence of imaged pictures and sounds on the detection of visual and auditory signals. *Journal of Experimental Psychology, 83,* 458–464.

Segal, S. J., & Glicksman, M. (1967). Relaxation and the Perky effect: The influence of body position on judgements of imagery. *American Journal of Psychology, 80,* 257–262.

Segal, S. J., & Nathan, S. (1964). The Perky effect: Incorporation of an external stimulus into an imagery experience under placebo and control conditions. *Perceptual and Motor Skills, 18,* 385–395.

Shallice, T. (1972). Dual functions of consciousness. *Psychological Review, 79,* 383–393.

Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science, 171,* 701–703.

Sidgewick, H. A. (1894). Report of the census of hallucinations. *Proceedings of the Society for Psychical Research, 26,* 259–394.

Siegel, R. K. (1984). Hostage hallucinations: Visual imagery induced by isolation and life-threatening stress. *Journal of Nervous and Mental Disease, 172,* 264–272.

Siegel, R. K., & Jarvik, M. E. (1975). Drug-induced hallucinations in animals and man. In R. K. Siegel & L. J. West (Eds.), *Hallucinations: Behavior, experience and theory* (pp. 81–162). New York: Wiley.

Sietz, P. F., & Malholm, H. B. (1947). Relation of mental imagery to hallucinations. *Archives of Neurology and Psychiatry, 57,* 469–480.

Skinner, B. F. (1945). The operational analysis of psychological terms. *Psychological Review, 52,* 270–277.

Slade, P. D. (1972). The effects of systematic desensitisation on auditory hallucinations. *Behaviour Research and Therapy, 10,* 85–91.

Slade, P. D. (1973). The psychological investigation and treatment of auditory hallucinations: A second case report. *British Journal of Medical Psychology, 46,* 293–296.

Slade, P. D. (1974). The external control of auditory hallucinations: An information theory analysis. *British Journal of Social and Clinical Psychology, 13,* 73–79.

Slade, P. D. (1976a). An investigation of psychological factors involved in the predisposition to auditory hallucinations. *Psychological Medicine, 6,* 123–132.

Slade, P. D. (1976b). Towards a theory of auditory hallucinations: Outline of an hypothetical four factor model. *British Journal of Social and Clinical Psychology, 15,* 415–423.

Slade, P. D. (1984). Sensory deprivation and clinical psychiatry. *British Journal of Hospital Medicine, 35,* 256–260.

Slade, P. D., & Bentall, R. P. (1988). *Sensory deception: Towards a scientific analysis of hallucinations.* London: Croom Helm.

Snyder, W., & Cohen, L. H. (1940). Validity of imagery-testing in schizophrenia. *Character and Personality, 9,* 36.

Sokolov, A. N. (1972). *Inner speech and thought.* New York: Plenum Press.

Spanos, N. P., & Barber, T. X. (1968). Hypnotic experiences as inferred from subjective reports: Auditory and visual hallucinations. *Journal of Experimental Research in Personality, 3,* 136–150.

Spanos, N. P., Ham, M. W., & Barber, T. X. (1973). Suggested ("hypnotic") visual hallucinations: Experimental and phenomenological data. *Journal of Abnormal Psychology, 81,* 96–106.

Stevens, J. R., & Livermore, A. (1982). Telemetered EEG in schizophrenia: Spectral analysis during abnormal behavior episodes. *Journal of Neurology, Neurosurgery and Psychiatry, 45,* 385–395.

Strauss, J. S. (1969). Hallucinations and delusions as points on continua functions. *Archives of General Psychiatry, 21,* 581–586.

Tarrier, N. (1987). An investigation of residual psychotic symptoms in discharged schizophrenic patients. *British Journal of Clinical Psychology, 26,* 141–143.

Taylor, M. A., & Abrams, R. (1975). Acute mania: Clinical and genetic study of responders and nonresponders to treatments. *Archives of General Psychiatry, 32,* 863–865.

Toone, B. K., Cooke, E., & Lader, M. H. (1981). Electrodermal activity

in the affective disorders and schizophrenia. *Psychological Medicine, 11,* 497–508.

Vaughn, C., & Leff, J. P. (1976). The influence of family and social factors on the course of psychiatric illnesses. *British Journal of Psychiatry, 129,* 125–137.

Warner, R. (1985). *Recovery from schizophrenia: Psychiatry and political economy.* London: Routledge and Kegan Paul.

Wells, E. A. (1983). Hallucinations associated with pathological grief reaction. *Journal of Psychiatric Treatment and Evaluation, 5,* 259–261.

West, D. J. (1948). A mass observation questionnaire on hallucinations. *Journal of the Society for Psychical Research, 34,* 187–196.

West, L. J. (1962). A general theory of hallucinations and dreams. In L. J. West (Ed.), *Hallucinations* (pp. 275–291). New York: Grune & Stratton.

West, L. J. (1975). A clinical and theoretical overview of hallucinatory phenomena. In R. K. Siegel & L. J. West (Eds.), *Hallucinations: Behavior, experience, theory* (pp. 287–311). New York: Wiley.

White, N. J. (1980). Complex visual hallucinations in partial blindness due to eye disease. *British Journal of Psychiatry, 136,* 284–286.

Williams, B. (1971). *Descartes.* London: Penguin Press.

Winters, K. C., & Neale, J. M. (1983). Delusions and delusional thinking: A review of the literature. *Clinical Psychology Review, 3,* 227–253.

Wittgenstein, L. (1953). *Philosophical investigations.* London: Macmillan.

Young, H. F., Bentall, R. P., Slade, P. D., & Dewey, M. (1986). Disposition towards hallucination, gender and EPQ scores. *Personality and Individual Differences, 7,* 247–249.

Young, H. F., Bentall, R. P., Slade, P. D., & Dewey, M. (1987). The role of brief instructions and suggestibility in the elicitation of auditory and visual hallucinations in normal and psychiatric subjects. *Journal of Nervous and Mental Disease, 175,* 41–48.

Zuckerman, M. (1969). Hallucinations, reported sensations and images. In J. Zubeck (Ed.), *Sensory deprivation: Fifteen years of research* (pp. 85–125). New York: Appleton-Century-Crofts.

Received December 3, 1987
Revision received January 9, 1989
Accepted February 8, 1989 ■