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EDITORIAL

Hallucinations

Hallucinatory phenomena were recognized as long ago as the 4th century by Macarus and, until fairly recent times, were generally credited with occult significance which gave rise to a belief in the magical powers of the percipient. Such experiences have had a considerable effect on the lives of the hallucinators – the hysterical crisis of Paul (who saw Jesus in a vision) was instrumental in his acceptance of the new faith; Socrates had his 'daemon' which warned and guided him from within; while Joan of Arc's visions and voices played a memorable role in altering the course of history. But it was the decline of the demoniacal model during the 18th and 19th centuries and its replacement by the medical model in the realm of insanity which led to a more objective evaluation of hallucinatory significance and an increasing concern with phenomenology and definition.

The definition of a true hallucination has posed problems, both of inclusion and exclusion. On the one hand, observers have been keen to reach agreement on a set of positive defining criteria, while on the other to distinguish true hallucinations from similar kinds of non-veridical perceptual experience. The latter concern has given rise to the differentiation of true hallucinations from illusion (Esquirol, 1838), from pseudohallucinations (Kandinsky, 1885), from hypnagogic images (Maury, 1848) and from a large variety of other types of mental imagery. Horowitz (1970) has proposed that various kinds of hallucinatory and imagery experiences can be distinguished and classified on four dimensions: in terms of their vividness, the context in which they occur, their content, and the degree of interaction with veridical perception.

From the viewpoint of positive defining criteria of a true hallucination, three such criteria would probably be considered essential by modern observers: namely (1) percept-like experience in the absence of an external stimulus, (2) percept-like experience which has the full force and impact of a real perception, and (3) percept-like experience which is unwilled, occurs spontaneously and cannot be readily controlled by the percipient. Each of these three criteria also serves to differentiate a true hallucination from other types of similar experience. The criterion of 'absence of an external basis' is an obvious one and has been included in nearly every definition of the phenomenon since Esquirol. It serves to separate the different experiences of hallucination and illusion. The second criterion concerning the realistic nature of the experience has gained prominence in recent times. Jaspers (1911, 1963) distinguished true hallucinations from imagery and pseudo-hallucinations on the grounds that the latter occur in 'inner subjective space' while the former have an objective reality of their own. Sedman (1966) used similar criteria in distinguishing 'inner voices' which are a form of pseudo-hallucination from those that can be considered true hallucinations. In a series of recent phenomenological studies, Aggernaes (1972*a*, *b*; Aggernaes & Myeborg, 1972) has shown that hallucinatory experiences can be reliably classified on seven specific and relatively subtle dimensions of reality characteristics, including that of involuntarity. Moreover, he has demonstrated that the true hallucinations of chronic schizophrenic patients are akin to actual perceptions in having positive reality characteristics and in being clearly discriminable from imagined objects and people. The third criterion of 'lack of control' on the part of the percipient is important for differentiating hallucinatory experiences from examples of memory and imagination imagery. The latter have been discussed at length by Richardson (1969).

HALLUCINATIONS IN NORMAL INDIVIDUALS

It has long been recognized that hallucination-like experiences can occur in normal healthy individuals under certain conditions. Sir Francis Galton (1883), who collected a series of such examples from his colleagues and relatives, noted that fasting, lack of sleep and solitary musing were often 'conducive to visions'. The relationship of such experiences to severe food and water deprivation has become a matter of common, universally accepted folklore: the severely dehydrated refugee crawling across the desert under a blazing hot sun is expected to hallucinate an oasis. Some less extreme examples of such a relationship have been described and discussed by Forrer (1960), who concluded: 'The circumstance of hunger and thirst which accompanied each benign hallucination suggests an ultimate physiological origin for the phenomenon itself.' There are two particular circumstances, thought to be conducive to the production of hallucinations in normal individuals, which have received particular attention in recent times: namely sensory deprivation and hallucinogenic drugs.

Sensory deprivation procedures involve an attempt to minimize as far as possible all external sensory stimulation or to reduce the patterning of such stimulation without abolishing it completely (the latter procedure being generally referred to as perceptual deprivation). The first report of such a procedure, which emanated from McGill University (Bexton *et al.*, 1954), indicated that hallucinations were experienced by nearly all individuals subjected to it. However, it has become clear that the definition of a hallucination employed in this and most of the other early studies was fairly loose and included many kinds of perceptual and imagery experiences. Zuckerman & Cohen (1964) carried out a systematic survey of approximately 40 sensory deprivation studies in which adequate and clear information had been provided concerning the nature of hallucinatory-like reports. They opted to use the more neutral terminology of Murphy *et al.* (1962), who refer to such visual experiences as 'reported visual sensations' (RVS) and such auditory experiences as 'reported auditory sensations' (RAS). Furthermore, since both kinds of experience can run the whole gamut from meaningless sensations such as flashes of light, spots, simple geometric patterns, etc., to meaningful integrated scenes, they subdivided both report categories into type A (meaningless sensations) and type B (meaningful, integrated sensations). The general impression they give is that the type B reports come far closer to true hallucinatory experiences than those of type A, although the criterion of a complete reality experience may still be lacking in many of them. The median percentage incidence of the two kinds of type B reports was: RVS, 19%; RAS, 15%. However, the actual incidence of true hallucinations as opposed to illusions, imagery and pseudo-hallucinations may be even lower, as is suggested by the study of Leff (1968). One of the interesting features observed in many of the sensory deprivation studies is that of a clear progression over time from type A to type B reports although the total number of reports does not necessarily increase with the length of the isolation period.

The hallucinogenic effects of drugs such as psilocybin, mescalin and LSD-25 have aroused considerable interest among investigators in the hope that they would provide an ideal model for studying the functional psychoses. Most of the work in this area has therefore involved phenomenological comparison between the drug-induced and the spontaneously occurring psychotic state. Such comparisons have tended to highlight their differences rather than their similarities. Most observers agree that the perceptual disturbances induced by ingestion of mescaline and LSD-25 are predominantly visual in nature, reports of auditory experiences being particularly rare (Bliss & Clark, 1962; Feinberg, 1962; Malitz *et al.*, 1962); the reverse is generally held to be true for schizophrenia.

The visual perceptual disturbances reported after administration of these drugs show a similar variation to those encountered with sensory deprivation. They appear to range along a continuum from simple, meaningless and unstructured sensations (e.g. distortions of the colour, shape and size of objects), through more structured simple sensations which Klüver (1942) described as being invariably present and referred to as 'form-constants' (e.g. various geometric shapes, lattice-work, cobwebs, etc.), to the experience of meaningful and integrated objects and scenes. As with sensory

deprivation, many investigators have observed a progression in the complexity of visual disturbances over time and in relation to dosage level. However, it is the former two kinds of experience which predominate in the drug-induced state, the experience of meaningful and integrated perceptions having a relatively low incidence. As with sensory deprivation, the experience of true hallucination under mescalin and LSD-5 intoxication is probably fairly infrequent.

Another point of difference between drug-induced and schizophrenic hallucinations has been uncovered by Aggernaes (1972*b*). He has demonstrated that, whereas the hallucinations of chronic schizophrenic patients have relatively clear-cut, stable and positive reality characteristics akin to those of actual perceptions, the reality characteristics of LSD hallucinations are more ephemeral and unstable. There is, however, some evidence of overlap between the two kinds of experience. Langs & Barr (1968) found that, while the experiential reports and behaviour of normal subjects receiving LSD in no way resembled those of an undifferentiated schizophrenic group, approximately 25% of the LSD subjects exhibited similar experiences to a paranoid schizophrenic subgroup. This LSD subgroup was characterized on personality tests and questionnaires as having 'paranoid tendencies'. Langs & Barr summarized this important finding in the following terms: 'The drug response appears, then, to be an extension of pre-existing tendencies, expressed openly in the altered state.'

HALLUCINATIONS IN ORGANIC DISORDERS

Hallucinations occur in a wide range of physical and organic diseases, occasionally on their own but more commonly as part of a generalized psychotic state. Although no single, therapeutically created lesion, reported by the neurosurgical community, has been found to be invariably and exclusively associated with the production of hallucinatory activity, various sources of evidence suggest that the temporal cortex and related structures may play a more important role than others.

One piece of evidence comes from the clinical examination of patients with focal epileptic lesions. Hallucinations are frequently present in temporal lobe epilepsy, during either the aura or the attack itself, while being relatively uncommon in epileptic states of other origin. As with the hallucinatory experiences which can be induced in normal individuals, those of temporal lobe epilepsy vary in structure and complexity from simple, elementary sensations and patterns to those of more meaningful and integrated percepts. In general it appears that the more posterior the lesion in the temporal cortex, the more complex and structured the hallucinatory experience. (Mayer-Gross *et al.*, 1969).

A second source of evidence comes from the study of drug/lesion interactions. Baldwin *et al.* (1959) administered LSD-25 to a group of chimpanzees, with the consequent production of bizarre, psychotic-like episodes in the animals. These episodes were not affected by lobectomies, either unilateral or bilateral, of the frontal, parietal or occipital lobes, nor by unilateral temporal lobectomies. But they did not occur after bilateral temporal lobectomies. The existence of an intact temporal cortex (although not necessarily a healthy one) appeared to be required for the production of psychotic-like behaviour, presumably including some hallucinatory activity.

The third source of evidence, and the one which has inspired the greatest amount of interest, comes from studies involving direct electrical stimulation of the human brain under local anaesthesia. Penfield and his associates (Penfield & Rasmussen, 1950; Penfield & Jasper, 1954; Penfield & Perot, 1963) have observed that meaningful visual and auditory hallucinations occurred only with electrical stimulation in or near the temporal lobe. Similar results have been obtained by other workers (Mahl *et al.*, 1964; Horowitz & Adams, 1970). Furthermore, a similar response has been observed in one ethically questionable study (Ishibashi *et al.*, 1964) in anatomically healthy brains as opposed to those of patients undergoing surgery for intractable temporal lobe epilepsy.

One important feature of these direct electrical stimulation studies is that hallucinatory experiences cannot be induced in all patients. In fact only 40 out of a total of 520 of Penfield's epileptic patients (i.e. 7·7%) reported such experiences. Nor can hallucinations be reliably produced by repeated stimulation of identical structures in the same patients (e.g. Horowitz & Adams, 1970). This kind of observation is seemingly incompatible with Penfield's thesis that the mechanism is a normal one

involving the direct activation of stored records. The alternative explanation offered by other workers (e.g. Mahl), namely that of an indirect effect mediated by an altered state of consciousness, would seem at present to be more likely.

HALLUCINATIONS IN FUNCTIONAL PSYCHOTIC DISORDERS

While hallucinations are known to occur in all the major functional psychotic states, it is generally believed that the phenomenological characteristics of such hallucinations vary according to the diagnostic category of the patient and that, as a result, the nature of the hallucinatory experience has a particular diagnostic significance. A number of statements are often made to this effect. First, that auditory hallucinations are common in schizophrenia while visual hallucinations are rare. The evidence from systematic investigations is overwhelming in favour of this proposition. Secondly, that the opposite pattern is true for patients suffering from affective disorders and organic brain syndromes: and, thirdly, that auditory hallucinations generally, and certain types in particular, are characteristic of schizophrenia to the point of being pathognomic. The evidence relating to these latter two contentions is conflicting.

A number of American studies have produced evidence which is contrary to both the modality-specific and form specific notions of hallucinations in schizophrenia and the affective disorders (Goodwin *et al.*, 1971). On the other hand, the ongoing World Health Organization study of schizophrenia (WHO, 1973) has shown that there is a high incidence of auditory hallucinations among a core or central group of schizophrenic patients (74%) in general, and that two of Schneider's first rank types in particular (i.e. third-person voices and running commentaries) are highly discriminatory for a diagnosis of schizophrenia. This conflict between findings may be a function of two factors. First, it may stem from the broader conception of schizophrenia and the narrower conception of affective disorder employed in the United States compared with Europe (see Cooper *et al.*, 1969). Alternatively, it may depend on whether the conception of schizophrenia employed in diagnosis is fundamentally that of Schneider (1959) or that of Bleuler (1911). If the Schneiderian conception is adopted, in which certain forms of auditory hallucinations are considered first-rank symptoms, then a high correlation between these and a diagnosis of schizophrenia is to be expected. If, on the other hand, Bleuler's conception involving auditory hallucinations as accessory symptoms is used, then the correlation between the type of hallucination and the diagnosis of schizophrenia is likely to be somewhat diluted.

THEORIES OF THE HALLUCINATORY MECHANISM

Many theories have been proposed to account for the appearance in consciousness of hallucinatory-like phenomena, including dreams. These range from purely psychoanalytic conceptions such as 'regression', on the one hand, to fairly specific neurophysiological conceptions on the other. A few of the more general, explicitly stated models will now be considered.

One such model is the 'neurophysiological dissociation' theory of Marrazzi. Using electrodes to measure evoked cortical potentials in the exposed cortex of the cat, Marrazzi (1962) found that LSD-25 produced inhibition of the association areas without affecting the primary visual cortex. On this basis he proposed that hallucinogenic drugs have their effect by producing a functional dissociation between the primary receiving cortex and the association areas, this loss of control of the latter over the former being responsible for the hallucinatory experience. In more recent studies, Marrazzi and his coworkers have been able to quantify the behavioural effects of this functional dissociation in both the visual system (Marrazzi, 1970) and the auditory system (Marrazzi *et al.*, 1972) in man, and to show that the effect can be nullified by the prior administration of chlorpromazine.

A somewhat similar theory to that of Marrazzi is the 'perceptual release' theory. This was first postulated by Hughlings Jackson, who considered all hallucinatory phenomena as stemming from

the loss of control of one area of the brain (an inhibitory mechanism) over the rest. Jackson's theory has been updated and further developed by West (1962) into a general theory to account for a whole range of non-veridical percept-like experiences, including dreams, hypnagogic and hypnopompic imagery, hallucinations and delirium. The essential assumptions of West's theory are first, that percept-like experiences are based on neural traces, templates or engrams which are the permanent record of past experience in the brain (Penfield & Perot, 1963); secondly, following the Gestalt notion of a continual and dynamic organization of memory traces, that these templates or engrams are woven into the basic material of fantasies, dreams and hallucinations; and thirdly, that the end-product of this reorganized experience is normally prevented from emerging into consciousness by the presence of effective, external sensory input, but that release into consciousness can occur under certain specific conditions. These conditions involve the existence of a level of arousal sufficient to permit awareness, combined with impairment of effective sensory input.

While West's theory is a purely psychological one, it differs from that of Marrazzi in at least two other important respects. First, in making arousal level a central concept, West is presumably according an important role to subcortical structures, especially those of the reticular system. In contrast, Marrazzi's theory limits the area of dysfunction to structures within the cortex itself. Secondly, unlike Marrazzi, West accords a central role in his theory to the disequilibrium between external sensory input and internal input from within.

In Fischer's 'sensory/motor ratio' theory this concept of a disequilibrium between internal and external sensory input has been made both the necessary and sufficient condition for the occurrence of hallucinations. Fischer (1969) defined hallucinations as 'intensively active sensations with blocked peripheral, voluntary motor-manifestations'. This proposal was based on the observation that in the hallucinogenic-drug-induced state and during REM sleep, cortical activity and awareness are increased while voluntary motor activity is greatly diminished or inhibited completely. This led to the theory that the hallucinated state is characterized by increased sensory awareness combined with decreased motor responsiveness: a high sensory/motor ratio. Fischer and his colleagues (Fischer *et al.* 1970) went on to develop an operational definition of this sensory/motor ratio in terms of handwriting area (the sensory component) and handwriting pressure (the motor component). In a series of studies involving the administration of psilocybin to college students, these workers found that the sensory/motor ratio is generally increased at drug peak and then decreases again as the drug effect diminishes; that the effect increases with dosage level; and that the effect is greater in subjects who are categorized as 'perceivers' than in those categorized as 'judgers'. Fischer suggests that the important inhibitory effect of voluntary motor activity resides in its function of providing a reality check on the experiences of the individual. Moreover, he suggests that some individuals are able to counteract the hallucinogenic drug effect by increasing their voluntary motor activity, while others are not. Fischer's theory therefore differs from West's mainly in terms of this conception of the inhibitory process: while it must be an active process for Fischer, for West a purely passive receipt of external sensory input is sufficient to prevent the emergence of hallucinatory experience in consciousness.

FURTHER RESEARCH DIRECTIONS

There are three particular areas within the realm of hallucinatory processes and experience which are badly in need of further elaboration and exploration. First, there is a dearth of information concerning the precise mechanisms (biochemical, physiological and psychological) underlying the spontaneously occuring hallucinations of functional psychotic and organic patients. There is some suggestion that physiological arousal may be an important factor in this respect. For example, Alpert *et al.* (1970) demonstrated that hallucinatory experiences could be induced in alcoholic patients with a prior history of such experiences, by means of ditran administration: and, more importantly, that the occurrence of hallucinations coincided in time with a state of increased physiological arousal induced by the drug. In a similar vein, Allen & Agus (1968) reported that they could reliably induce hallucinations in two schizophrenic patients with a hallucinatory history by

getting them to hyperventilate, i.e. by artificially manipulating their respiration rate. The author of this editorial (Slade, 1972, 1973) has observed in two schizophrenic patients that the occurrence of their auditory hallucinations was temporally related to increases in self-rated emotional arousal (i.e. tension, anxiety, etc.).

A second area of importance, much neglected both experimentally and theoretically, is that concerning the nature of hallucinatory predisposing factors. One of the most outstanding features of the literature on hallucinations, including those experimentally induced in normals as well as those spontaneously occurring in pathological states, is the fact of individual differences. Some people experience hallucinations under specifiable conditions, while others do not. This provides a clear and strong indication that there must be constitutional factors which predispose some individuals to such experiences. The appropriate research paradigm for investigating such factors would seem to involve the comparison of a group of patients having a history of hallucinations with another group without such a history but matched in terms of all other relevant symptoms. Although this paradigm is an obvious one, very few studies of this type have been carried out. A notable exception is the recent study of Mintz & Alpert (1972). They found that their group of auditory hallucinators differed from non-hallucinating patients and normal controls on two measures: one involving vividness of auditory imagery, the other involving poor reality-testing in the auditory modality. They therefore concluded that a combination of vivid imagery allied with defective reality-testing may provide the predispositional basis for hallucinatory experiences.

A final important area for further research is that concerning the precise factors which determine the modality, form and content of a hallucinatory experience. While phenomenological studies have a significant role to play here, experimental investigations of hypothesized factors are also likely to be crucial.

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