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THE IMAGERY OF VISUAL HALLUCINATIONS

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INTRODUCTION

The weird imagery of visual hallucinations has intrigued and puzzled clinicians for centuries. Although thought or behavioral disorders challenge any attempt to record these subjective experiences, finding the precise imagery of visual hallucinations may point to their etiology.

As early as 1887 it was suggested that the physical eye itself furnishes the material on which visual hallucinations are based (27). This was consistent with the then current theory that dreams originate in endogenous somatic stimuli. Subsequently, psychoanalysis focused the interest of clinicians on the psychologic origin of dreams and hallucinations. The purpose of this paper is to reconsider the hypothesis that a nidus for some visual hallucinations indeed may be provided by optical structures, and to examine this hypothesis in the light of current neurophysiology and psychodynamics.

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CLINICAL OBSERVATIONS

A study of graphic communication involved frequent painting with chronic schizophrenic patients (25). A peculiar cessation in their communication was sometimes noted: they would stop painting and stare with the expression of abstract, perplexed intensity that seems to be associated with hallucinatory phenomena, and then they made simple figures which were different from the previous pictorial forms.

This observation led to questioning patients more closely about their visual experiences. It was necessary to persist beyond initial verbal descriptions of their hallucinations, and insist that the patient describe and *draw* what he had seen. Initial descriptions of "vicious snakes" might then be drawn and redescribed as wavy lines. "Two armies struggling over my soul" arose from the subjective experience of seeing moving sets of dots. "Spiders" might be reduced, when the patient stated and drew what he actually saw, to a few radiating lines. In drawings of their hallucinations patients could often distinguish those forms which duplicated what they saw with their eyes from those forms which were what they "made out of it." When the same hallucination was recurrent, the image experienced might be simplified as the clinical state improved. Of course, some patients gave descriptions of hallucinations that were not reducible to simpler forms. These generally were fully formed, animate objects, usually a particular person such as a parent or sibling. Descriptions that sounded as though the hallucination had exfoliated from a simple form were so common, however, that a hypothesis of some optic phenomenon providing the nidus for such elaborations was

formed. The following clinical examples illustrate this kind of description.

Visual hallucinations in schizophrenic patients

Case 1: A young man was diagnosed as having a schizoid personality underlying an acute schizophrenic reaction of the simple type. The first symptom of illness was the vision of a dragon one year previously. He had been brooding over the traumatic death of his older brother while staring at the flames in a fireplace. The jagged peaks of the flames assumed the shape of a dragon that menaced him accusingly. This image spontaneously reappeared before his eyes several times during the next few days in spite of efforts to blink it away. During the acute state of the present illness, he again felt accused by "heads" which, on repeated questioning for details, seemed to arise from prominent after-images or double visions of real objects. Figure 1A represents the patient's drawing of the dragon event and Figure 1B, the transition of a faucet into a head.

Case 2: A patient having a schizophrenic reaction jerked his gaze to one side periodically during an office interview. When asked why, he replied, "You've got bugs over there." After further clarification of what he experienced, he was asked to draw exactly what he saw. On another occasion he stated that he saw the faces of the Holy Trinity. The drawings made on both occasions were identical (Figure 1C).

Case 3: A chronic schizophrenic patient saw his "eyeball burning." Figure 1D represents his drawing; the heavy lines are what he "really saw." As his clinical state improved he saw "just flames" or "just wavy lines" and regarded them as "not really being there."

Visual hallucinations in a schizophrenic patient, apparently exacerbated by a drug-induced visual scotoma

Case 4: An 18-year-old, single, enlisted man in the Armed Forces was hospitalized when discovered roaming the streets in a confused and disoriented state. He had "hallucinations" of dots in the corner of his visual field, of which he made the drawing shown in Figure 2A. These visions occurred almost constantly during certain hours of the day, especially if he were not occupied in some distracting activity. During an interview he pointed to them with his finger and, when he would attempt to focus them, they drifted to the periphery of his visual fields. At times he was convinced they were "cosmic balls of fire sent to punish me." Treatment was started with chlordiazepoxide (Librium), 20 mg. four times daily. He reported a marked worsening of the visual disturbances and made drawings of what he saw (Figure 2B). On confrontation examination of his fields, he had a subjective left central scotoma which was confirmed by campimetry during an ophthalmologic consultation. When the opposite eye was closed he was able to see a figure in the left eye and another in the right eye (Figure 2C). With an exclamation of surprise, he identified the latter as "the snakes" he had been hallucinating. He then reported a schizophrenic episode, one and a half years previously, which he had kept secret hoping to remain in the Service. He stated he had not had visual hallucinations until he received medication which, by his description of the capsule colors and recognition of the current medication, had been chlordiazepoxide. For this reason chlordiazepoxide was discontinued. The visual phenomena diminished markedly although the dots persisted; the scotoma disappeared subjectively and by campimetry. A single dose of chlordiazepoxide caused these particular symptoms to recur. This medication, therefore, was permanently discontinued. When the patient was treated with thioridazine (Mellaril) no similar effects were noted.

In a patient reported previously, a sudden change in graphic imagery was noticed coincidentally with the administration of chlordiazepoxide (25). Murray reported

ophthalmologic changes as a side effect of this medication (38).

Visual hallucinations associated with Meniere's disease

Case 5: A 69-year-old woman with a 20-year history of Meniere's disease, documented by extensive neurologic evaluation and followup, gave the following history (with drawings). Her mother and two sisters had migraine headaches. The patient was asymptomatic until the age of 40, when she had an initial attack which she recalled vividly. While she was outside gardening, a shrub seemed to move. Then falling black spots appeared from above. Her vision became obscured by what appeared to be smoke and fog. She experienced a tremendous spinning sensation characterized by the world moving clockwise. As the "fog" cleared she saw brilliant herringbone scintillations in the periphery of the right eye's visual field and a bright halo around objects, bilaterally. The attack lasted 20 minutes and recurred two to five times a year thereafter, with some variations. She was very frightened, especially by the herringbone scintillations which she originally interpreted as fire and icicles of metaphysic origin. Her fears were relieved by reassurance from her physician who explained that these were auras of some sort and had a natural explanation. Subsequently she experienced them as repetitions of the pattern (Figure 3A) which appeared as though projected about six inches from the right eye. If she were looking at printing during an attack, the letters seemed to "jump like fleas." The "halos" appeared to be complementary figural after-effects rather than diplopia. Occasionally, instead of snow flakes, she would see fiery splashes ("tiny . . . suspended . . . all different") (Figures 3B and 3C).

Visual hallucinations persisting after LSD-25 usage

Case 6: A young married couple, both artists, sought psychiatric consultation because both claimed to experience visual hallucinations for several weeks following a single ingestion of LSD-25. The husband described being frightened of a dragon or demon that appeared in a toilet-bowl as it was flushed. He had lingering after-images of complementary color and form and would often see dots and sparklers in his peripheral vision. The images were reproduced in his paintings and consisted of stripes, parallel lines, dashes and many little circles. Clinically, he appeared to have a schizoid personality in adequate, nonpsychotic integration. His wife seemed to have a markedly hysterical character; her paintings were highly tinged with masochistic imagery. The hallucinations she reported seemed to be a histrionic bid for attention rather than a true visual experience. (Increased sensitivity to persistent figural after-effects, for weeks following LSD-25 usage, has been reported to the writer by experimental subjects and was also recorded by Asher [6]. Figure 4 reproduces the husband's drawing of portions of his visual experience.)

REDUNDANT ELEMENTS OF FORM

The repetition of such descriptions, although not invariably present when visual hallucinations were a symptom, suggested the possibility that some entoptic event, usually ignored, might provide a nidus around which hallucinations could be elaborated. Since a variety of visual phenomena, such as perceiving "floaters" or after-images, are commonly experienced, the following questionnaire was distributed to 80 staff members to obtain graphic representations of the forms of such experiences in normal subjects.

Questionnaire—Visual Impressions

Name:_____ Age:__ Sex:__ Date:__

1) Draw and describe the visual impressions you sometimes have while falling asleep or waking up.
2) Draw and describe the visual impressions you have had while looking at

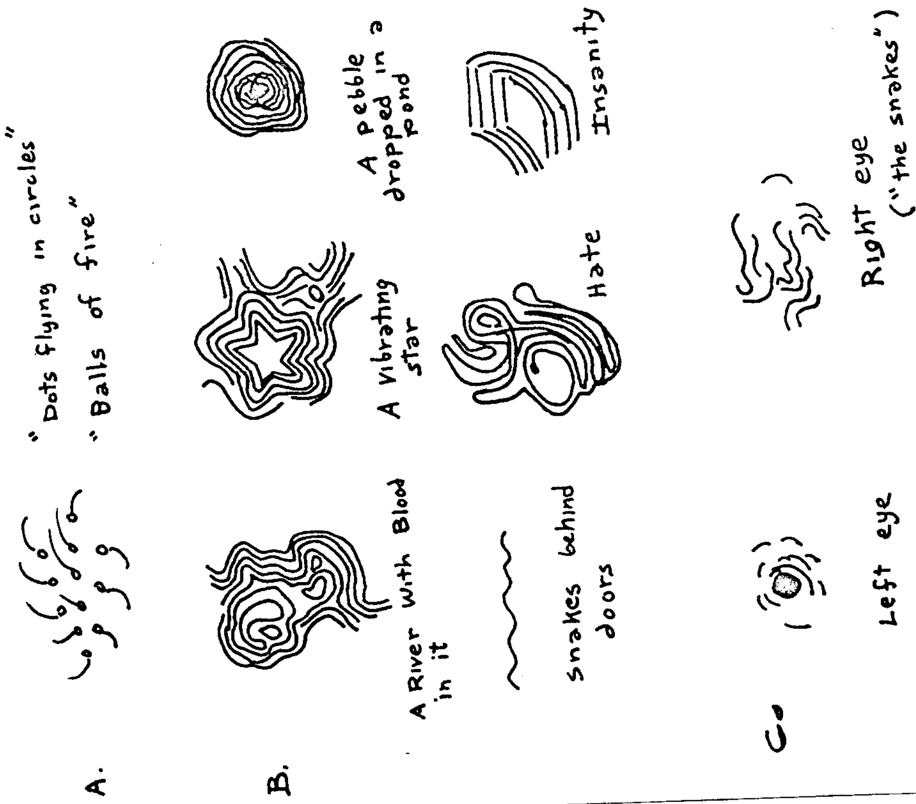


FIG. 2. Drawings of hallucinations. A, B & C: Case 4.

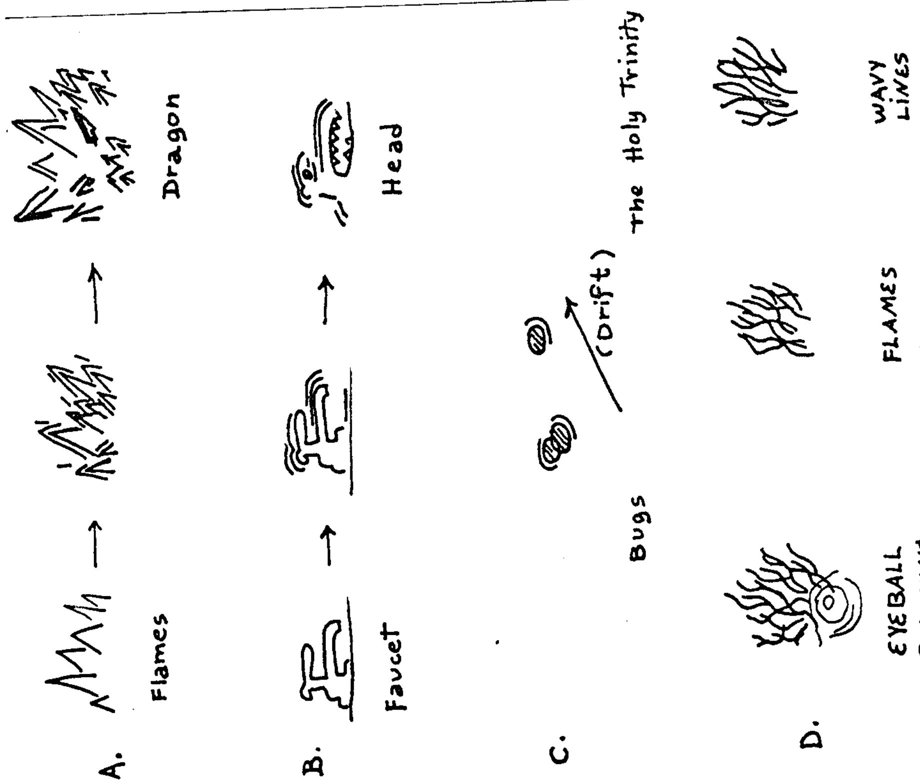
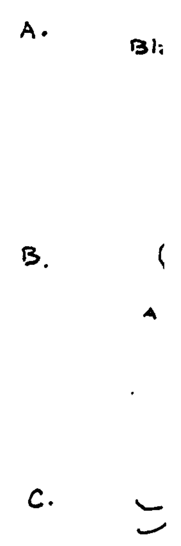


FIG. 1. Drawings of hallucinations. A & B: Case 1; C: Case 2; D: Case 3.



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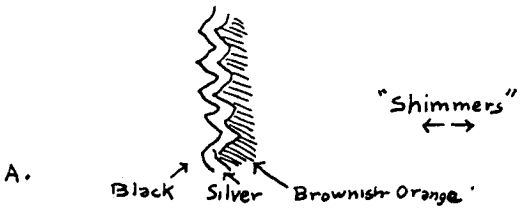
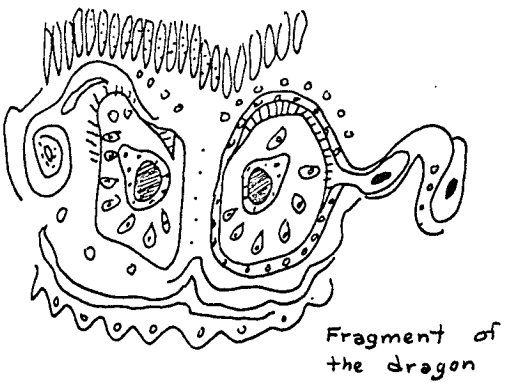


FIG. 3. Drawings of hallucinations. A, B & C: Case 5.



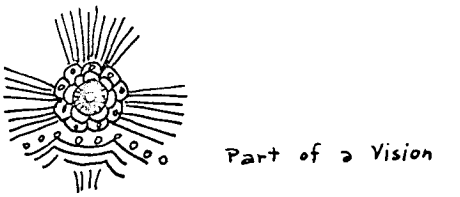


FIG. 4. Drawing of hallucination: Case 6.

bright spaces such as the sky, clouds, walls, etc.

3) Draw and describe the visual impressions you have had on being struck on the eyes or head, or on seeing a very bright light.
4) Close your eyes and press on your eyeballs with your thumbs. Draw and describe the visual impressions you get.
5) Have you ever had unusual visual experiences when:
   a. Delirious or confused
   b. Intoxicated
   c. Very ill or feverish
   d. Alone for a long time
   e. Unrested for a long time
   f. Isolated

   Draw and describe your impressions.

The completed forms contained descriptions and drawings which were quite similar to the graphic productions or verbal descriptions of patients reporting visual hallucinations. There was some tendency to interpret visual forms such as calling flashes "stars," wavy lines "snakes" or circular figures "marbles," but this was less pronounced than in the descriptions elicited from patients.

A redundancy of form was noted throughout the questionnaires completed by normal individuals, the drawings and descriptions of schizophrenics' hallucinations and the author's experience with psychotic art productions. In reviewing the literature on hallucinosis, the same forms were repeatedly reproduced in drawings of such visual experiences. In descriptions, the words used were also redundant, *e.g.*, stars, pinwheels, wheels, marbles, dots, specks, circles, snakes, swirls, wavy lines and filigrees. The repetitive figural elements were present in drawings and descriptions of the visual hallucinations of schizophrenics (4, 9) and in patient art (1, 2, 53). They were present in states in which there was a physiologic or biochemic disturbance such as in chemogenic hallucinations (35, 36), lesions or

FIG. 2. Drawings of hallucinations. A, B & C: Case 4.

FIG. 1. Drawings of hallucinations. A & B: Case 1; C: Case 2; D: Case 3.

stimulation of the brain (43, 49), retinal stimulation (28), toxic or starvation deliria (37, 56) and sleep deprivation (33, 55). Similar figural elements were also present in eidetic imagery (40), blank screen effects, hypnogogic hallucinations (26), the visions in sensory deprivation (37, 51), artistic imagery (5, 24, 29) and even mystical or "visionary" experiences (52).

Figure 5 represents the redundant figural elements in their simplest and most common forms; at times they appeared as overlapping, combined or multiplied.

DISCUSSION

Clinical material suggests that the subjective experience of having a visual hallucination may arise from a perceptual nidus of simple form. There are two possible entoptic sources of such forms: 1) the retinal ganglionic network and 2) anatomic bodies within the eyeball.

Retinal ganglionic network: This is the complicated circuitry of interlacing neurons which is fed by stimuli from the rods and cones and, in turn, connects with the optic nerves. Knoll and his coworkers (28) continued the nineteenth century work of Volta, Purkinji and Helmholz by studying the subjective visual phenomena which arise on mild electric or mechanical stimulation of the optic system. The drawings and descriptions of their subjects are very similar to the descriptions reported earlier and are com-

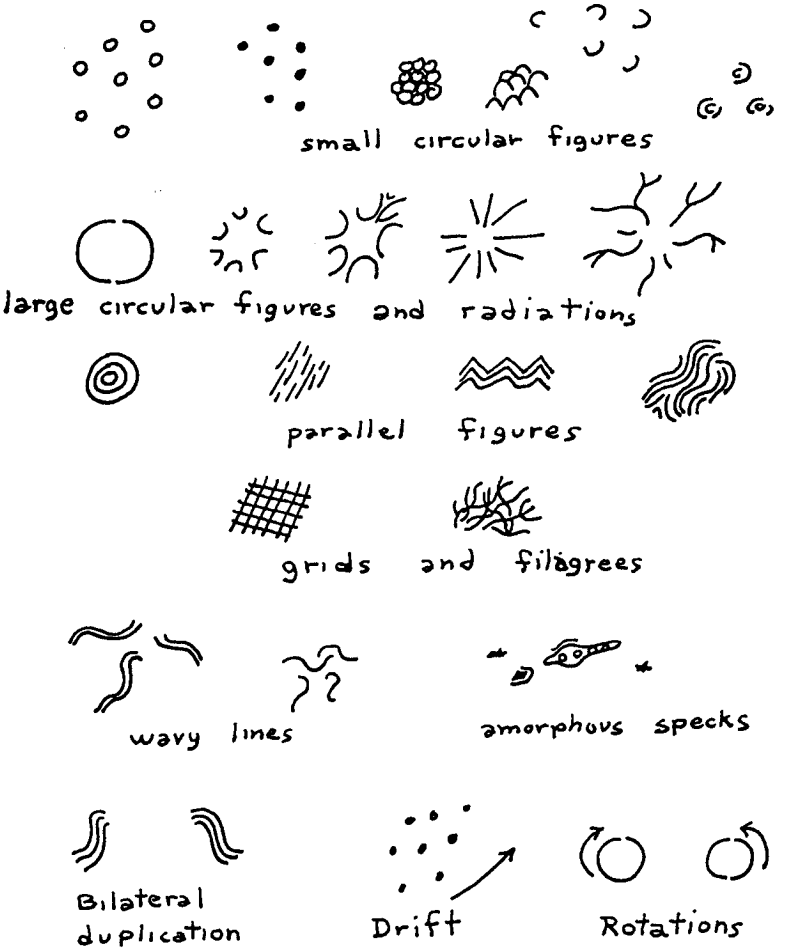


FIG. 5. Redundant elements in hallucinations and visual imagery.

posed largely of the figures abstracted in Figure 5. Knoll suggested that such experiences arise from the effect of electric stimulus on the retinal ganglionic network.

The early view of the optic pathway, as being a kind of telegraphic system with point-to-point retinal-cortical representations, has been discarded; the retina appears to do more work in terms of codifying information than was previously thought. This codification consists of special receptivity to patterns and takes place in the complex tangle of retinal neurons, feedback circuits and ganglia (18, 30). It is postulated that the basic elements of such recognition are: 1) straightness of line, regularity of arc; 2) circularity; 3) parallelisms of straight lines, arcs and circles; and 4) congruence of figures, equidistance and equiangularity (Figure 6) (44, 45). These elements resemble, in part, the images abstracted earlier from clinical material. They also fulfill the psychologists' criteria of pregnanz and figural goodness—the qualities found in figures most readily perceived (7, 22, 58). It is conceivable, then, that the images so repetitive in the clinical material may relate to the nature and function of retinal circuitry and receptivity.

Anatomic structure of the eye: The eye usually does not see its own contents, yet most people have visualized one or another of their entoptic elements. These are usually called floaters and are commonly seen while staring at a blank source of illumination such as an overcast sky.[2] It seems likely that the figures abstracted earlier could arise, in part, from stimuli originating in entoptic configurations. The patterns of the retinal blood vessels affect the light-sensitive rods and cones peripheral to the macula lutea, the area of precise vision. The shadows of such vessels could give rise to the wavy, radiating, filigreed elements; the blood cells within them might produce dot-like apparitions. The optic disc, *i.e.*, the central scotoma, could give rise to the large circular figures and the layers of rods, cones and neural bundles to the parallel figures. The fibers of the lens are arranged around six diverging axes; this causes the rays seen around distant lights (giving them a star-like luster) and can also produce a sense of parallel fibers, swirls or spots when such defects are present (21). The muscae volitantes, or floaters in the vitreous humor, like the artifacts in the lens, are produced by the invagination of integument during embryonal development of the eye and can give rise to oval or irregular shapes in entoptic visions. The movement of dots could be the flow of formed blood elements. The constant variations in optic movement caused by tremor, flicker and drift would also impart a sense of movement to the elements. Optic rotation could cause circling effects and bi-

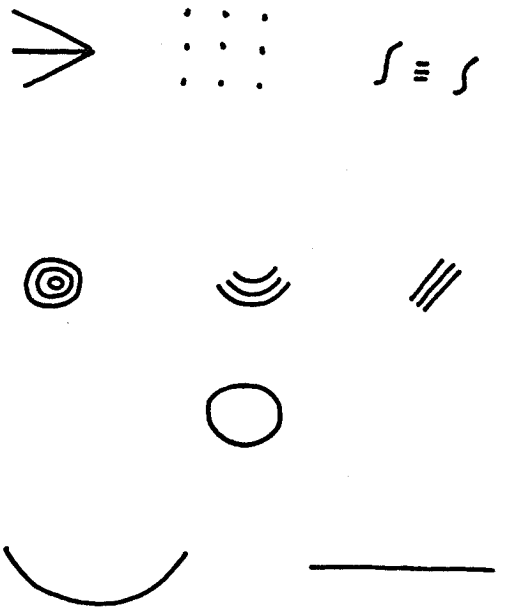


FIG. 6. Hypothesized patterns of special retinal receptivity.

[2] The reader may wish to experience this by trying the following procedure: Make a visual tunnel by forming a fist in front of the eye; clench the fist so that only a tiny prismatic stream of light enters, before staring at a very bright source of light. Alter the depth of gaze while staring at the prismatic streamers which fan out from the minute light-source. The refractile bodies that arise from structures within the eye will usually be seen.

lateral orbital stimuli could result in the reciprocal duplications. Other features of imagery might be related to such optic phenomena as the production of figural aftereffects (20, 34).

To restate the hypothesis, it is speculated that there is a redundancy in visual clinical material; that such redundance can be abstracted into simple forms, and that the origin of such forms may be entoptic—either from the anatomic characteristics of the eye or arising in the bioelectrical circuits for pattern receptivity in the retinal ganglionic network.

What would be the fate of entoptic images? Why are they usually not consciously perceived? Images that are stationary on the retina fade out in six seconds. The natural involuntary movements of the eye, especially flicker and tremor, regenerate the image and compensate for drift (11, 46). Certain entoptic elements, especially the optic disc and the retinal blood vessels, would not generate many impulses because of their relatively stable retinal position. Their shadows, however, would shift under certain circumstances of moving illumination. In addition to fadeout, then, there must be other ways of limiting the penetration of such stimuli.

There is continuous retinal activity, even with the eye at rest, and there are continuous forces of inhibition and facilitation which alter receptivity to various stimuli and patterns (8, 19). It is known that the visual field varies with the deployment of attention and that receptivity to visual messages depends on the state of visual pathway excitability (10, 31, 41, 57). With the evidence for centrifugal control, that is, for optic nerve impulses moving towards the retina, comes the realization that inhibition and facilitation may operate at a peripheral locus as well as in the brain (19, 44). Cortical responses to stimulation of the retina show: 1) a topographic, organized process and 2) a slower, more diffuse process, partially intraretinal, which activates major portions of the visual cortex (14). Such data elaborate the idea that vision is a complex transactional process with the eye telling the brain what it sees and the brain telling the eye what it should look for, what it should see and what it should not see in what it has seen.

Stimuli originating within the eyeball would register at the retinal level but could be kept from being perceived, under normal circumstances, by active inhibition or lack of facilitation. Such inhibition and facilitation probably take place at both the retinal and higher levels of the nervous system and represent the somatic equivalents of the deployment of attention. Under conditions of increased need to see, as in sensory deprivations, entoptic imagery could be facilitated or "tuned up." The somatic purpose would be to prevent optically dependent areas of the brain from being lulled by insufficient afferent stimulation. In schizophrenic persons normally extraneous imagery could be "tuned up" for defensive purposes such as to aid withdrawal from an environment perceived as hostile.

Some hallucinatory states are probably associated with lowered inhibition from neurophysiologic, biochemic or psychodynamic etiologies. If inhibitory ability were interfered with, images that are usually screened out could impinge on higher centers. There they could undergo a variety of secondary elaborations. The final conscious imagery would be like a microdream and would follow the same psychodynamics as dream work—this is substantiated by the study of immediate imagery and later dreams following subliminal tachistoscopic exposure to a variety of stimuli (12, 15–17, 32, 42). In this regard one may consider the initial registration as homologous to the day-residue, a stimulus that through image-work is changed into the conscious imagery.

In individuals with a relatively well functioning perceptual ego the secondary elaborations, moving along lines of wish-fulfillment, could result in illusions, hypnogogic

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hallucinations, or eidetic imagery. It has been demonstrated that these are related to the momentary wishes and needs of the subject (47, 50).

In schizophrenic patients the secondary elaboration of such elementary stimuli might culminate in a visual hallucination. Many schizophrenic patients describe being swamped by an incoming tide of sensations (18, 39). They are frequently unable or unwilling to screen out meaningless stimuli in order to focus their visual attention on meaningful stimuli. Their elaboration of percepts is often regressive and defensive; it may follow archaic primary processes without correction. This type of formulation agrees with von Domarus' (13) ideas of paleologic, Arieti's (3) concepts of awholism and active concretization and Shakow's (48) concept of segmental set. It also correlates with ideas concerning modalities other than vision. Luby (33) suggested that disrupted body input mechanisms, such as in audition, are responsible for some of the disturbances of schizophrenia. Hoffer (23) accounted for olfactory hallucinations by a hypothesis of lowered olfactory threshold. Sullivan postulated a loss of inhibitory ability as the cause of schizophrenic language. When inhibition is lowered, language regresses to its primal purpose—the establishment of a sense of security with others rather than the transmission of information. Such a process, he continued, goes on at all times but is screened out as unreasonable as long as one is alert. Should a person fall asleep while talking, however, he may awaken to find himself talking schizophrenic language (54). Shakow summarized the disorganization in schizophrenia as the inability to maintain a major or generalized set in conjunction with a trend to establish minor sets—to segmentalize both the external and internal environments. Thus "there is an increased awareness of, and preoccupation with, the ordinarily disregarded details of existence—the details which normal people spontaneously forget, train themselves, or get trained rigorously to disregard" (48). Schizophrenic persons may selectively adapt-in entoptic visions as an environmental avoidance defense or they may be physiologically unable to adapt-out entoptic visions as can normal persons.

SUMMARY

Redundancies in clinical material concerning hallucinations and visions have been abstracted into a series of simple elements. It is hypothesized that these images may arise in the retinal ganglionic network or may be from the anatomic structures of the eye. While usually unseen, under various conditions of special facilitation or during disinhibition, they would impinge on higher centers of the central nervous system. The type of secondary elaborations would vary with the state of the individual. The images would then provide a nidus that, through image-work, could be elaborated into illusions, eidetic imagery or hallucinations.

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