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Original Articles

A PRELIMINARY NOTE ON THE PSYCHIC ACTION OF MESCALIN, WITH SPECIAL REFERENCE TO THE MECHANISM OF VISUAL HALLUCINATIONS[1]

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In the world of psychical things, our experience is always confined within the narrow limits of what we call our own mind. We can gain knowledge regarding psychic phenomena which we ourselves have never consciously experienced only from that which is imparted to us,—only from that which is externalized of the mental processes occurring within the psyche of others. What these others actually experience, we can but faintly realize, for we are wholly dependent upon that which they choose to

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reveal. If they can but imperfectly express their mental experiences, either verbally or emotionally, we can never attain to any but a vague conception of the actual psychical processes which they are undergoing. If they are reluctant to inform us of what is passing within their consciousness, we must remain practically in ignorance of it. We can just as little decipher their thoughts as we can decipher the thoughts of animals. As psychiatrists, therefore, we must be as chary of deduction when dealing with abnormal minds as we would be as psychologists, when dealing with animals.

Seldom can an insane person rationally communicate the essential nature of his disturbed mental processes, and still more seldom are we in a position to compare such a patient's mental picture with analogous pictures from our own experience.

We must therefore realize that, from a strictly scientific standpoint, the subjective abnormal mental complexes, called psychoses, are extremely difficult processes to interpret. We know of them very little. What we do know are usually accompanying objective phenomena, which apparently play no essential rôle in the psychoses; but which are added to, or incorporated with the subjective phenomena.

Obviously we would soon clarify the whole symptomatology of psychiatry, if psychiatrists themselves were in the position to live through all the different psychoses. As this experience is denied us, only one way remains, by which we can hope to reach more light in our science; namely, by administering to one another such substances as will produce in us transitory psychoses.

Kraepelin was the first investigator to endeavor, by means of experimentally induced psychoses, to explore the way to the complicated mental phenomena of the insane. He and his pupils established exact experimental methods, by which they investigated the action of tea, alcohol, morphine, trional, bromide and other drugs upon mental processes. Their researches have yielded valuable advances in psychopathology. Unfortunately, the substances, which Kraepelin and his pupils employed, produce mental states which have little similarity to actual insanities. In Kraepelin's clinic we endeavored further to extend knowledge of pathological mental states by producing mental conditions nearly allied to generally recognized types of insanity, in order to study the mechanism of processes which bore a close

likeness to actual mental disease. For this purpose we used the Mexican drag pelotte—the mescal button.

Prentiss and Morgan, Weir Mitchell and Eshner had described the phenomena induced by the mescal button, *Anhalonium Lewinii*,—a favorite narcotic among Mexican Indians, and dilettante drug habitués. Heffter had shown that the active principle of the drug was contained in the alkaloid mescalin. We administered to a number of physicians who volunteered, and several times to each of ourselves, the sulphate of mescalin, the essential principle of this delusional Mexican drug. We made altogether twenty-three experiments. The drug was injected into the subcutaneous tissue of the forearm. It caused an intoxication of a curious and unique nature, which markedly developed in about an hour.

Consciousness, during this intoxication, remained practically unclouded. Its extent was, however, tremendously limited, in a fashion somewhat similar to that which Vogt has described as characteristic of consciousness in hypnosis. In mescalin poisoning, the partial and systematized consciousness of hypnosis is not absolutely reproduced: in mescalin poisoning, attention is not so restricted as in hypnotic conditions. Although attention is directed to one subject at a time, it is not immured in that one subject, as happens in hypnosis, but successively passes from one subject to another. Yet, during a poisoning, while any one subject is under consideration, that subject occupies conscious attention in a much more intense and exclusive manner than normal.

Mescalin and Alcohol.—The mescalin poisoning has also certain similarities with alcohol intoxication, inasmuch as it produces a feeling of increased mental capacity, of ease in mental work. This increase, however, is not, as a rule, objectively substantiated when the capacity for mental work is tested, although the disparity between the amount of mental work done and the feeling of increased capacity is not so evident as is usual in alcohol poisoning. Indeed, in some of the investigated persons, there was not merely a feeling of increased capacity, but actually a demonstrable objective increase in the capacity for a simple mental task, such as reckoning. An increase in the person's capacity for apperception (auffassung) also was usually demonstrable; but, as apperception depends in part upon visual acuity, and, as visual acuity is incontrovertibly enhanced by the action of the drug,

this increased apperception may not have been due as much to increased rapidity of the mental processes as to increase in the visual power.

The integrity of the associative and apperceptive faculties is retained in mescalin poisoning. Hence arose one of the features distinguishing mescalin from alcoholic intoxication: viz., that the investigated person, as a rule, seemed outwardly little affected, and appeared to the uninformed not to be under the influence of a powerful intoxicant. The most remarkable feature of the intoxication was hallucinations. Exceptionally, auditory hallucinations were present. Often the hallucinations in the muscular sense sphere were quite astonishing. The following is a brief account of these hallucinations observed in one of the earliest experiments. Time, two and a half hours after the injection of the drug:—

"When standing, I could not walk until I was pushed, and then I unsteadily, stiffly, shuffled along, certain I was going to fall, but improving in confidence and ease of walking with every step. On reaching the laboratory felt faint; could not remember what mechanism to employ to get from the upright to the sitting posture; and was helped to lie down on the floor. Shortly afterwards, to my great surprise, I realized that I had no head, but in its place a sheet of ground glass, such as is used in cameras as a screen. Trying to touch my nose, I, with my eyes open, watching my hand, felt about my chest, neck and face, quite unknowing where I would find it, but I recognized it at once when I did touch it. Where my ear was, was an insoluble mystery; I could not find it so long as with open eyes I followed and controlled the movements of my searching hand. But, with my eyes shut, if I did not attempt consciously to do the task, or to think of what I did, my hand moved accurately to the desired locality. I was quite unconscious of the position of any part of my body, so long as it was still, but if it were moved for me, or if I moved it myself, my power to judge its position immediately awoke. At rest, I felt I had no thighs or legs, only tiny ankles and feet attached to the groin. Yet, on being tested, on being required to perform a fairly complicated movement, I did it almost faultlessly, and during the movement, although the limbs appeared numb and heavy, the real delusion disappeared, *i. e.*, I was no

longer conscious of the two little feet in any way existing alongside of, or combined with the sensation of my moving legs.

Visual Hallucinations.—Subjectively, the visual sensibility was tremendously increased. This hyperesthesia we objectively demonstrated for color, by means of Marbe's color wheel. The sharpness of contour which all objects seemed to have, while very apparent subjectively, we failed to demonstrate objectively.

Soon after the onset of the visual hyperesthesia, to nearly all of the investigated persons, out of total darkness, kaleidoscopic pictures appeared.

The following excerpts from the report of a poisoning will perhaps suffice to convey the general trend of the visual hallucinations. Time, four hours after injection.

"Immediately before my open eyes are a vast number of rings, apparently made of extremely fine steel wire, all constantly rotating in the direction of the hands of a clock; these circles are concentrically arranged, the innermost being infinitely small, almost point like, the outermost being about a meter and a half in diameter. The spaces between the wires seem brighter than the wires themselves. Now the wires shine like dim silver in parts. Now a beautiful light violet tint has developed in them. As I watch, the center seems to recede into the depth of the room, leaving the periphery stationary, till the whole assumes the form of a deep funnel of wire rings. The light, which was irregularly distributed among the circles, has receded with the center into the apex of the funnel. The center is gradually returning, and, passing the position when all the rings are in the same vertical plane, continues to advance, till a cone forms with its apex toward me. (These changes in position of the vision were probably due to the same disturbance as caused the vomiting associated in this case with the poisoning.) The cone apex recedes, the inner rings of the circle rapidly change color; beautiful crimsons, purples, violets, blues and greens quickly succeed one another. The wires are moving sinuously in groups from below upwards, passing, crossing and recrossing each other, and curving intricately, so as to produce rarely balanced figures, such as are seen in a kaleidoscope. The background to this gorgeous color panorama was first like faintly illuminated ground glass; it is now a silvery tint, and is deepening into a yellow like pure gold. The colors and their shades vary in different parts of the field. The illumination

proceeds from a light, or lights moving suddenly from place to place behind the background, and producing wonderful effects of deep shade and bright light contrast, of sudden bursts of light, and equally sudden extinctions.

"On pressing upon my eyes, the whole picture seemed to materialize; the wires became thicker, and much more brightly colored; they now seemed very much nearer, more solid, more real and quite distinct from the background, which apparently remained where I had seen it previously; soon they slowly receded.

"All this occurred within a circular area which had at first been bounded by the outermost of the concentric wire rings, which after all the other rings had disappeared, somehow persisted, without my consciously noticing it.

"The wires are now flattening into bands or ribbons, with a suggestion of transverse striation, and colored a gorgeous ultramarine blue, which passes in places into an intense sea green. These bands move rhythmically, in a wavy upward direction, suggesting a slow endless procession of small mosaics, ascending the wall in single files. The whole picture has suddenly receded, the center much more than the sides, and now in a moment, high above me, is a dome of the most beautiful mosaics, a vision of all that is most gorgeous and harmonious in color. The prevailing tint is blue, but the multitude of shades, each of such wonderful individuality, make me feel that hitherto I have been totally ignorant of what the word color really means. The color is intensely beautiful, rich, deep, deep, deep, wonderfully deep blue. It is like the blue of the mosque of Omar in Jerusalem, but there is here no trace of Arabic script on the mosaics. The dome has absolutely no discernible pattern. But circles are now developing upon it; the circles are becoming sharp and elongated at the four points of the compass, and are flattening at the sides; now they are rhomboids; now oblongs; and now all sorts of curious angles are forming; and mathematical figures are chasing one another wildly across the roof. The colors are changing rapidly —from blue green to black, to brown—passing successively through an infinite variety of transitional shades. . . . "

6 hours later: "A beautiful palace, filled with rare tapestries, pictures, and Louis Quinze furniture has been peacefully unfolding itself, room after room, each a little different from all the

rest, all marvelously bright and beautiful, and all colored in the same scheme—violet, cream and gold.

"In these rooms ladies appeared. They were all absolutely without motion, without the slightest suggestion of reality; in fact they were as a series of portraits, or of statue groups, which I was observing in a picture gallery."

Twenty hours later: "Long, light green outlines, suggesting crocodiles, lizards and other reptiles are appearing, but they are all indistinct, remote and unreal; they arouse absolutely no sensation of fear. Gigantic plaster casts, rough and unfinished, suggesting death masks; crude representations of gargoyles, such as ornament the Notre Dame in Paris; grotesque dolls; hideous monstrosities of human birth, preserved in bottles; visions of human intestines, of sections of abdomens, and sections of the pregnant uterus, have been annoying me all night."

It was characteristic of practically all the poisonings that to wavy lines succeeded mosaics; carpets; floral designs; ornaments; wood-carving; windmills; monuments; mausoleums; panoramic landscapes; statuesque men and animals, frequently of unnatural, doll-like form; and finally complete scenes which changed so as to unfold episodes in a connected manner. The pictures were mostly plastic in form, of very sharp contour, painfully bright, and colored as by chalk. The pictures were usually, but not invariably, rich in imaginative content.

The vividness of these hallucinations varied remarkably in the same person in the course of the same intoxication. Sometimes the visions were dark, contourless, colorless shadows; at other times they had a remarkably sharp contour. Usually they were marvelously colored, and not rarely their brightness seemed positively to pain the eyes. Twice definite delusions arose.

Independence of the Hallucination.—The independence of the hallucinations towards thought and will was not quite absolute. Upon intently thinking, or intently willing to see, a particular object, no immediate result occurred; the hallucination apparently continued undisturbed and unchanged. Yet after a longer or shorter interval, obtruding itself upon the panorama of the hallucinations, came another hallucination, one which was directly related with the particular object which had been intently willed. In addition to its delay this self-suggested representation was not a precise reproduction, but merely a distorted effigy of the vision

which was desired. Thus, while watching a panorama of a danseuse on a stage, one of us attempted to picture a shoe. He repeated to himself all the separate parts of a shoe, and endeavored by concentration to bring up an hallucinatory image of a shoe. The danseuse continued to dance undisturbed for some time, and then suddenly and unexpectedly there appeared a gigantic misshapen .shoe, seemingly moulded in plaster, and colored green.

Hence these hallucinations, though mainly of an objective character, were partly, and remotely under the influence of the will.

The Hallucinations and Visual Images.—In spite of the vividness of the hallucinations, the poisoned person possessed visual images of daily events, just as is normal in reverie. Such visual images occurred synchronously with and separate from the mescalin hallucinations, from which they differed by seeming to have no independent existence; by seeming to belong to the person's own thought, and to be a part of his own personality. The visual images had a personal and intimate relation to the investigated person, which was altogether absent in the hallucinations. The visual images could be controlled, changed and recalled as in normal life, but not with quite the same facility.

The hallucinations always seemed to be something arising outside of and independent of the investigated person. The hallucinations could not be reproduced at will; they came unsought, they were uncontrollable, and they were only remotely interfered with by the will.

As the hallucinations and the visual images can coëxist, as the hallucinations are not subject to the will and the visual images are, and as the relation of the hallucinations to the personality is fundamentally different from the relation of the visual images to the personality—a mescalin hallucination must, therefore, be something quite distinct from a mere visual image; and in mescalin poisoning a visual idea, no matter how vivid, can never merge into an hallucination.

The poisoned person retained all his critique; he recognized practically always that the hallucinations, although independent of his thought, were yet much less objective than any external object with real existence. Although a mescalin hallucination is felt to be much more objective than a mere idea such as a visual

image—with but few exceptions, in our twenty-three experiments this objective character was never so intense as to confer upon the hallucination any suspicion of real existence.

Points of Distinction between Mescalin Hallucinations and Peripheral After-images.—Peripheral after-images could be reproduced by the usual methods alongside the hallucinations. These peripheral after-images were easily distinguishable from the hallucinations. They at first alternated with, next coëxisted with, and then merged with the mescalin hallucination. These peripheral after-images always had a totally objective character, and they were much more material and real than the most vivid of the hallucinations produced by the mescaline. Moreover, by moving the eyes laterally, the position of the peripheral after-images in relation to the hallucinations could be made to change; the hallucinations remained stationary in space, the peripheral after-images moved with the eyes. The distance of the peripheral after-image from the eye was short, and varied little; whereas the hallucinations appeared sometimes as far as a stage is from a person in the auditorium; and constantly varied in remoteness, advancing almost up to the person, and then retreating far into the darkness. All the hallucinations were enacted within a visual field, which was as a cone with its apex towards the person, so that the size of the pictures varied only with their distance from the observer; whereas, the after-images were not enclosed within any such well-defined area, but were limited only by the extent of the visual field.

Hallucinations and Central After-images.—A very curious relationship was observed between central after-images and mescalin hallucinations. One of the investigated persons, before his intoxication became manifest, carefully studied a map of a region known to him. Among his first hallucinations was a reproduction of this map, in its most minute details; but, in addition to all the details of the map, a town which was actually omitted in the map appeared in its proper position in his hallucinatory representation of the map. Here was an example of a central after-image being converted into an hallucination, but into an hallucination which corrected and amplified the original object which had given rise to the central after-image.

Fate of the After-images.—The after-images merged ultimately with the hallucination. This phenomenon was very re-

markable, for no matter how distinct and how dissimilar the hallucination and the after-image originally were, their ultimate fusion produced an harmonious hallucination. Thus, subconsciously, these two dissimilar apparitions, competing with each other for notice, were compounded actively, so that one apparition alone remained, in which the elements of the hallucination and of the after-image could be detected.

Our experiences seem to indicate that five levels may be distinguished in passing from purely objective imagery to purely objective realization:

First level, the most subjective. The visual image, the visual idea.

Second level. The mescalin hallucination, more fantastic, more objective, but still definitely without suggestion of material existence, although largely independent of the personality.

Third level. The central after-image. A mechanical copy of an objective impression, emerging out of darkness, without spontaneity. This level seems to be just above that of the mescalin hallucinations. Indeed, the hallucinations very frequently began with a display of central after-images of the wires of an electrical apparatus which we had just used, and only gradually acquired an independent character, a character without relation to the personality as regards content.

Fourth level. The peripheral after-image. Totally objective but still not real.

Fifth level. The true objective reality.

Some idea of the relation of these levels to one another is suggested in the following diagram.

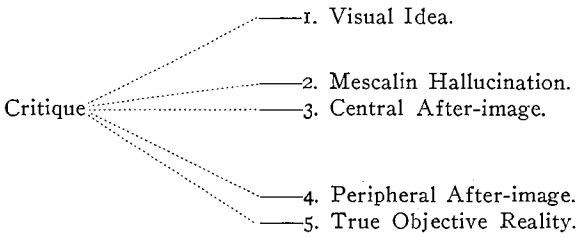

Diagram of Levels in the Visual Sphere.

There exists at present two schools of thought with regard to the hallucinations of the insane. One says that hallucinations

are essentially hallucinations, whether they be of very weak, or of very strong imaginative force; the other, that an hallucination is merely a much exaggerated visual idea.

We wish not to side with either school, but merely to state our personal experiences in the matter of these poisonings. All our hallucinations, no matter how weak, or how strong their imaginative force, no matter how feeble their development, remained indubitable hallucinations, and never sank to be merely ideas, the outcome of a vivid imagination.

We feel that this part of our work has only served to show how complex is the question of hallucinations. Whether an idea may become intensified till it merge into an hallucination or not, is only a part of the problem, for hallucinations can involve at least any one of several of the levels which by the action of mescalin we have been able to distinguish.

Definite delusions appeared in several of the investigated persons; had for these persons all the elements of reality; were identical with mescalin hallucinations; and owed their reality mainly to the affection of the critique.

One of us imagined he saw crawling on the wall an insect, of whose material existence he was so convinced that he proceeded to slay it; he then discovered that the object was nothing more than a stationary nail. Another hearing the pencil scratching on the paper on which one of us was recording his hallucinations, thought it was a dog howling, and insisted upon the creature being quieted. Thus the critique sometimes disappeared; but in each of these examples, there was some external stimulus—in the one case the nail, and in the other the scratching of the pencil on the paper—which was wrongly interpreted. Whether or not the existence of this external stimulus was a determining factor in the temporary obscuring of the critique we are not prepared to say. It is noteworthy that the visual hallucination materialized in a darkened room—that is, under circumstances in which our critique of visual impressions normally is somewhat uncertain.

As regards the auditory delusion we may remark that, as only one sound can be heard at a time, whereas visual hallucinations can be perceived together with ordinary external objects, the auditory critique is so much the more liable to disturbance than the visual.

In one instance, however, the hallucinations of muscular

sense and of vision were replaced by definite combined delusions. In this person the feeling arose that the body was cut in halves transversely at the waist. Presently he saw the lower half of his body before him, and somewhat to the right side. He became very excited about it, and found that when he moved, the separated part of the body moved with him. He danced vigorously in an effort to restore his former integrity. In this person also other visual delusions occurred. Thus, he saw a French soldier and had to be forcedly restrained from attacking his delusion.

It is noteworthy that we found no indication of the fundamental importance of sexual experience in the content of our artificial hallucinations and delusions, even when special means were taken to elicit it.

In addition to these actions, mescalin produced a most remarkable effect upon the appreciation of time. Persons under the influence of mescalin enormously overestimated time periods. Seconds seemed minutes; minutes seemed hours. One of the investigated persons, who had been left half an hour in the dark, thought he had lived through the whole night in this time. We investigated this phenomenon experimentally, and found that the overestimation although largely subjective was still demonstrable objectively. The results of these investigations, together with the details of our measurement of the power of perception, the power of reckoning, the power to distinguish, the memory, the simple motor reactions, the weight sense, fixed and free word associations, and the visual acuity for colors, will later be published.