

sence of any sense stimulation might do to a man — say, a man lost alone in space. And it found, to nobody's great surprise, that floating limply in a tepid bath in the silent dark hour after empty hour is very trying for most of them, normally leading to hallucinations within a day. Various subjects have reported seeing "prehistoric demons," rows of little yellow gnomes, squirrels marching with knapsacks through futuristic beehive cities, five-dimensional teeth and the ultimate "gone" feeling of being swallowed down an "astral throat" into a "stomach outside the universe" — some such effects persisting for days after returning to normal living.

The world record for enduring "total" sense deprivation — staying alive, conscious and sane without appreciably seeing, hearing or feeling anything — is 3 days and 20 hours, recorded in 1962 at Lancaster Moor Hospital in England. This ordeal of course did not include motionlessness, the world record for which is only 4½ hours, and I doubt if the darkness, silence and feellessness were anywhere near total.

In actuality there is a large, sometimes fearful, amount of background noise to be heard in one's ears if one rests quietly, listening for it and tuning on it. Even on a still night in subfreezing weather I find I can hear something like crickets chirping, wind whistling, machinery grinding and of course my own heart thumping. And something comparable occurs with vision for I see what appears to be the Brownian movement of molecules in the air and other mysterious moving forms and colors, especially when my eyes are shut.

PHOSPHENES

This brings up the subject of a kind of inner sight that is hard to categorize because it is not yet well understood but seems too important to omit from our discussion of senses. It is the phenomenon of images known as phosphenes, the scientific word for the "stars" you see when your head gets banged and for the scenes that appear when you're half asleep or when you meditate with your eyes closed. Derived from the Greek *phos* (light) and *phainein* (to show), phosphenes may appear whenever visual input from outside fails to penetrate your eyes. They are believed to originate primarily inside the retina and brain, "reflecting the neural organization of the visual pathway," and may be the nearest thing to a scientific explanation for the visions of religious mystics. Pilots flying alone in empty skies at very high altitudes habitually experience phosphenes, and presumably astronauts on long interplanetary voyages will be familiar with them, al-

though at least some of the flashes already seen by astronauts going to the moon are deduced to have been caused by the heavy particles known as cosmic rays.

Phosphenes are also seen, probably inevitably, by all normal young children (not to mention animals), to whom they may be as real as the external world — that is, until, little by little, the unfolding years of growing up shed light on how to tell the difference. Between the ages of two and four, when the child can hold a crayon but knows little of how to draw objectively, he is most apt to draw things with a distinctly phosphene character. And this is about equally true of primitive humans who lived during mankind's childhood, to judge by the phosphene-like figures in some of the prehistoric cave paintings, in folk art and Indian blanket designs. Drugs likewise bring on phosphenes, particularly hallucinogenic drugs like mescaline, psilocybin or LSD. So does alcohol, as anyone who has been through delirium tremens can tell you, and diseases of high temperature, particularly scarlet fever.



Probably the simplest way to see phosphenes though is to shut your eyes and rub your eyeballs hard. This is pretty certain to ignite for you an array of lights like a city viewed at night from an airliner, a dramatic crystalline checkerboard or moiré pattern featuring many colors and flashing rubies, diamonds, sapphires and emeralds. That these patterns are not just random is now well accepted, especially as they were recently classified into fifteen categories by a researcher named Max Knoll on the basis of reports from more than a thousand volunteers. While psychologists seem reluctant to conclude more than that "certain forms are characteristic of each pulse frequency for each individual," to my mind these fifteen characters are rather otherworldly and exciting and I let myself imagine they just might be the alphabet of some still undiscovered interworld code or script — or maybe even the signs of a mental zodiac of the universe.



UNSENSSES

If phosphenes are a manifestation of an inner sight that blossoms into being when one's normal outer vision is cut off (by eyelids, injury, drugs, etc.), they are a living testament to the abstract nature of the world, the relativity of its qualities and to the paradox that we must *unsense* some things in order to *sense* other things. The fact that only when it is dark can you see the stars is thus reconciled to the fact that only when you lose some senses do you become aware of others. Helen Keller became the classic and eloquent advocate of this principle when she exclaimed "I sense the rush of ethereal rains . . . I possess the light which shall give me vision a thousandfold when death sets me free."

Sometimes it is easier to adjust to losing sight, as John Howard Griffin did when blinded by a bomb in World War II, than to the return of sight, which shocked him when his vision unexpectedly came back more than ten years later. The sudden intensity of the light then seemed cruel. When an understanding attendant turned off a lamp, he said, "I felt as though a burden were lifted from me — safe, at home in the dark . . . Certainly this adjustment [to vision] is more difficult than the one to blindness . . . Then I was alive to all stimuli. Now I am blurred to all of them except sight."

The aspects of relativity may be even more striking in the case of hearing. At least that is suggested by the story of the aging English earl who liked to entertain diplomats and, when he grew hard of hearing, trained his servant to beat a drum in a certain rhythm whenever one of the guests spoke. The earl wasn't really perverse, as you might think, but had made a practical discovery as to how to hear better. The noise of the drum, hardly noticeable to his own half-deaf ears, nonetheless forced the speaker to raise his voice to the earl's hearing amplitude. At the same time, for other listeners, it effectively drowned out what was being said, so the earl could enjoy his most sensitive conversations in exclusive privacy.

A lot more important of course were the deafnesses of such composers as Beethoven, Bruckner and Smetana, whose aural failures may well have helped them and the world by intensifying their concentration on listening and by blocking extraneous sounds. Beethoven

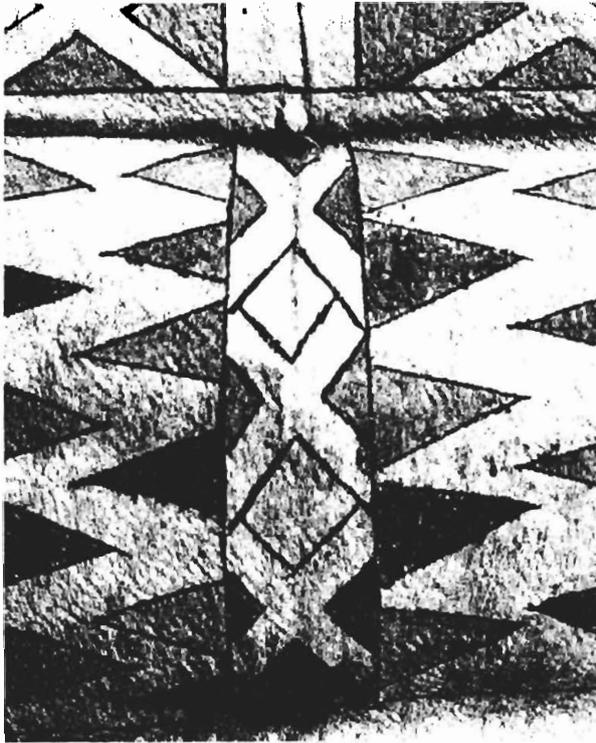
is the most dramatic case of all. When his First Symphony was first performed in 1800, young Ludwig, already famous at thirty, was also hard of hearing; two years later when his beautiful Second Symphony was completed, he could barely hear a full orchestra through his ear trumpet. Yet, as his deafness reached totality, that work was surpassed by his *Eroica*, *Moonlight Sonata*, *Fifth Symphony* and, after a quarter century of deafness, his glorious *Ninth Symphony*. If he hadn't gone deaf, one may presume that he would have continued his brilliant career as a Viennese piano virtuoso, as well as the teaching and social activity that traditionally went with it. But he was an extremely sensitive man and so deeply embarrassed by his deafness that he became a recluse, retiring shamefacedly to the little suburb of Heiligenstadt at the age of thirty-two, largely shutting himself off from the world while moodily, broodily withdrawing inwardly, dreaming, composing and recomposing, hearing music only in his imagination. Indeed without the loss of his hearing, his unequalled profundity of creation might never have flowered. And a paradoxical truth we may conclude from this is that sense in general is not only life's bridge to the world but also its inexorable cloud that veils and distorts reality.

THE MEANING OF SENSE

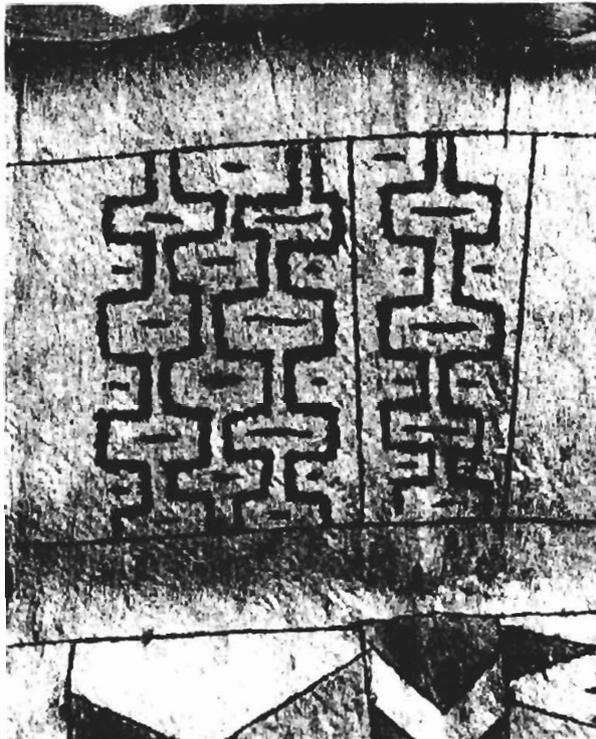
Surely the world adds up to something greater than just what our senses tell us. But what? And if the real world is not the material one we sense, what is matter for? And is the stuff of Earth and the universe in any way intrinsically base or unworthy as some spiritual leaders seem to imply?

I submit that the essence of matter may be that it is the means (God's means, if you can accept God) of acquainting us with facts during this elementary finite phase of our existence. For, if there were no material world of sense, would not some other kind of world have to replace it, assuming we are to learn anything or grow or evolve? And would not that substitute world have to be sensed in some way also if it were to serve its purpose? And, in doing so, would it not demonstrate that it too must be a material, palpable world — indeed a world just about like the one we live in (and presumably *must* live in) at this stage of our development?

If this line of reasoning be close to the mark, perhaps the material world is nothing but the stuff of consciousness, composed of things that can be tuned in on by senses. For even an odorless gas like carbon monoxide can be sensed deductively or indirectly with instru-



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Figs. 49, 50. Cubeo: Painted bark cloth

contained quite similar motifs and it was these the commentators recognized and interpreted. It was a system of communication from which I was excluded.

As the number of finished designs increased and it became possible to perceive an overall, stylistic patterning composed of individual motifs and units, it also proved easier to pick out certain elements that repeated themselves in various designs. These individual motifs recurred repeatedly but seldom exactly the same. Each contained a readily distinguishable basic element, say a diamond, concentric circles, or a line of dots, which varied in size, color, and firmness of stroke, but were each contained that one basic trait that made it distinguishable from others and gave it its individuality.

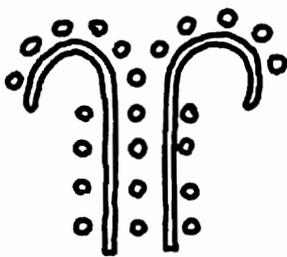
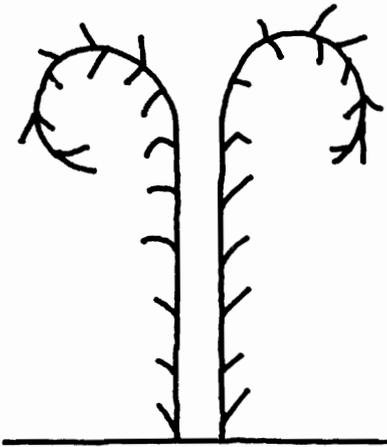
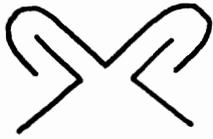
After isolating a series of motifs, I made a copy of each on a numbered card, simply outlining the basic shape. When the cards were shown around, the reaction was extraordinary; most people not only recognized the design elements, but often attributed to each a quite specific meaning. This meaning, moreover, was almost always phrased in terms of fertility symbolism, of growth and regeneration, referring occasionally to the women of other exogamic units. Although these interpretations were checked with several dozens of men, the sample is far too small to be of statistical significance, but the fact remains that a large number of design elements appeared to be coded.

The overall agreement on the significance of certain motifs was striking indeed. The men affirmed that they had seen these patterns when taking yajé and that the individual motifs stood for specific concepts. No more, no less; there was no secrecy involved, no mystical awe. It was a very simple matter to all concerned.

These are the individual design elements, together with their respective meanings, as described by the Indians.

1. A bifid or bicornate form of divergent scroll, similar at times to certain pubescent botanical forms such as two fern crossiers, at other times to a spurting fountain, represents the male organ and, in a wider sense, all organic

growth. It is a symbol of emerging life, both in terms of emerging fluids or of incipient plant growth.

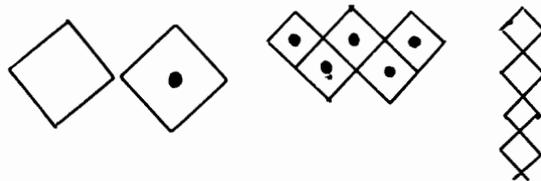


2. A triangle flanked by two short vertical lines, the upper ends of which are outward-turning scrolls, was identified by most men as representing the union of a male and a female organ, the triangle being the female element, the scrolls indicating the testes. The Indians explained that the sign represents the sprouts of

the rubber tree (*Hevea pauciflora* var. *coriacea*), called *vahsú* in Tukano. The fruit of this tree is edible when boiled and encodes a seminal concept because of its gelatinous texture. It is often used as fish bait, a metaphor for sexual pursuits. The fruit is the favored food of the long-beaked toucans, the phallic ancestral birds that have given their name to the Tukano. The white latex is compared to semen.



3. A diamond or lozenge represents the female organ and is a basic sign that can be elaborated and combined in various ways. In its simplest outline it stands for one female and, when a small central dot has been added, impregnation is implied. A heavily traced diamond with a strongly marked central dot represents a whole exogamic unit in terms of providers of



women. The color—red or blue—is essential for distinguishing “my people” from “other people.” Various diamonds, each with a central dot of the opposite color, combined into an interlocking unit, represents the reciprocal relationship among several exogamic groups. A vertical chain of diamonds connected at top and bottom points stands for a line of matrilineal descent and, in a wider sense, for biological and social continuity.

4. An element shaped like a U is said to represent a "door." The motif is conceived as a frame surrounding a hollow space and, on the most elementary level of interpretation, is said to depict a vagina, the protuberance at the top



center indicating the clitoris. On a more abstract level the motif signifies a point of transition, of passing from one state of existence to another; in other words, it stands for rebirth.

5. Rows of dots or of small, simple or concentric, circles or rings represent the concept of impregnation by a male principle; they are fer-



tilizing fluids—rain or semen—but can also stand for an abstract conception of fructifying powers and evolving life.

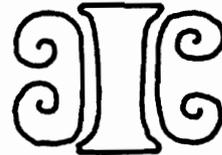
6. A spiral is said to symbolize incest. It stands for all noneligible females and indicates, in general, the threat of pollution. The design element is said to be derived from the imprint left



in the sand by the lower end of a ritual trumpet (*yurupari*), the elongated funnel-shaped body of which consists of a piece of bark twisted in a spiral. These ritual instruments are of importance in Tukano religion and are the center of

a complex that is concerned with the maintenance of exogamic rules and of male supremacy. An analogy in nature is a snail shell.

7. An element resembling a fleur-de-lys stands for the opposite concept from the spiral, that is, it represents all eligible marriage partners. This back-to-back double-C scroll, is said to be derived from a view of two reed fish traps put back



to back and seen from above. These traps are commonly interpreted as female organs which "devour" fish that enter into them and which, in this context, are taken to be male elements.

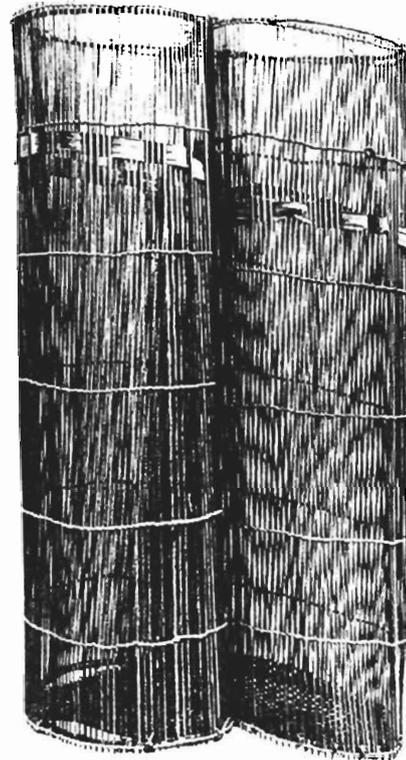


Fig. 51. Desana: Fish trap.

8. Vertical, parallel chains of small dots arranged in slightly undulating rows represent the Milky Way which is imagined as a celestial river.



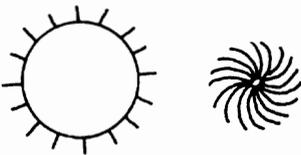
a great, stormy current, and which is the first goal of the ecstatic flight of narcotic trance. Occasionally these rows of dots may be confused with the sign for fertilization (no. 5).

9. An arc or semicircle of several multicolored parallel lines represents a rainbow. In some



mythological contexts the rainbow is said to be the Sun-Father's penis.

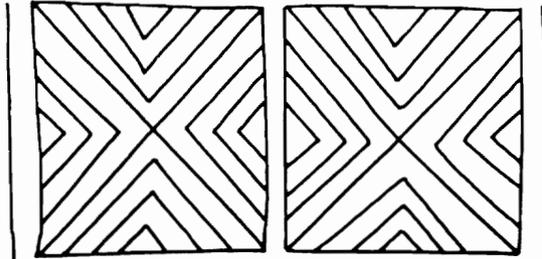
10. A sunburst pattern consisting of a circle from which radiate short lines, represents the



sun, the Sun-Father, or any focus of energy. A whorl or a circle with the radii pointing inward, might represent a female organ.

11. A large diagonal cross* formed of parallel lines is seen as a frame around a hollow space,

interpreted here as a female organ. To perceive the negative, empty spaces and to attribute to

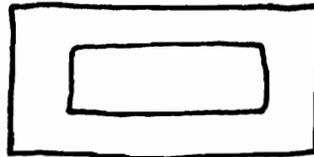


them special importance are not infrequent in Tukano culture.

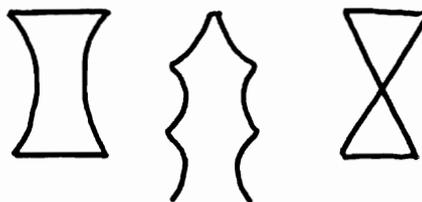
12. Motifs shaped like long-leaved plants represent vegetable growth.



13. Two concentric, elongated squares represent a box with ritual dance ornaments. The box is said to be a womblike element.



14. An hourglass-shaped element has two interrelated meanings; it can stand for the mouth-piece of a *yuruparí* trumpet or for a clay pot-stand. Both objects have phallic associations.

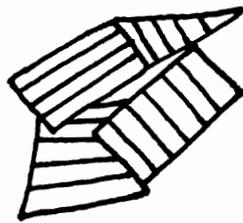


*St. Andrew's cross or asp.



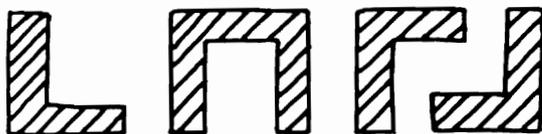
Fig. 52. Tukano: Hourglass-shaped clay pot-stands.

15. Squares filled with parallel lines—generally red—represent the small wooden stools of



the men; a combination of these designs indicates a gathering of men and implies introspection and stability.

16. Bandlike angular designs, generally L-shaped or shaped like an inverted U, and filled with short, oblique parallel lines, stand for



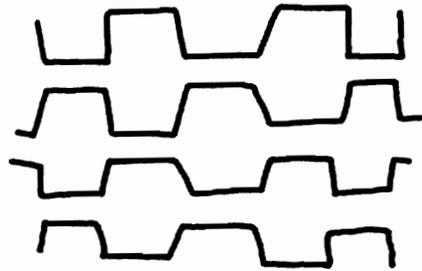
gourd-rattles and, by extension, refer to a specific ritual or to a particular sound.

17. Fork-shaped elements represent, first of all, ritual cigar holders of carved wood that stand

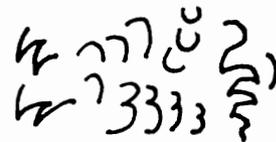


for the affirmation of alliances between complementary exogamic groups. Other meanings are: a swallow-tailed hawk, or a branched tree, any bifurcation having the connotation of a crotch.

18. Horizontal frets, crenellated lines, or indented lines often represent the Snake-Canoe of the Creation Myth.



19. Multiple scribbles or curlicues often stand for oral communication—speech or ritual address.



20. Wavy parallel lines in horizontal position represent "the thought of the Sun-Father."



Apart from these patterns, most of which are symmetrical and abstract in nature, there are some other, less well-defined elements, some resembling geometrical forms, others consisting of patterned spots, roving or crossed lines, or shapeless scribbles. It is possible that some of them encode a certain meaning, but this was only vaguely mentioned by the Indians.

As I pointed out earlier, the pictures fell, at first view, into two categories: abstract geomet-

rical motifs and figurative motifs. The Indians themselves were aware of the difference and rightly attributed it to the varying intensity of the narcotic trance.

Someone watching a man at work or finishing a drawing would say: "This is what one sees after three cups of yajé!" occasionally specifying the *kind* of plant that had been used and thus giving an indication of the nature of the narcotic effects they attributed to different concoctions. Sometimes this interpretation seemed to carry a certain element of prestige, as when a person would say: "That is all well, but *I* have seen something much more important!" It is clear that the Indians recognize that the narcotic trance develops in successive stages and that it evolves in accordance with the properties of the particular drug, the setting of the scene, and many personal factors that are likely to affect the receptiveness and sensibility of the individual.

IV

Subjective Seeing and Decorative Patterns

Before turning to a more detailed analysis of the Indian designs, a brief excursion into neurophysiology is in order. In approaching this highly specialized and complex field I must necessarily be very concise in certain facts about the problems of subjective vision.

During the last years of the eighteenth century Alessandro Volta observed in the course of his experiments that, when he applied two electrodes to his face and then closed his eyes, he would perceive a brilliant flash of light, sometimes in the form of a bright circle (Volta, 1918-29:124). In the early nineteenth century these experiments were carried a step forward by the Czech physiologist Jan von Purkinje (1819) who, by using a voltaic cell of 20 volts or by applying optical or mechanical stimulation, was able to excite not only such "Galvanic light patterns" as stripes and arches, but a whole series of multi-shaped abstract pictures such as concentric circles, diamonds, eight-spoked wheels, and many others. It seems that during most of the rest of the century, except for Von Helmholtz's (1867) work, little or no experimental research was accomplished with reference to these phenom-

ena, and it is only in relatively recent times that they have again attracted attention.

A brief summary of the basic neurophysiological mechanisms is essential before I can turn to an aspect of considerable interest: the possible cultural significance of these complex light effects.

Occasionally the human eye perceives subjective light patterns which illuminate briefly the visual field, but which otherwise are quite independent from an external light source. The perception of these luminous patterns is entoptic, that is, they are not the result of mere visual, retinal observation of an external object, but are generated mainly in a neuronal system which includes the retinal ganglion network together with the cortical and subcortical range. Being thus originated within the eye and the brain, these light patterns, called *phosphenes*, are common to all men (Knoll et al., 1963:215).

Phosphenes can be experienced with closed eyes and are especially well perceived if the eyes are already dark-adapted, but they can also be seen with open eyes and, in that case, may appear as superimposed upon normal vision. Some

of these photic sensations are hardly more than sudden flashes, stripes of light, or scintillating shapeless flickers that pass over the field of vision like lightning, but others may appear as well-defined, abstract, geometrical patterns, sometimes of a remarkable complexity.

Under certain conditions phosphenes can appear quite spontaneously, for example during periods of sensory deprivation, in hypnagogic states, or simply in conditions of emotional stress or fatigue. Moreover, they can be produced by a number of external stimulants. Pressure upon the eyeballs can create the sensation of luminous concentric circles similar to the eye-shaped designs on a peacock's tail feathers. A sharp blow on the head or the elbow, or a startling fright or sudden noise may make us "see stars," and similar luminous impressions can be observed when suddenly waking up in a dark room, or during electric stimulation in brain surgery, or by electric excitation with low-frequency pulses. Furthermore, the perception of phosphenes can be induced chemically by the ingestion or injection of drugs, or it can be the consequence of prolonged fasting, meditation, or strong psychological emotions. There exists, then, a large number of possible stimulations, both external and endogenous, that may lead to a variety of luminous sensations.

In recent years, Max Knoll (1958; Knoll and Kugler, 1959; Knoll et al., 1962, 1963; Oster, 1970) of the Laboratory for Medical Electronics at the Technische Hochschule in Munich has carried out research on the origin and nature of phosphenes, and his work has opened a field of great interest, not only to neurologists but also to specialists in the social sciences and the humanities.

Knoll developed an objective method of brain excitation by using temporal, frontal, and occipital electrodes and by applying low-voltage square-wave pulses within the electroencephalic frequency range. The phosphene patterns thus produced were sketched by his subjects, and detailed verbal descriptions of the visual phenomena and all other sensations were simultaneously tape-recorded. In this manner, a

whole spectrum of phosphenes was established under controlled conditions, to serve as a basis for further experiments.

In his earlier experiments Knoll had already made some important observations. Under electrical excitation patterns of brightly shining white, bluish, or reddish dots appeared against a dark background, like stars, luminous discs, and turning firewheels. Also beams of light were perceived, falling obliquely across the field of vision. All these light patterns, it was noted, were somewhat shapeless and flat and did not form clearly defined pictures. There were, however, certain other light patterns that were perceived *after* the electric stimulation had been interrupted, and these obviously were of a well-defined geometrical nature, often of rotation-symmetrical shapes such as concentric circles, rosettes, or many-pointed stars. It was also observed that the verbal descriptions of these geometrical forms contained stronger emotional overtones than those referring to light patterns perceived in synchronization with the electric impulses. This observation led Knoll to suggest that there was a difference in the neural origins of these two categories of luminous sensations; while the synchronic light patterns do not necessarily appear to be emotion-connected, they can trigger patterns that do *not* appear during excitation and that probably are connected with the central-subcortical system (Knoll, 1958:115-118). At this point, Knoll recalls C. G. Jung's (1955:145) hypothesis according to which mankind's most ancient symbols might have originated in subjective light patterns, and goes on to observe that the eight-spoked wheel pattern he (Knoll) and Purkinje (1819, table 1, fig. 4 and 11) had induced was also present in prehistoric South African rock paintings, and that Purkinje's concentric circles and semicircles appeared in Australian pictographs.

In the course of further experiments Knoll noted that some of the light patterns were changing their shapes during the period of excitation although the nature of the electric stimulation had not been altered. Others, however, appeared to be stable and could be located at

TUKANO

KNOLL

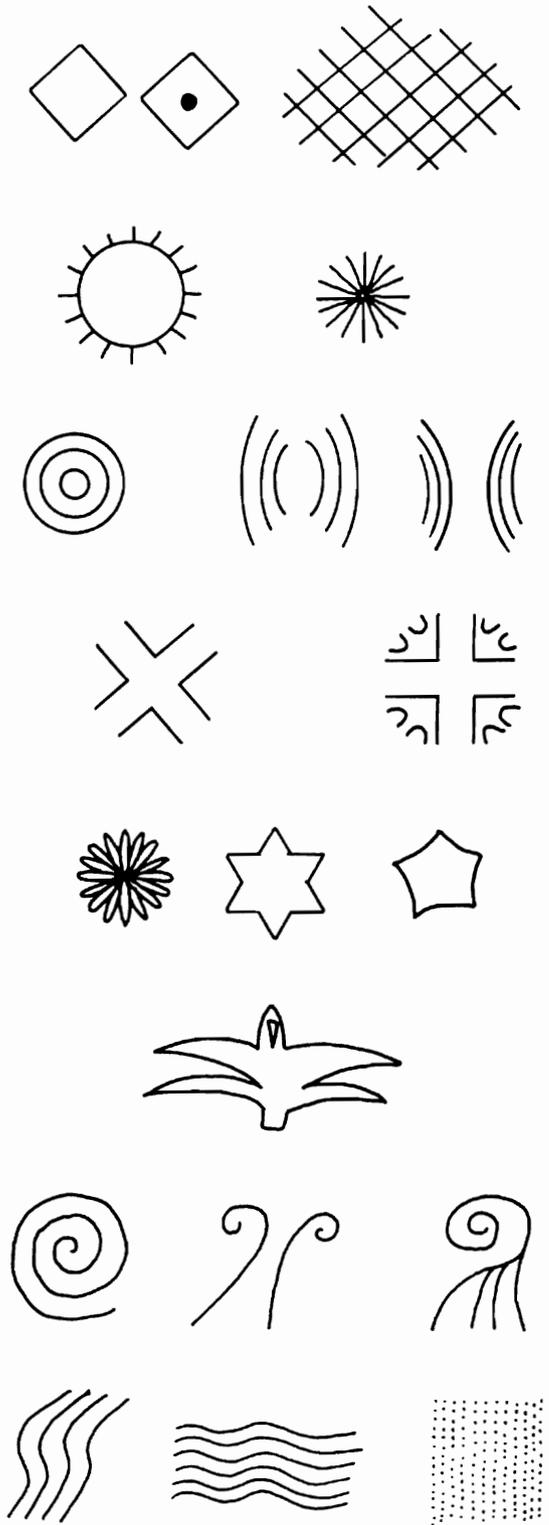
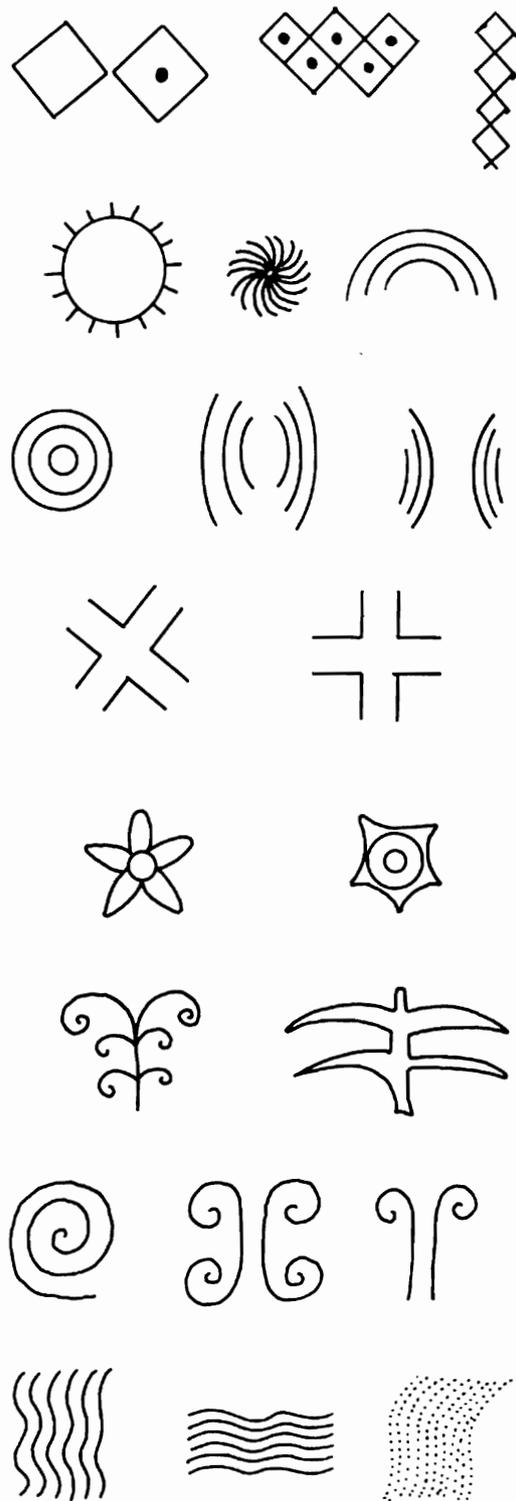


Fig. 53. Comparison of Tukano and Knoll phosphene patterns.

the same mean excitation frequency weeks after their first stimulation (Knoll, 1959:1824). As a matter of fact, it was found possible to reproduce some specific phosphenes even up to six months after their first excitation (Knoll et al., 1962:236, 242).

In his experiments with the changing shapes of individual phosphenes, Knoll and his collaborators had already observed that the administration of chemical stimulants such as Percodrin or Meprobamate increased the quantity of light patterns, while an inhibitory effect was noted after the administration of Ephedrin (Knoll et al., 1962, 236). Further experimentation with subcutaneous injections of mescaline, psilocybin, and LSD, combined with electrical stimulation, produced light patterns of high intensity in which a great variety of shapes, bright colors, and strong movements was observed. The subjects mentioned light patterns similar to a "fountain of sparks," or to "exploding fireworks," and compared others to flowing waters or to spiral movements.

Whereas under electrical stimulation no figurative images whatsoever had been observed by Knoll's subjects and only abstract geometrical phosphenes were perceived (Knoll, 1958, 123), among the drug-excited phosphenes there now appeared flowers, animals, and man-made landscape features such as roads and bridges. Knoll adds here an important observation: "This difference may be due to the fact that electrical excitation is restricted to a smaller part of the brain, e.g., because of the brain's different conductivity. If this is true, the appearance of living or man-made objects can be expected to occur not only as a result of chemical stimulation but also during meditation or fasting or sensory deprivation where larger parts of the brain, e.g., the temporal cortex, are affected" (Knoll et al., 1963, 219-220). In fact, Knoll's drug-excited phosphenes produced in their viewers a strong emotional response. The so-called "glorification effect," in which common external objects seem to acquire great beauty by being filled with a special luminosity, was observed under mescaline stimulation, and many other perceptions of form and color appeared to

the beholders to be imbued with a certain transcendental significance.

A comparison between the spectrum of phosphenes observed by Max Knoll and the ornamental patterns of Tukano decoration comes immediately to mind. In fact, it seems that many of the luminous images described by Knoll and his collaborators correspond in detail to those the Tukano claim to see in their drug-induced visions and, subsequently, use to decorate their artifacts as metaphorical kennings.

When speaking here of "visions" it is necessary to clarify the following point: It is during the first stage of yajé intoxication that the geometrical light patterns appear; this stage is *not* one of true hallucinations but merely represents an initial stage of neurophysiological stimulation. On this level, then, it is permissible to make comparisons. The second stage, that of figurative representations, marks the onset of hallucinations and is, obviously, a stage dominated by cultural projections. The mythological scenes seen by the Tukano in the moving shapes and colors of this advanced stage of narcotic trance, can only be seen *by them* because their interpretation depends upon preexisting models that are culturally determined. The phosphene patterns are inbuilt, but the figurative imagery is of a projective nature.

It is also important to keep in mind Knoll's observation that the afterimages of phosphenes can repeat themselves for several months. In the case of the Tukano and their neighbors it is clear that a man will have consumed several more doses of the narcotic drug within this time span, so that the afterimages are likely to persist in an almost chronic state. They then may manifest themselves at any time when triggered by a change in body chemistry, or by one of the many stimulations that will release these luminous phenomena.

The phosphene patterns isolated by Knoll, those comparable with the ones observed in Tukano designs, are shown in figure 53. The similarities are such that there can be no doubt left: The decorative patterns of the Tukano are almost wholly derived from drug-induced inner light experiences.