

Sacred plants and visionary consciousness

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Abstract Botanical preparations used by shamans in rituals for divination, prophecy, and ecstasy contain widely different psychoactive compounds, which are incorrectly classified under a single denomination such as “hallucinogens,” “psychedelics,” or “entheogens.” Based on extensive ethnopharmacological search, I proposed a psychopharmacological classification of magic plants in 1979. This paper re-evaluates this taxonomy in the context of consciousness research. Several groups of psychodysleptic magic plants are proposed: (1) hallucinogens—psilocybin mushrooms, mescaline cacti, dimethyltryptamine snuffs, and the synthetic ergoline lysergic acid diethylamide induce strong perceptual changes, affective intensification, and cognitive enhancement. Their ethnobotanical uses include long lasting divination rituals, prophecy, and sacramental practice. (2) Trance-inducers—ergoline Convolvulaceae and South American *Banisteriopsis* produce quietness, abstraction, lethargy, mild sensorial and cognitive changes, and salient visual imagery changes used in trance rituals and specific divination practices. (3) Cognodysleptics—marijuana (tetrahydrocannabinol) and other terpene-containing plants induce changes in thought, imagination, and affective functions and are used in short-term divination or oneiromancy. (4) Deliriant—tropane-containing Solanaceae, wild tobacco, and *Amanita muscaria* (muscimol) induce a delirium characterized by dim and clouded consciousness, stupor, confusion, disorientation, perception distortion, difficulties in recollection, anxiety, irritability, excitation, and behavioral disorganization employed in sorcery, purification, or exorcism rituals. The core mental effects required for a drug to be used in shamanistic rituals include light-headedness, enhanced imagery, and experience intensification. This constellation was the reason why, in his classification of psychoactive compounds, the pioneer German psychopharmacologist Louis Lewin established in 1924 a group of drugs under the appropriate name of Phantastica.

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The sacred plant and the human brain 38

For the indigenous peoples of Mesoamerica, the psychoactive plant used in 39
divination rituals possesses divine qualities. After consuming it ritually, the shaman, 40
transformed into a vehicle of the supernatural world, perceives and expresses the 41
transcendent voice of a deity. From this belief come the plant's ritual harvesting and 42
the divinatory chant, the long period of training, and the mastery of the ecstatic state, 43
the diagnosis, and the cure. 44

In addition to its exalted and effective role in indigenous tradition, the sacred 45
plant has been the subject of research and reflection for scientists and humanists. It 46
has been addressed in botany, ethnology, chemistry, pharmacology, physiology, 47
psychology, psychiatry, literature, and theology. At the end of the nineteenth century, 48
each respective field of science approached this same object of study independently 49
with a multidisciplinary approach. It was the age of the search for alkaloids and 50
active principles responsible for the effects of the plants attributable to a specific 51
substance. The mission of *pharmacognosy* was to isolate, identify, and determine the 52
biological effects with the aim of applying them in therapeutics and adding them to 53
the “*materia medica*,” as most medications were derived from traditionally used 54
plants. The Germans were the main protagonists in this and many other scientific 55
quests, having isolated morphine in 1817 from opium (the gum from *Papaver* 56
somniferum), and cocaine in 1859 from the coca plant of the Andes (*Erythroxylon* 57
coca), one of the most widespread and customary magical and divine plants of the 58
Americas. 59

In the early twentieth century, the peyote cactus (*Anhalonium lewinii*, later named 60
Lophophora williamsii) captured the imagination of academics, as by 1902, its use 61
as a visionary aid by indigenous groups in Mexico had been documented by the 62
Swedish explorer Carl von Lumholtz. In 1898, the chemist Arthur Heffter isolated 63
mescaline from peyote, and in 1919, Spath succeeded in chemically synthesizing it. 64
The pharmacological study of this alkaloid and its psychological effects were 65
described in two different monographs produced in the 1920s, both typical of 66
German descriptive psychology: one by Kurt Beringer and the other by Heinrich 67
Klüver (1966). The effects described by these pioneers in psychopharmacology 68
included vivid visual phenomena, intense emotional changes, modifications of 69
thought patterns, and even states of ecstasy. None of these effects was deemed to be 70
of interest to therapeutics, and so, they were viewed in psychology and psychiatry as 71
no more than curious facts obtained using phenomenological methods. 72

This subject remained limited to a small academic sphere until the arrival of the 73
extraordinary generation that followed the Second World War, when peyote and the 74
mescaline it contained rocked Western culture through literary figures such as 75
Antonin Artaud, Aldous Huxley, and Henri Michaux. These literati fully understood 76
the implications of a substance that could alter mental processes to the point of 77
reaching both, high states of ecstasy or the abyss of the terror of death. The magical 78
power of the sacred plant was attributable to mescaline, a simple chemical substance 79

that induced the most transcendental mental states in the human being necessarily through a pharmacological effect on the brain. In the view of Huxley and others, this fact offered an avenue of access to the dilemma of the mind–body problem, with implications both poetic and scientific: ecstasy within arm's reach and experimentally induced psychosis.

In *The Doors of Perception*, the acclaimed writer and thinker Aldous Huxley tells of how he was captivated by the fashionable theory on the action of mescaline published in 1952, *Anno Mirabilis* of psychopharmacology, which noted the chemical similarity between two cerebral neurotransmitters (adrenaline and noradrenaline) and mescaline. The structural difference is the presence of three methyl groups in the common nucleus of both cerebral substances. Osmond and Smithies (1952) proposed a methylation of these neurotransmitters in the brain, whereby mescaline could be synthesized and produce a psychosis-like schizophrenia. This hypothesis remained heuristic for more than 30 years supported by additional empirical evidence (Diaz 1989). In its day, it awoke the enthusiasm of the exceptional mind of Aldous Huxley for its suggestion of a physical and cerebral basis for states of mystical and visionary consciousness.

Thus, on the first opportune occasion in 1953, Huxley consumed 400 mg of mescaline and sat down to await the effects. The explosion of intensely colorful images was both striking and enjoyable, but it was not the colors and textures that most captured his attention, but something far more transcendental. When he looked at a floral arrangement, Huxley says:

I was not looking now at an unusual flower arrangement. I was seeing what Adam had seen on the morning of his creation: the miracle, moment by moment, of naked existence.

The simple action of looking at flowers transformed Huxley into the first man staring in amazement upon the dawn of creation. The hallucinogen demolished his individuality to immerse the user in a realm of absolute reality that he had predicted before. Indeed, “naked existence” for Huxley is a preverbal reality, the empty reality of Zen Buddhism, the pure reality to which he had dedicated *The Perennial Philosophy* in 1945. Thus, with mescaline flowing through his brain, a spellbound Huxley opens the doors of his perception onto that other reality that appears genuine, the vehicle of which is this chemical substance that resembles certain neurotransmitters: the philosopher's stone within his reach. The idea was as lofty as it was captivating, and a decade later, a generation of youth welcomed both the notion and the drugs that accompanied it.

However, at this point, it is worthwhile revisiting another journey towards that same nirvana, also embarked upon from Mexican soil and around the same time.

The hallucinogen uprooted

In the mid-1950s, R. Gordon Wasson, an amateur but extremely knowledgeable mycologist, arrived in the Mexican state of Oaxaca. He would follow the footsteps of Blas Pablo Reko, the Viennese doctor who had written *Mitobotánica Zapoteca*, published in 1954, and of the Harvard student Richard Schultes, who had made reference in botanical publications to the ritual use of certain small mushrooms of the

genus *Panaeolus* in the Sierra Mazateca. Wasson made contact with European ethnologists studying the indigenous languages and cultures of Mexico, and through their contacts in June of 1955, he witnessed a divination ceremony presided over by Maria Sabina, an extraordinary Mazatec shaman. The story was first published in *Life* magazine, and it opened a new, wholly interdisciplinary phase in the research into sacred plants. Aware of the importance of the discovery, and with a shrewdness and range of influence that few scientists have managed to muster, Wasson brought together several accomplished European specialists for a joint study of the visionary mushrooms of Oaxaca: the mycologist Roger Heim classified several new mushroom species, all of the *Psilocybe* genus; the chemist Albert Hofmann used himself as a guinea pig and very quickly isolated psilocybin as the plant's hallucinogenic principle; the pharmacologist Hugo Cerletti carried out animal experiments, and the famed psychiatrist Jean Delay described the psychological effects of its active principles using the phenomenological method. With all these contributions, and his own piece, in which he accurately identified these mushrooms as the ancient *teonanácatl* ("the flesh of the god") of the Nahuatl peoples, Wasson published a wonderful book in 1958 with Roger Heim, *Les Champignons Hallucinogènes du Mexique*.

It would be difficult to overestimate the significance of this scientific venture, which successfully demonstrated the continued ritual use of a genus of mushrooms from the times of the ancient Nahuatl up to the modern Mazatecs, identified the chemical principle responsible for the hallucinogenic effect, and presented the mental effects of the plant and of the drug, which did not resemble adrenaline, but serotonin, another neurotransmitter with an indole structure. With these findings, Wasson established a remarkable career in the fields of science and culture. In subsequent research, he demonstrated the use of hallucinogenic mushrooms among the Nahuatl, Otomí, Totonaca, and other communities. He then identified various psychoactive plants in the famous Aztec sculpture of the god Xochipilli, and later ventured to interpret the myriad little children in the Baroque chapel of Tonanzintla as figured mushrooms sculpted by indigenous craftsmen of a hybrid culture.

These and other contemporaneous or later endeavors were scholarly systematized by Richard Schultes at the Harvard Botanical Museum in various publications, taking their most complete form in *Plants of the Gods*. Albert Hofmann, the man responsible for isolating psilocybin in Mexican mushrooms, synthesized lysergic acid diethylamide (LSD)-25 in 1939 from ergotamines found in rye ergot, a psychotropic fungus in Europe, and subsequently in another sacred plant of Oaxaca—*ololiuhqui* or "Cloak (and/or Seeds) of the Virgin Mary" (*Ipomoea violacea* and *Rivea corymbosa*).

These three molecules—mescaline, psilocybin, and LSD—their plants of origin, and their traditional users—were forces behind the widespread cultural revolution of the 1960s, a cardinal principle of which was the broadening of consciousness as an engine of personal and social transformation. However, unlike the indigenous groups, who carefully regulated the hallucinatory adventure with the support of a tested cultural tradition, the daring and tempestuous rock generation sought to establish a new culture and a new life through a wild and recreational psychedelic experience. Intoxicated by the imposing, vaguely Zen-like figure of Don Juan, the supposed Yaqui shaman written about by Carlos Castaneda, there were many others who likewise failed to assimilate the strict requirement of a teaching patterned by tradition and thus strayed from the exalted goal into a pitiful scene of narcotic

addiction and the premature deaths due to overdoses suffered by several musical geniuses and other visionaries of their generation. Nevertheless, it seems important to state that the damages related to drug abuse were largely due to heroin, cocaine, and alcohol and only rarely to psychedelics.

This was the decade of the 1960s, the time of what was then called “altered states of consciousness,” which not only spread among the rebellious youth but also had an effect on the arts and sciences. In geometric and vividly colorful images, pop art attempted to capture certain visual phenomena evoked by hallucinogens. This art was called *psychedelic*, a word coined by psychiatrist Humphrey Osmond to identify hallucinogens as “revealers of the psyche,” although it was an art form that had been fully developed by the Huichol peoples of the Nayar in Mexico since time immemorial. One of the world's most prestigious and serious scientific publications, the magazine *Science*, gave space at the beginning of the 1970s to two articles that theorized on these altered states. One of them proposed a cartography of ecstasy in two forms: one a stimulating and dazzling condition of *ergotropic* stimulation of the sympathetic nervous system, and the other a reflective, restrained state of *trophotropic* stimulation of the parasympathetic nervous physiology (Fisher 1971). The other publication suggested a correction of the theory of knowledge sustained by science with the proposal of the existence of sciences and fields of knowledge belonging to particular states of consciousness (Tart 1972).

A fantastic ethnopharmacology

At the National Autonomous University of Mexico, we took an ethnopharmacological approach during the 1970s in our efforts to understand the sacred plants of Mexico, not only from the point of view of their active principles but also their traditional uses and multiple effects. We proposed that a governing point of view was needed, not for empirical research, the bases of which are provided for in each discipline, but for the understanding of the plants that would allow an integrated perspective. This basic axis consisted in the identification of the mental effects of the plants and their molecules, as it is precisely these effects that have provoked both the traditional rites and beliefs and the academic, literary, and popular interest (Díaz 1977, 1979).

With this focus, it was possible to propose a taxonomy of traditionally used psychoactive plants not only in Mesoamerica but in general. This taxonomy enables the comparative analysis of aspects as diverse as the traditional uses, the effects on the brain, and the chemical structure of the plants in question, but before presenting this taxonomy, it is necessary to state that it did not constitute a totally new approach. It was just this tactic that was put into practice by one of the founders of psychopharmacology, conceived as an interdiscipline between pharmacology and psychology: the German toxicologist Lewis Lewin, the same man who warned Sigmund Freud of the hazards of cocaine, in which the founder of psychoanalysis had taken an interest. In his classic work of 1924, fittingly titled *Phantastica*, Lewin (1964) makes an interesting classification of psychoactive drugs into five groups:

- *Excitantia* (stimulants: coffee, tea, and mate)
- *Euphorica* (euphoriant: opium and coca)

- *Inebriantia* (inebriants: fermentates and distillates) 215
- *Hypnotica* (soporifics: chloral) 216
- *Phantastica* (hallucinogens: peyote) 217

The astuteness of the German professor is made evident in the last term, *Phantastica*, 218 which emphasizes the increase in visual imagination and fantasy that is a characteristic 219 and core effect of the sacred plants and their psychoactive chemicals. The intensely 220 colored geometric figures that are typical of their action on visual perception are 221 sources of artistic expressions as distinct as the archeological petroglyphs, the yarn 222 pictures of the Huichol people, and the “psychedelic” art of the 1960s, which has led 223 to the supposition that the first of these might be expressions of shamanic visions 224 during ritual consumption of the hallucinogens several millennia ago. 225

A second taxonomy was constructed by Jean Delay, who proposed three major 226 psychoactive drug families: those that increase or activate the mental functions, 227 which he named *psychoanaleptics* (stimulants, antidepressants, etc.); those that 228 reduce them, called *psycholeptics* (tranquilizers, anxiolytics, and antipsychotics), and 229 those that modify the mental functions qualitatively rather than quantitatively, which 230 he named *psychodysleptics*. However, in spite of sharing similar effects that would 231 allow to consider them as psychodysleptics, the particular effects of various 232 substances justify the categorization of specific subfamilies that qualitatively modify 233 mental processes in several different senses. We can therefore distinguish six types 234 of psychodysleptic substances (Díaz 1979), of which, the first four are of interest to 235 us here: hallucinogens, cognodysleptics, trance-inducers, deliriogens, narcotics, and 236 dissociatives. This distinction has not only a psychological basis but also interesting 237 correlations at ethnological, chemical, and cerebral levels. 238

Psychodysleptic species 239

Hallucinogens are drugs that produce hallucinations, i.e., perceptual experiences 240 without an identifiable consensual object, within a clear and even lucid or amplified 241 consciousness. In this definition, we follow a long tradition reviewed by Lanteri- 242 Laura (1994, pp. 26–27) and particularly the notion of Henry Ey of a hallucination 243 as a perception without an object to be perceived. The mescaline of Mexican peyote, 244 the psilocybin of Mesoamerican mushrooms, and LSD, a synthetic molecule derived 245 from ergot, are the three most characteristic examples of this family. There is a plant 246 inhaled among Amazon tribes called the yopo (*Anadenanthera peregrina*) which 247 contains *N,N*-dimethyltryptamine (DMT), a powerful hallucinogen but with a shorter 248 effect than those mentioned above. All of these are sacred plants *par excellence* for 249 the traditional cultures that have used them for centuries. Their ritual gathering has 250 come to constitute a ceremony as complex as the long pilgrimage of the Huichol 251 from the Sierra del Nayar to *Wiricuta* in the desert zone of Real de Catorce, or their 252 consumption in a ceremony of chants as impassioned as those of María Sabina. They 253 are revered and sacramental plants, and their handling, use, and application is the 254 privilege of the shaman. Their divinatory uses are derived from the property or belief 255 that they put the user into contact with the transcendental world through an ecstasy 256 that makes diagnosis or divination possible. 257

Another botanical preparation of mixed, hallucinatory effects is the ayahuasca of South America, the main botanical ingredient of which is *Banisteriopsis caapi*. The psychopharmacology of this potion used throughout the northern Amazon is difficult to discern because it is almost always administered in combination with other plants with complementary effects, particularly plants containing the hallucinogen DMT, such as *Psychotria viridis*. Ayahuasca contains B-carbolines called harmalines, which are inhibitors of the enzyme known as MAO. The first antidepressants were MAO inhibitor substances, and therefore, psychodysleptic effects cannot be attributed to them. The extraordinary ethnopharmacological aspect of ayahuasca is such that, in combination with plants containing DMT, the hallucinogenic effect is greatly increased because the inhibitor of the MAO boosts the hallucinogenic effect of the DMT. Recently, a cognitive scientist, Benny Shanon (2003), has taken an interest in outlining a cartography of states induced by ayahuasca, which is an example of the cognitive paradigm for studying these plants.

All of the hallucinogenic molecules act as agonists on the same cerebral receptors of serotonin or 5-hydroxy-tryptamine (5HT), particularly those of the subtype 5HT-2A (Aghajanian and Marek 1999). Hallucinogens bear a stereochemical similarity to serotonin, which is involved in brain mechanisms related to perception, sleep, and emotion. It is not known how this localized pharmacological agonism on the receptors of certain neurons ultimately influences higher mental functions. Furthermore, peyote and the brain synthesize another transmitter in the same way: dopamine, which the cactus converts into mescaline but the brain does not, in spite of the hypothesis of Osmond and Smithies mentioned above.

The effect of hallucinogens is not “psychotomimetic” in the sense that it constitutes a precise model of psychoses, as the visual hallucinations provoked by hallucinogens are not typical of endogenous psychoses, as are the distressing auditory hallucinations of insulting or accusing voices that tend to afflict schizophrenic patients.

Trance-inducers are plants and substances with less spectacular effects than hallucinogens as it is rare for them to produce hallucinations. They are nevertheless ritual plants in ancient tradition, among which stand out the *Ololihqui* (Seeds of the Virgin Mary), identified as *I. violacea* and *R. corymbosa*, used traditionally in Oaxaca and which in the colonial chronicles of Mexico are compared with the use and effect of peyote and teonanácatl. Rather than an ergotropic and exalted visionary state, these plants and substances produce a trophotropic state of lethargy and apathy in which the subjects experience an increased sensitivity to the point of irritation with external stimuli and a stimulation of the imagination that is used in ritual contexts such as divination. The Mexican ethnobotanical pioneer Blas Pablo Reko spoke of a “sleepwalking state” as the effect of certain plants whose use is restricted to the state of Oaxaca. The molecules responsible for these effects were identified by Albert Hoffman (in seeds that Wasson sent him in the 1950s) as ergotamine alkaloids, upon which a minimal chemical modification would confer the truly hallucinatory effects of LSD. Both the ethnobotanical use and the chemical similarity led to the supposition of hallucinatory effects in *ololihqui*, when in fact the effects are sedative and trophotropic. It is possible that the plant named *sinicuiche* (*Heimia salicifolia*), on which very little documentation exists, may produce trance effects in some curative ceremonies documented in the Mexican state of Veracruz. This plant appears carved among the psychotropics engraved on the image of the god Xochipilli.

Cognodysleptics are marijuana-type substances that contain not alkaloids but terpenes, i.e., molecules without nitrogen that produce effects distinct from those listed above. Thus, although they no doubt stimulate the imagination, affect recent memory mechanisms, or highlight auditory or taste sensations or fantasy, they would rarely produce hallucinations. Marijuana (*Cannabis sativa*) is not a plant of American but of Asian origin; it was introduced to New Spain during the colonial era on ships from China as a source of hemp fiber. Shortly afterwards, it began to be used ritually by indigenous groups with the beautiful Náhuatl name of *Pipiltzintzintli*. It has been recently discovered that the brain produces forms of endogenous marijuana, that is, molecules similar to the active principle of this plant, Δ -9-tetrahydrocannabinol, which allow this to act on their natural receptors. These endocannabinoid neurotransmitters are anandamide and oleamide and are involved in short-term memory, pain, hunger, and sleep mechanisms.

There are other less well-known plants of the sacred Mexican pharmacopeia that have relatively similar effects, such as Hoja de la Pastora of the Mazatec (*Salvia divinorum*) and the Hoja Madre of the Chontal people (*Calea zacatechichi*; Díaz 1975). The uses of some of these plants include oniromancy, i.e., divination during dreaming, and they are capable of modifying the phases of sleep and the content of dreams. In the case of *S. divinorum*, the active agent is salvinorin, a highly potent psychotropic nitrogen-free diterpene and an agonist on the kappa opioid receptor, which has depersonalization, dysphoric, and disassociation effects similar to pentazocine.

The fourth group constitutes a very different mental world. It is that of *deliriogens* such as the Toloache or Tlápatl of the Mexicans (*Datura stramonium*), the Kieli (or Kieri) of the Huichol (*Solandra brevicalyx*), the Angel's Trumpet of Colombia (*Brugmansia* spp.), and wild tobacco or "yétl" (*Nicotiana rustica*). These are plants with powerful mental and behavioral effects but in an opposite sense to the three previous groups, because while the first three broaden the state and level of consciousness, these cloud it and diminish it: the term "stupeficients" can thus be applied only to this family. In high doses, they produce a delirium-resembling fever, with disorientation and intense hallucinations, which the subject may confuse with external reality in the stupor of a dimmed and confused consciousness.

This family of solanaceous plants is part of a dark, secret tradition both in the Old and the New World. Many of its species are used in witchcraft rites and administered surreptitiously to do harm to enemies, manipulate people, or torment an unfaithful spouse. These plants contain tropane alkaloids, in particular scopolamine, an alkaloid used by the Nazis as a "truth drug," found in both the Mexican Toloache and in Mandrake (*Mandragora officinalis*), Belladonna (*Atropa belladonna*), Henbane (*Hyoscyamus niger*) of Europe, and in the Angel's Trumpet of Colombia (*Brugmansia* spp.). Scopolamine acts in the brain blocking muscarinic receptors specific to acetylcholine, the neurotransmitter most affected in Alzheimer's disease, which even better explains the deleterious effect of these substances on memory.

Chemical ecstasy: from archeology to phenomenology

The indigenous Mesoamerican tradition of sacred psychotropic plants is as ancient and prolific as it is enlightened. Ethnopharmacology has clarified many mysteries of

their uses, which may be traced to the most ancient past of Mesoamerica. It is worth listing a few examples here from psychodysleptic archeology (Díaz 1979, 2003). The mescal seed (*Sophora secundiflora*), a deliriogen and neurotoxin that would eventually be substituted by peyote in Aridoamerica, has been found in tombs in the south of Texas dating back 10,000 years. The ancient pottery of Casas Grandes is decorated with spirals similar to those used by the Huichol to represent peyote. Two reliefs at Tula show the god Chac Mol with a plant with the morphology of the Toloache emerging from his belly. Several codices contain representations of mushrooms associated with deities, and in the Mayan zones, many ceremonial sculptures of mushrooms have been found. Finally, the magnificent Nahuatl sculpture of Xochipilli mentioned previously is adorned with representations of mushrooms, sinicuiche, ololiuqui, and other psychodysleptic species.

It was not in vain that the father of ethnology, Fray Bernardino de Sahagún, identified in his sixteenth century *Florentine Codex* six psychotropic plants mentioned above: Ololiuhqui, Péyotl, Tlápatl, Tzintzintlápatl, Míxítl, and Nanácatl. The Franciscan Sahagún made no distinctions between them and characterized them as plants that caused madness and a thing of the devil. His sensitivity as a pioneer of ethnology did not immunize him against the religious bias of deeming as sacrilegious the magical and divinatory use of certain plants that reputedly put the users in contact with necessarily fallacious and demoniacal deities.

To explore the effects of the sacred plants and their psychodysleptic molecules, it is worth referring to the ecstatic properties they share with various procedures which were systematically and extensively analyzed by William James in his other classic entitled *The Varieties of Religious Experience*. In 1969, Marghanita Laski published a comprehensive historical, phenomenological survey study on ecstasy. In this study, she contrasts the effects of mescaline and the ecstatic states evoked by meditational techniques, by the trance of prayer, or by stimuli such as music, analyzing the reports of Westerners who consumed the drug in experimental test situations. The greatest contrast is identified as the presence of visual hallucinations, which are rare in nonpharmacological ecstatic states. Smith and Tart (1998) identify a substantial difference between mystical experiences and the effects of hallucinogens in a first-hand comparison. However, this difference does not appear to be so clear when comparing the meditative, religious, and secular ecstasies with traditional ceremonies channeled with psychotropics by an indigenous shaman in a traditional context. It is well known that the place, circumstances, intention of the consumption, and the culture concerned are decisive factors in determining the experience. It is not easy to study the effect of these plants in their traditional cultural context, but everything points to the conclusion that, just like the religious mystic, what the shaman seeks is precisely a contact with a transcendental reality. Aldous Huxley, who was well-versed in both traditions and experiences, compares them openly.

We are faced with a dilemma in the phenomenological research into these substances. On one hand, chemically induced ecstatic states occur particularly in specific cultural and traditional contexts that are difficult to study adequately. The recording, translating, and analyzing shamanic ceremonies involving psychotropic preparations has been an interesting ethnopharmacological technique (Wasson 1980; Díaz 1975), but a more direct *ethnophenomenological* research aiming at obtaining and analyzing first-person reports on the psychotropic experience would be of

special value. On the other hand, the stories of controlled psychotropic administration and consumption outside this context in secular or experimental experiences particularly underline the effects on perception, especially the effects on vision. This research has been and continues to be of interest for understanding cognitive mechanisms of perception, and it is just this research that is worthwhile reviewing here.

The phenomenology of visionary effects

The pioneering studies of Beringer and Klüver with mescaline outlined a model of visual effects in successive phases of growing intensity. The pioneer self-experiment of the French psychiatrist G. E. Morselli with mescaline in 1936 (extensively cited by Lanteri-Laura 1994), where he authoritatively refers visual images, illusions, and both concrete and substantive hallucinations, have been corroborated and added to by subsequent studies, in particular, the research of Ronald Siegel (1977, 1992) of the University of California. Thanks to these types of studies, we can distinguish the following aspects and stages of visual alterations induced specifically by hallucinogens.

1. Dishabituation of perception: The ordinary visual scene looks new, and everything seems as if seen for the first time. Textures or colors are fascinating and are perceived as much more intense. The brightness and hues of the colors are particularly notable elements.
2. Visual imagination increase and automatization: With eyes closed, visual images intensify and acquire geometric shapes and rhythmic kaleidoscopic and automatic movements. The simple, colored shapes in constant movement resemble tunnels, spirals, weaves, and webs, which also appear in other conditions such as migraines, the epileptic aura, hypoglycemia, and synesthesia. These may be related to the architecture of the primary visual cerebral cortex (entoptic visions). Other prevalent images include animals, in particular, serpents or jaguars, occurring in subjects who have consumed ayahuasca regardless of their cultural background (Shanon 2003). The ethnographic study of art often provides interesting clues about the content of the images, as is the case of the famous Huichol yarn pictures. In this sense, the imagery of the experience with psychedelics may be defined as a construction of mental contents that imbues them with mythological meanings.
3. Illusions: Visual illusions are deceptive visual percepts in the sense that do not correspond with the stimuli in the visual field. During the experience with hallucinogens, alterations and distortions are perceived in the visual scene, with rhythmic movements in the objects, vibrations along their edges, distortions of lines and angles, micropsia and macropsia, and after-images of objects in movement. The geometric and intensely colored visual images tend to be dynamic, displaying movements, pulsations, and transformations.
4. Substantive concrete hallucinations: Occasionally, objects, animals, or subjects are seen in the visual field, i.e., not only with eyes closed but apparently located in the external scene. There is continuity between increased imagination and the

- apparent projection of certain contents onto the external visual field that impedes a strict distinction between mental image and perceptual hallucination (Siegel 1977, 1992). The pink elephants popularized in the Walt Disney film *Dumbo* (1945) or any other fantastic animal are rare with hallucinogens, being much more common to the *delirium tremens* of the alcoholic.
5. Substantive global hallucinations: The scene before the eyes is totally changed, and ordinary consensual reality is perceived as mixed up, in a manner analogous to that of virtual reality. The hallucinator may have difficulties deciding whether what he is seeing is real or not. Some authors use the term pseudohallucinations to refer to when the subject realizes that the hallucination is “unreal.” Although highly uncommon, the substitution of reality has been used in so-called visionary art, although it is quite possible that this art uses the general imagery of the state induced by this type of drug or by other procedures that alter the level of consciousness. These types of hallucinations may follow the ingestion of large amounts of deliriogens.

The effects of hallucinogens have been considered and interpreted from two perspectives so extreme and polar that it is difficult to discern a common element in the two. On one side, a sector of psychiatry has viewed these substances as psychotomimetic, that is, drugs that induce a chemical psychosis similar to endogenous psychoses and that may unveil a latent psychosis. Such “models of psychoses” would provide with tools to understand the neurobiological mechanisms of endogenous psychoses. Although there doesn't seem to be a substance that mimics the psychiatric condition of schizophrenia or of bipolar psychosis, there is little doubt that some substances emulate or induce particular symptoms of these disorders. A session of hallucinogens may result in a “bad trip,” in a delirious condition, or a recurrent perceptive disorder (the so-called flashback). However, the danger posed by the use of these substances has been exaggerated as, apart from these psychiatric complications, hallucinogens do not produce addiction, nor is there evidence that they lead to the use of narcotics just by their pharmacologic effects. In opposition to this position, a group of individuals enthusiastically support the widespread use of hallucinogens with the idea that they induce heightened states of consciousness and ecstatic or mystic experiences with notably beneficial consequences. These states may indeed occur with the use of hallucinogens, but usually within the cultural, ritual, and divinatory context tried and tested over many years.

Some mental health professionals have advocated the use of hallucinogens as aids in psychotherapy in contexts of careful administration, monitoring, and analysis of the effects. The experiences of the US-based Czech psychiatrist, Stanislav Grof (1980), with hallucinogens have resulted in a transpersonal psychopharmacology that has clarified some phenomenological aspects of both the negative or hellish and the beatific or heavenly experiences with these substances. According to Grof, the images fit within a mythical iconography that he interprets in agreement with Carl Jung as universal archetypes captured in the visionary and religious art of many eras and cultural traditions. This type of research continues to arouse academic interest, and it is necessary to leave behind the sectarian controversy to focus simply on the phenomenology of the hallucinatory experience and on the methodological requirements to better understand it.

A promising perspective is currently being developed through the phenomenological studies of pharmacological hallucinosis by obtaining first-person reports submitted to analysis and interpretation by trained analysts (Díaz 2007). This access would enable researchers to obtain cerebral images in correlation with specific phenomena of psychedelic consciousness.

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AUTHOR QUERIES

AUTHOR PLEASE ANSWER ALL QUERIES.

- Q1. The abbreviation "LSD" was defined as "lysergic acid diethylamide". Please confirm if the change is appropriate.
- Q2. The abbreviation "THC" was defined as "tetrahydrocannabinol". Please confirm if the change is appropriate.
- Q3. Please confirm if the city "Mexico City" and country "Mexico" supplied for the author's affiliation are appropriate.
- Q4. Please confirm if the supplied running title is appropriate. Otherwise, please provide running title consisting of not more than 65 characters including spaces.
- Q5. [The sacred plant and the human brain section, 5th paragraph] 'Osmond and Smithies (1952)' was cited in the text but was not given in the reference list. Please provide details in the reference list or delete the citation from the text.
- Q6. The term "*Paneolus*" was changed to "*Panaeolus*". Please confirm if the change is appropriate.
- Q7. The citation 'Lewin 1966' (original) was changed to 'Lewin 1964'. Please confirm if the change is appropriate.
- Q8. The citation 'Wasson 1958' (original) was changed to 'Wasson 1980'. Please confirm if the change is appropriate.
- Q9. [References] The following references were not cited in the text. Please provide citation or delete them from the reference list.
[CR10] Heim R, Wasson RG. Les Chamignons Hallucinogenes du Mexique: Etudes Ethnologiques, Taxonomiques, Biologiques, Physiologiques et Chimiques. Paris: Editions du Muséum National d'Histoire Naturelle; 1958. [CR11] Huxley A. The doors of perception. New York: Harper & Row; 1954. [CR12] James W. The varieties of religious experience. London: Fontana; 1900/1974. [CR15] Laski M. Ecstasy in secular and religious experiences. Los Angeles: Tarcher; 1961. [CR17] Schultes RE. Plantas de los Dioses. México City: Fondo de Cultura Económica; 1992. [CR20] Siegel RK. Intoxication: Life in pursuit of artificial paradise. New York: Dutton; 1989.
- Q10. Please confirm if the publisher location "London" supplied for reference "Shanon 2003" is appropriate.