Title page

Anomalous psychedelic experiences: At the neurochemical juncture of the humanistic and parapsychological

Acknowledgements

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Anomalous psychedelic experiences:
At the neurochemical juncture of the humanistic and parapsychological

Abstract

This paper explores the nature of psychedelically-induced anomalous experiences for what they reveal regarding the nature of 'expanded consciousness' and its implications for humanistic and transpersonal psychology, parapsychology and the psychology and underlying neuroscience of such experiences. Taking a multidisciplinary approach this essay reviews the nature of ten transpersonal or parapsychological experiences that commonly occur spontaneously and in relation to the use of psychedelic substances, namely synaesthesia, extra-dimensional percepts, out-of-body experiences, near-death experiences, entity encounters, alien abduction, sleep paralysis, interspecies communication, possession, and psi (telepathy, precognition, and clairvoyance and psychokinesis).

Keywords: Psychedelic, anomalous experience, subjective paranormal experience, transpersonal, parapsychology

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Introduction

Quite some prominent literature and research exists with regards to the induction of genuine spiritual, mystical and peak experiences with psychedelic substances (e.g., Griffiths, Richards, McCann & Jesse, 2006; Huxley, 1954), but exploration of the associated 'anomalous' experiences that commonly accompany such pharmaco-mystical excursions is more obscure. Nevertheless, ever since the beginning of the 20th century when Western scientists and academics began earnestly turning their attention to psychedelics, there has been a clear association between the use of these substances and both the mystical and ostensibly paranormal experience. Indeed, those people most readily associated with the discovery and popularization of psychedelics also witnessed and explored both the transpersonal and the parapsychological dimensions that these substances induced, such as Albert Hofmann, Humphrey Osmond, John Smythies, Aldous Huxley, Gordon Wasson, Timothy Leary, Ken Kesey, Duncan Blewett, Walter Pahnke, James Fadiman and Stanislav Grof, to name but a few (Luke, 2006a, 2012).

Leaving aside what are termed solely mystical or spiritual experiences, this essay investigates the relationship between psychedelic substances and so-called anomalous experiences. The term 'anomalous', somewhat broader and less freighted than the term 'paranormal', and somewhat more neutral than the term 'transpersonal', here refers to "…an uncommon experience (e.g., synaesthesia), or one that, although it may be experienced by a significant number of persons (e.g., psi experiences), is believed to deviate from ordinary experience or from usually accepted explanations of reality according to Western mainstream science" (Cardeña, Lynn & Krippner, 2014, p.4). More simply, "anomalous experiences... are distinct from our ordinary state of awareness or contravene assumptions about reality" (Holt, Simmonds-Moore, Luke & French, 2012, p.2).

Given the broad range of possible anomalous experiences, numbering over a hundred in one systematic review and categorisation (White & Brown, 1997), the current paper will focus on only a few examples typically occurring with psychedelics, for which the author has conducted reviews published elsewhere (Krippner & Luke, 2009; Luke, 2010, 2011, 2012, 2014; 2017, 2019; Luke & Kittenis, 2005; Luke & Terhune, 2013). These anomalous psychedelic experiences include synaesthesia, extra-dimensional percepts, out-of-body experiences, near-death experiences, entity encounters, alien abduction, sleep paralysis, interspecies communication, possession, and psi (telepathy, precognition, and clairvoyance and psychokinesis). Somewhat beyond the scope of this paper, there are of course many more chemically-mediated anomalous or potentially peak experiences that occur, and a broader range of 45 such experiences has been catalogued and classified into three major and six minor categories by Grof (2000): The three main categories being, i) experiential extension within space-time and consensus reality (e.g., planetary consciousness, embryonal, fetal and phylogenetic experiences); ii) experiential extension beyond space-time and consensus reality (e.g., mental mediumship, entity encounters and cosmic consciousness), and iii) transpersonal experiences of a psychoid nature (i.e., having apparent physical concomitants, e.g., physical mediumship, UFO phenomena and yogic siddhis). Anomalous experiences in this paper all

belong to Grof's second category, with the exception of synaesthesia, which, if anywhere, falls into the first category.

Given the interdisciplinary nature of the research relating to these experiences, the paper borrows widely, but by no means exhaustively, from parapsychology as well as transpersonal and religious studies, anthropology, ethnobotany, psychopharmacology, neurobiology, psychiatry, psychotherapy, and even critical theory. Empirical evidence shedding light on these experiences will be discussed, where available, for some insights on the possible ontology of these experiences. Regarding ontology, for the purposes of this paper *experiences* are regarded to be at least subjectively genuine, though they are not necessarily objectively genuine *phenomena*.

1. Synaesthesia

Synaesthesia is an unusual but non-pathological condition in which a stimulus will consistently and involuntarily produce a second concurrent experience. An example includes grapheme-colour synaesthesia, which is a common form of the congenital condition where letters and numerals will involuntarily elicit experiences of colour. Synaesthesia qualifies as an anomalous experience due primarily to its uncommonness, being estimated to occur in some form in up to 4% of the general population (Simner et al., 2006), and despite some researchers once doubting it as a genuine perceptual experience it is now considered to be real, i.e., some people really do see sounds or taste colours (Marks, 2014). As such it is only an anomaly in prevalence but not anymore an anomaly in its deviance within Western mainstream science. Furthermore, save for the possible association between synaesthesia and aura vision (Milán et al., 2012) – an experience reported to occur under the influence of psychoactive drugs by 46% of users (Luke & Kittenis, 2005) – a professed spiritual dimension to the mundane, albeit odd, experience of synaesthesia is not especially pronounced among experiencers.

Most likely psychedelic synaesthesia would fall within Grof's (2000) transpersonal category of 'experiential extension within space-time and consensus reality', if at all. Nevertheless, synaesthesia-like experiences occur quite widely across psychedelic users and across different substances (for a review see, Luke & Terhune, 2013). One good example comes from Owsley Stanley, the first sound engineer of the proto psychedelic rock band Grateful Dead. Stanley was also one of the 1960s' pioneering underground LSD chemists and would combine his interests, and consequently his senses, leading him to see the waves of sound coming out of the speakers, and so he arranged the sound system spatially to maximize this effect (McKenna, 1992).

Figures for the frequency of occurrence within individuals are scant, but prevalence rates indicate that psychedelic synaesthesia occurs in anywhere from 10% (mescaline; Hartman & Hollister, 1963) up to 100% of participants (mescaline; Simpson & McKellar, 1955) in small group experiments intended to induce synaesthesia. Experiments merely noting subjective reports of synaesthesia under the influence of psychedelics in the laboratory produce prevalence rates of between 10% (MDMA; Studerus, 2013) and 57% (*Salvia divinorum*; Addy, 2010), and demonstrate that this prevalence is dose dependent with psilocybin, occurring in up to 50% of participants receiving the highest dose versus 0% with the lowest dose and placebo (Studerus, 2013). Surveys report similar maximum figures with up to 50% (various psychedelics; DeGracia, 1997) to 57% (LSD; Luke, Terhune & Friday, 2012) of 'recreational' psychedelic users reporting substance-induced synaesthesia across the lifetime,

with classic serotonergic tryptamines (e.g., LSD, psilocybin) being the most likely to induce experiences, followed by phenythlamines (e.g. mescaline), then NMDA-antagonists (e.g., ketamine) and then other drugs (Luke, Terhune & Friday, 2012).

One theory proposes that at least some types of congenital synaesthesia may be mediated by serotonergic action (Brang & Ramachandran, 2008), hence the predilection for the experience with tryptamine psychedelics. Typical explanations for this neurochemical action offer that the experience of synaesthesia is ordinarily suppressed but disinihibition can give rise to the experience, such that congenital synaesthetes are normally hyper activated cortically (e.g., Grossenbacher, 1997). However competing theories and some, albeit inconclusive, evidence suggests that at least some types of congenital synaesthesia, such as grapheme-colour, are anatomically mediated, and due to excess cross-activation in adjacent brain regions, termed *hyperconnectivity* (e.g., Hubbard, Brang & Ramachandran, 2011).

There may well be multiple aetiologies for congenital synaeathesia, as there are many types, however determining the nature of the relationship between induced and congenital synaesthesia is crucial, though there is no common agreement about whether psychedelic experiences are genuinely synaesthetic or just synaesthesia-like (for a review see Terhune, Luke & Cohen Kadosh, 2017). The four defining features of congenital synaesthesia are its consistency over time within individuals (e.g., Tuesday is always green), automaticity (occurs without effort), specificity (e.g., B minor is chartreuse), and access to consciousness. Of these four criteria only the access to consciousness is incontrovertible with psychedelic synaesthesia, specificity is sometimes absent (e.g., the concurrent visual experience to sound may be complex), and automaticity and consistency have not been sufficiently tested for under controlled conditions, save for a recent study exploring LSD-induced synaesthesia under laboratory controlled conditions (Terhune et al., 2016). This was the first such experiment conducted in 50 years and, unlike previous direct experimental studies (e.g., Hartman & Hollister, 1963; Simpson & McKellar, 1955) this study explored drug-induced synaesthesia for both consistency and inducer specificity using behavioural measures in a controlled manner. Furthermore, this was the first direct psychedelic synaesthesia experiment to employ a blind placebo-controlled design.

Unfortunately that study did not produce evidence to support the existence of consistency or inducer specificity of LSD-induced grapheme-colour and sound-colour synaesthesia. This does not rule out that such consistency and specificity is not possible with psychedelic-induced synaesthesia, as occurs with congenital synaesthesia, but that the current methodological approach did not support this, perhaps due to the simplicity of the stimuli used, which may be dissimilar to those occurring naturally. However, participants did report more spontaneous synaesthesia-like experiences (concurrent visual movements, experiences of touch and entoptic patterns) occurring with the visual and, especially, the auditory stimuli under LSD than compared to the control condition. Although it should be noted that colour concurrents were not explicitly observed, perhaps indicating why the experiment was not successful in producing LSD-induced consistency and inducer specificity of grapheme-colour and sound-colour synaesthesia.

In any case, it is probable that with congenital synaesthesia both consistency and specificity arise from the consolidation of inducer-concurrent pairings over time (perhaps years) and so are not evident in short-lived substance-induced instances. If this is the case then psychedelic-induced synaesthesia would be unlikely to ever produce consistency and specificity effects in tests, unless the experience was especially prolonged. It is hard to speculate how long

someone would need to be tripping for to achieve such an effect, given that evidence suggests that congenital synaesthesia seemingly begins development as an infant (Simner & Bain, 2013).

One possibly is to test those rare people reporting hallucinogen persisting perceptual disorder manifesting as synaesthesia-like symptoms. One such individual presenting such a condition following the ingestion of a large dose of the phenethylamine psychedelic 2C-B some seven years prior was successfully tested for face-colour synaesthesia automaticity and consistency using a Stroop-like face colour priming task (Yanakieva, Luke, Jansari & Terhune, 2019). The positive findings of this case study led us to speculate that the hallmark features of congenital synaesthesia are a product of developmental overlearning and that psychedelic-induced synaesthesia-like experiences do not ordinarily exhibit these features as they are so transitory, although in some cases, such as accidental overdose leading to persistent perceptual changes, these features may eventually manifest. Such a discovery has implications for understanding the underlying neural mechanisms of congenital synaesthesia and the experience of perceiving auras.

2. Extra-dimensional percepts

Typical synaesthetic experiences with psychedelics are of the audio-visual (inducer-concurrent) type, such that sound, particularly music, elicits colourful images, often geometric, although the geometric imagery also occurs in the absence of synaesthesia too. Such geometric forms appear to be relatively common, with 64% of first-time ayahuasca users reporting them (Barbosa, Giglio & Dalgalarrondo, 2005). Experimenting extensively with mescaline and perception nearly a century ago Klüver (1926) named these geometric percepts *form constants*, due to the consistency of their forms, which he categorized as lattices, cobwebs, tunnels, and spirals. Later researchers used cocaine, LSD and cannabis, as well as a variety of non-drug means of inducing geometric visual percepts, including transcranial magnetic stimulation (see Billcock & Tsou, 2012; Dronfield, 1996) and they defined similar categorizations. Using form constants as a means of explaining Paleolithic rock art, Lewis-Williams and Dowson (1988) combined these various categories to make six forms: grids, lattices, dots, zigzag lines, nested curves and filigrees. They called these forms *entoptic phenomena* (derived from *entoptical phenomena* by Helmholtz, 1925), defined as "visual sensations derived from within the optic system anywhere from the eyeball to the cortex" (Lewis-Williams and Dowson (1988, p.202). More recently Dronfield (1996) opted for seven distinct forms.

Renderings of these geometric percepts on paper obviously look two-dimensional, but using mathematical operations the various patterns can be inferred from the various cortical mechanisms used to process edges, contours, surfaces and textures (Ermentrout & Cowan, 1979). This model is "based on the assumption that the form of the retino-cortical map and the architecture of [the visual cortex region] V1 determine their geometry" (Bresloff et al, 2002, p.474). Nevertheless, it has been noted that, "the experience of mental imagery is qualitatively different from the experience of seeing a 2D picture" (Froese, Woodward & Ikegami, 2013, p.205). Furthermore, these psychedelic geometrical percepts have the tendency to appear to belong to the external objects in view and follow their contours rather than just free-floating idly as hallucinatory optic system percepts might be expected to (Luke, 2010). Experimenting with mescaline Klüver (1926, p505) observed that "the designs [as on rugs] seem to be localized on walls, on the floor, etc." as did Smythies (1956, p.81) who noted that the "hallucinations are spatial and coloured entities and may possess not only a high

degree of internal organization, but may also be closely integrated into the 'veridical' remainder of the visual field in which they occur."

Having geometric percepts apparently projected seamlessly onto the outer world is the least ontological concern however, as users of psychedelics, especially tryptamine-based substances such as DMT and ayahuasca, occasionally report percepts with more than the usual three spatial dimensions (see Luke, 2010). For example, ayahuasca researcher Shanon (2002, p.88), reports that, "at times, the geometric patterns may seem to defy ordinary real-world Euclidean geometry; some persons that I interviewed made reference to higher orders of spatial dimensionality." Indeed such extradimensional phenomenological reports with ayahuasca are littered across the academic literature (see Luke, 2010). Attempting to survey the number of reports, a review in November 2008 of all 142 ayahuasca *trip reports* in the *Vaults of Erowid* (www.erowid.org) revealed 30 reports containing the search term "dimension", and 5 of these discussed extra-dimensional percepts, which is 3.5% of all ayahuasca reports (Luke, 2010). Reports are screened before posting for accuracy, believability, interest and quality and only about 20% get published so generalizability is questionable, but they are of high quality and indicate that such percepts are seemingly somewhat widespread, though certainly not common. The following accounts give a flavor of the experiences:

> After a point i [sic] came to realize that the entire prismatic hyperdimensional wall of images that assailed me was itself one conscious entity (Scotto, 2000)
>
> Flying through a multidimensional place of pure vision and thought, I saw endless arches of golden salamanders, flowing through the very fabric of space & time, their colors changing and rotating like countless kaleidoscopes (Satori, 2003).

Similar reports are also extant for experiences with DMT (the main active chemical in ayahuasca) with nearly all high dose participants in Strassman's (2001) structured laboratory study reporting visual-spatial percepts as being either multi-dimensional or beyond dimensionality (Strassman, personal communication, 2008, 6th October). DMT experience cartographer Meyer (1994) was well aware of the these percepts too and indicated that the third and deepest of his supposed levels of experience involves three or higher-dimensional space, a classification which is justified by 15% of DMT trip reports on Erowid specifically reporting extra-dimensional percepts (Luke, 2010).

The experience of such 3D-defying geometries, albeit uncommon, seems to be in little doubt. The problem remains of how, informed by a flat sphere retina, essentially a 2D plane, misfiring neurons that code for edges, contours, surfaces and textures can give rise to percepts with more than three spatial dimensions, given that it is not possible to imagine greater than three-dimensional space let alone perceive it in ordinary states of consciousness. The solution to this problem is also embedded in an even greater mystery relating to the mind-body problem, that of understanding how light, coded as electrochemical signals in the brain, gives rise to a functionally veridical 3D percept of the world. Despite Ermentrout & Cowan's (1979) elegant computational model of form constants, no amount of mathematics can sidestep this conundrum either, for the 'hard problem' of consciousness cannot be solved algebraically. As Cowan (2013) admitted after a lengthy lecture to neuroscientists explaining the mathematics of his model of 2D geometrical percepts, "you're basically seeing your own visual architecture," leading to the absurd regress that something within the visual system sees itself. This seemingly impossible perceptual feat, which presumes meta-optic systems within

the optic system itself, is what Froese et al. (2013) somewhat understatedly call the "*strange subjective experience* of looking into oneself, where the patterns we see directly expose the underlying operation of our brains" (p.207, italics added).

However, given the nature of apparently veridical vision in congenitally blind individuals having near-death experiences, termed *mindsight* (Ring & Cooper, 2008), and the report of the direct perception with psychedelics of events that are not within view, such as molecules or absent relatives (Luke, 2012), could vision in extreme altered states of consciousness be informed by a kind of clairvoyance? This issue will be evaluated in the penultimate section of this paper, but meanwhile the perception of apparently 3+D spatial arrangements begs some questions about the nature of exceptional psychedelic vision and even ordinary perception (Luke, 2010).

3. Out-of-body experiences

An out-of-body experience (OBE) is the perception that one's self or centre of awareness is located outside of the physical body. Out-of-body experiences are no strangers to psychedelic users, indeed the discover of LSD, Albert Hofmann (1983), had an OBE on his first ever LSD trip in 1943 (he also experienced synaesthesia on that occasion). A review of the various surveys into substance use and OBE (Luke, 2012) indicates that, of those claiming to have had at least one OBE, between 13% (Palmer, 1979) and 37% (Blackmore, 1982) occurred when taking drugs, most often LSD or marijuana. On average 44% of psychoactive drug users (excluding alcohol, nicotine, caffeine & prescription drugs) reported OBEs under the influence (Luke & Kittenis, 2005), rising to between 40% (DeGracia, 1995) and 53% (Kjellgren & Norlander, 2000-2001) of those using psychedelics in general, 54% of those using cannabis (Tart, 1971), and 62% of those using ayahuasca (Luke, 2009b).

Drug users were also significantly more likely to have had an OBE than non-drug users, with frequency of psychedelic use also associated with reported OBEs (Luke, 2017). Seemingly, the most common inducers of OBEs are cannabis, psychedelics (especially DMT), and dissociatives such as ketamine and nitrous oxide (Luke, 2012; Luke & Kittenis, 2005). One contributory factor for the high incidence of OBEs with DMT and ketamine is that OBEs occur more often when the person is quiescent and lying down (Cardeña, 2005), as is typical of DMT and high dose ketamine trips, because of their debilitating effects.

Nevertheless, ketamine, which is of particular interest and has been shown to induce OBEs and autoscopy far more often than other (non-anaesthetic) psychedelics (Wilkins, Girard, & Cheyne, 2011), produces other phenomenological features which indicate that it is the substance itself rather than being supine that is the primary inducer of the K-OBE. To elucidate, it seems apparent that the degree of general anaesthesia induced by ketamine is relative to one's motor control ability and what Grosso (1976) identified as the degree of being out-of-body (Luke, 2012): Factors which are more pronounced with the positive S-isomer of ketamine rather than the negative isomer (Domino & Warner, 2010). Such relationships between sensory and motor impairment and reported body image have elsewhere been found with local anaesthesia (Paqueron et al., 2003), though not full blown OBEs. However, with ketamine there appears to be a relatively changing gradation in increased anaesthesia, body dysmorphia (e.g., micro- and macro-somatognosia) and motor control that proceeds as the dosage increases and the trip intensifies towards a full-blown out-of-body experience, total anaesthesia, and ultimately no motor control, and which reverse in

affect as the drug effects subside (Luke, 2012). Body image distortions are also more prevalent among OBE reporters generally (Cardeña & Alvarado, 2014).

Little has been discussed theoretically about drug induced OBEs *per se* (though see the following section on near-death experiences), and no experimental research has yet been conducted, but they are generally considered to be similar experientially to non-drug OBEs (Blackmore, 1986), though a systematic phenomenological comparison is still needed to support this. Nevertheless, explanations regarding drug-induced OBEs can be considered in terms of those provided for OBEs more generally.

The main competing theories are those of *projection* – that the person's consciousness genuinely leaves the body and is able to observe the world from a disembodied perspective – versus psychological, psychophysiological and neurological models, that suppose, for example, that the OBE is either an imaginary or hallucinatory experience, a reconstruction from flying dreams, or a failure to integrate proprioceptive, tactile and visual information in the temporal-parietal junction (for an overview see Cardeña & Alvarado, 2014). There is currently no conclusive position: the imaginary and hallucinatory arguments are somewhat circular; despite many unproven reports the laboratory evidence for veridical OBE perceptions, and therefore projection, is somewhat slim and can in any case be accounted for by travelling clairvoyance (see the latter section on psi); and the neurological evidence does not rule out genuine disembodiment but does contribute some probable physiological mechanisms involved. The fact that certain psychoactive substances produce a proclivity for OBEs can provide neurochemical insights into this experience that ultimately have to be incorporated into any explanation. Nevertheless any complete theory will likely also require a deep consideration of the ontological and philosophical perspectives regarding the hard problem of consciousness and not just neurocognitive viewpoints. The same goes for near-death experiences.

4. Near-death experiences

Out-of-body experiences are also a common core feature of near-death experiences (NDEs) and occur in 37% of NDEs (Ring, 1980). In Albert Hofmann's (1983) seminal LSD trip, having an OBE lead him to think at the time that he must be dead. Other features occurring during the NDE include ineffability, peace, unusual noises, seeing a dark tunnel, meeting spiritual beings, sentient bright light, panoramic life review, supernatural rescue, sensing a border or limit, and coming back to the body (Greyson, 2014). Despite a lack of consensus NDEs have been defined as "unusual, often vivid and realistic, and sometimes profoundly life-changing experiences occurring to people who have been physiologically close to death, as in a cardiac arrest or other life-threatening conditions, or psychologically close to death as in accidents or illnesses in which they feared they would die" (Greyson, 2014, p.334). Two psychedelic-NDE theories are here discussed but see Greyson (2014) for an overview of alternative theories, which, as with OBEs, are divided between those that support disembodied consciousness and those that deny it, but all of which currently remain inconclusive.

Few prevalence statistics are available for psychedelically induced NDEs. In one survey 32% of psychedelic users reported the experience of dying, rebirth, or memory of a past life under the influence of drugs (Luke & Kittenis, 2005) with such experiences being particularly associated with 5-MEO-DMT, being the second most common of 17 transpersonal events to occur with this substance, and observed to occur elsewhere too (Roney-Dougal, 2001; Shulgin

& Shulgin, 1997). In the same survey such death-related experiences were also the most common experience, after OBEs, to be reported to occur with ketamine (Luke & Kittenis, 2005). Prevalence figures for those experiencing NDEs under the influence of ketamine range from 12% (Jansen, 2001) to 40% (Corazza, 2010) of ketamine users, nevertheless it is unclear how often it occurs for these individuals as those in Corazza's (2008) study had used ketamine between 10 and 2000 times (Luke, 2012). It is also noted that ketamine appears to have multiple effects in the brain and multiple experiential features, some of which include those of the NDE (Greyson, 2000; Parker, 2001) so at best, ketamine and 5-MEO-DMT, particularly, and other psychedelics more generally (e.g., DMT), can be thought of only as occasional NDE triggers.

In a recent data mining study over 20,000 psychedelic 'trip reports', covering 165 different psychedelic substances publically available on the erowid.org website were compared to 625 NDE subjective reports using a semantic analysis (Martial et al., 2019). The analysis identified ketamine as the substance with the highest semantic similarity to NDE reports, followed respectively by *Salvia divinorum*, peyote, LSD, 5-MEO-DMT, psilocybin and DMT (in 7th place) somewhat supporting the survey research (Luke & Kittenis, 2005).

4.1. Ketamine and NDEs

Given the noted similarity of aspects of the ketamine experience to that of the NDE (Morse, Venecia & Milstein, 1989; Rogo, 1984) a neurochemical model of NDE has been proposed based upon the action of ketamine (Jansen, 1990). Ketamine acts by binding to the phencyclidine (PCP) site of the *N*-methyl-D-aspartate (NMDA) receptor, blocking the action of the neurotransmitter glutamate. Jansen indicated that potentially life-threatening circumstances (e.g., hypoxia, ischemia, hypoglycemia, temporal lobe epilepsy) can initiate a glutamate flood, which results in neurotoxicity through the over-activation of the NMDA receptors. This NDE trigger may be accompanied by a flood of neuroprotective agents that also bind to the NMDA receptors preventing damage, in much the same way as ketamine. Like Grinspoon and Bakalar's (1979) speculation that the brain synthesizes a chemical similar to ketamine in times of stress, Jansen proposed that endopsychosins, which bind to the same receptor site as ketamine, would be discovered as the neuroprotective agents that cause an altered state of consciousness (ASC), like that of ketamine, termed the NDE.

Despite several candidate neurochemicals – alpha/beta-endopsychosin (Jansen, 1990), N-acetyl-aspartyl-glutamate, kynurenic acid, magnesium (Jansen, 2004) and agmatine (Thomas, 2004) – no compelling endogenous *NDE-ogens* have as yet been discovered (Greyson, 2000; Smythies, 2011). Further criticisms of Jansen's model consider the disparity in emotional affect in NDEs and K-NDEs, with ketamine experiences thought to be more fearful, though this is somewhat unfounded as NDE's can also be frightening experiences and ketamine is most often a pleasant or fearless experience (see Luke, 2012). It is also contested that non-NMDA antagonists like LSD also induce occasional NDE features (Parker, 2001), although Jansen (1997) insists such features are typical with ketamine but not other drugs, though reviews by Luke (2012, 2017) and recent semantic analysis data mining research (Martial et al., 2019) suggests otherwise.

To date the only systematic exploration of the ketamine hypothesis, besides Jansen (2001), is that of Corazza (2008), who compared 36 cases of apparent NDEs induced by ketamine with 36 cases of NDEs reportedly caused by a cardiac arrest or other life threatening circumstances. Both groups showed a high degree of similarity in certain experiential

features, with both groups having a roughly equal prevalence of experiences involving altered perceptions of time, speeded up visions, and the occurrence of ESP, but the ketamine group were more likely to report unity with the universe, and the cardiac groups were more likely to report dissociation from the body, visions of light, and encounters with deceased or religious beings. However, Corazza asserted that the evidence indicates that NDEs can be induced through ketamine, although they may not be identical to those occurring naturally. Nevertheless, the ketamine participants were recruited on the premise that they felt that they had had an NDE on ketamine and focused only on their NDE-like ketamine experiences not the dozens or possibly thousands of other ketamine trips they had that did not resemble NDEs, although such figures are not reported by Corazza (Luke, 2009a). Assuming ketamine NDEs to be genuine, ultimately, however, the question remains of whether chemically induced NDEs utilize alternative pathways or the actual NDE pathway (Fracasso & Friedman, 2011) and further research is needed.

Returning to the discussion regarding ketamine and OBEs, another question may be asked as to why anaesthesia should accompany an OBE/NDE: Does the anaesthesia cause the perception of being out of one's body, and therefore leads to a feeling of dying or of having died, or does the near-death experience provoke an OBE and subsequent anaesthesia as a defence against likely pain, or merely as an accidental yet useful concomitant of being disembodied? In any case the natural anaesthesia associated with NDE/OBEs is particularly beneficial in painful circumstances, as often occurs in an NDE. Observing the ketamine experience from the recipient's perspective, it appears that the ketamine-induced anaesthesia occurs because one's consciousness is no longer connected to one's body, and certainly the OBE and anaesthesia are intimately connected, but why and how deserve further investigation and may shed light on the neurobiological factors of OBEs and NDEs (Luke, 2012, 2017).

4.2. DMT and NDEs

Following research investigating the phenomenological effects of administering intravenous injections of DMT, Strassman (2001) proposed DMT as an alternative endogenous *NDE-ogen* (causing an NDE) although one apparently independent of Jansen's speculated NMDA-antagonist neuroprotective mode of action. Given that the highly psychedelic molecule DMT is endogenous, Strassman proposed it as a 'reality thermostat' central to extraordinary events such as near-death and mystical experience, as well as birth and death. Speculating a pineal origin for DMT production, Strassman noted that the pineal gland is optimally situated to administer neurotransmitters to the brain via the cerebral spinal fluid following cardiac arrest, though one may ask what use this will be 10 seconds later once the brain's electrical activity (and so presumably neurotransmission) has ceased. Nevertheless, DMT is virtually unique among endogenous neurotransmitters in that it is a molecule small enough to have blood-brain barrier permeability (Jacob & Presti, 2005), and so can be easily absorbed into the brain via other routes. At this time, however, despite the discovery of DMT in the pineal glands of rats (Barker, Borjigin, Lomnicka & Strassman, 2013) and other indirect evidence (for a review see Luke, 2017), the speculation that DMT is made in the human pineal gland has yet to be demonstrated, though the evidence is mounting. More recently however a study exploring the post-cardiac arrest levels of brain chemicals in rats found a six-fold increase in occipital lobe DMT, comparable to concentrations of known canonical neurotransmitters (such as serotonin), independent of their having a pineal gland (Dean et al., 2019). These findings bolster the evidence for a possible role of DMT in NDEs but undermine the suggested necessity of the pineal gland as its site of origin.

Nevertheless, despite the questionable role of the pineal gland Strassman (2001) also noted that the NDE has psychedelic and mystical qualities, and that the DMT experience often shares the same features as an NDE. Some of Strassman's DMT study participants reported NDE-like experiences and death-rebirth experiences, with many others reporting a newfound fearlessness of death as occurs with an NDE. However, that the participants may have been inadvertently primed for these experiences cannot be ruled out because they were told in the briefing to expect feelings of death or impending death (Luke & Friedman, 2010). Nonetheless, at least one participant in the first ever study giving DMT to humans remarked, "This is death. How simple everything is" (Sai-Halász, Brunecker & Szára, 1958, p.4), and independent survey research indicates that DMT users sometimes do report death-like and near-death-type experiences, although such experiences were more typical with 5-MEO-DMT (Luke & Kittenis, 2005), a close chemical cousin.

Not all researchers agree that DMT experiences mimic NDEs. Potts (2012) indicates that there are several typical features of the NDE that do not occur with DMT, and vice versa. However Potts' comparison is not based on a systematic review or balanced sample of accounts and many of the features he lists as only occurring in NDEs (e.g., cosmic unity, peace, joy) *are* actually experienced in some DMT (e.g., Strassman, 2001) and ayahuasca experiences (Liester, 2013). Furthermore, a recent comparison of scores on items of Greyson's NDE scale between 67 participants reporting NDEs and 13 participants injected with DMT found a significant overlap in almost all the psychometric features of the NDE, save for experience of reaching a border or point of no return (Timmermann, et al., 2018).

Nevertheless, some of the weirder DMT features, such as encounters with clowns, elves and insectoid beings do tend to be absent from NDEs, as are the very common experience of colourful geometric patterns (form constants). However, in a systematic analysis of interviews with DMT experiencers one theme to emerge was the entities' tendencies to impart insightful information about themselves and the universe in which they were inhabited, much like the positive performative role played by the apparently sentient beings encountered in near-death experiences, typically identified as deceased persons (Cott & Rock, 2008).

Furthermore, countering Potts' analysis, Liester (2013) conducted a more thorough qualitative comparison of experiences on ayahuasca with the nine classic features of the NDE as outlined by Moody (1989), the original cartographer of the NDE and the man who coined the term. Leister determined that eight of Moody's nine key NDE elements could be found in ayahuasca experiences, although, as with DMT, some of the weirder entity encounters, such as elves and fairies were absent from the NDE cosmology. However, it should be noted that, historically, in folkloric accounts elves and fairies are commonly interpreted as spirits of the dead (Evans Wentz, 1911/2004; Lang, 1893; Luke, 2013b). Ideally, a systematic prospective phenomenological study, beyond the merely psychometric or functional and into the explicit content is required and myself and colleagues are currently conducting one.

5. Entity encounters

As discussed in the last section, encounters with seemingly sentient discarnate entities is a fairly common feature of the DMT experience, estimated by Strassman (2008) to occur in at least half of all high dose DMT participants, a figure supported by research with ayahuasca where 55% of participants reported entity encounters (Luke, 2009b). Entity encounter was also the second most common of 17 transpersonal experiences on DMT and ayahuasca (Luke & Kittens, 2005). Such an experience under the influence was also reported by 32% of

psychoactive drug users generally and was reported to occur occasionally with a broad range of psychedelics, though not all (Luke & Kittenis, 2005). In a recent survey exploring the nature of experiences either with or without tryptamine psychedelics (LSD, psilocybin, ayahuasca or DMT) of encountering, "something that someone might call: God, Higher Power, Ultimate Reality, or an Aspect or Emissary of God (e.g., an angel)" (Griffiths, Hurwitz, Davis, Johnson & Jesse, 2019). Some two-thirds of those having such experience who reported being atheist before indicated that they no longer identified as being atheist after the experience. Overall there were few differences in the nature of these encounter experiences, but relative prevalence rates for the experience between different drugs is not currently available. Given that little research has been conducted on the encounter experience with substances other than DMT and ayahuasca (e.g., Luke, 2011; Shanon, 2002) so this brief review will focus on DMT.

Having been first synthesised in 1931, isolated from a plant source in 1946, and discovered in human blood in 1965, it wasn't until 1956 that the Hungarian chemist and psychiatrist Stephen Szára synthesised DMT in his lab and injected it into himself thereby discovering the its psychedelic effects (Gallimore & Luke, 2015). Szára went on to give DMT to his medical colleagues, one of whom reported that, "the whole room is filled with spirits" (Sai-Halász, Brunecker & Szára, 1958, p.4), while another noted that, "In front of me are two quiet, sunlit Gods" (p.7). Following Strassman's (2001, p.185) later research injecting volunteers with DMT, experiencers frequently described the things they encountered as "entities, beings, aliens, guides or helpers," which would appear as "clowns, reptiles, mantises, bees, spiders, cacti, and stick figures" as well as dwarves, elves, imps, angels, spirits, gods, or just as a presence, the latter four of which were commonly supremely powerful, wise, and loving. However, encounters with serpents and large felines, particularly black pumas are much more typical on ayahuasca (Shanon, 2002). Besides visionary encounters with people, animals and other ordinary things (which are not typical of DMT), the kinds of supernatural beings encountered on ayahusaca are classified by Shanon (2002) thus:

1. *Mythological beings*: Such as gnomes, elves, fairies, and monsters of all kinds.
2. *Chimeras or hybrids*: Typically half human half animal (e.g., mermaids), or transforming or shapeshifting beings, for example from human to puma, to tiger, to wolf.
3. *Extraterrestrials*: These are particularly common for some experients and may be accompanied by spacecraft.
4. *Angels and celestial beings*: Usually winged humanlike beings that may be transparent or composed of light
5. *Semi-divine beings*: May appear like Jesus, Buddha, or typically Hindu, Egyptian or pre-Columbian deities
6. *Demons, monsters and beings of death*: Such as the angel of death

A similar classification might also be applied to DMT entities. In addition another category, of plant teachers or plant spirits (explored further in a later section), should be added to Shanon's list, because these are regularly encountered on ayahuasca according to interviews with shamans and surveys of users (Luke, 2009b). In any case, encounters with elves, gnomes, pixies, dwarves, imps, goblins and other 'little people' (though clearly not human people), are extremely prevalent and have long been at the spearhead of the debate on the reality of DMT beings, and have been popularly dubbed the "self-transforming machine elves" (McKenna, 1991, p. 16). Leading the debate, Meyer (1996) indicates that, under the influence, the independent existence of these beings seems self-evident, but suggests that

there are numerous interpretations of the entity experience. Meyer's and others' interpretations fall into three basic camps (Luke, 2011):

I – *Hallucination*: The entities are subjective hallucinations. Such a position is favoured by those taking a purely (materialist reductionist) neuropsychological approach to the phenomena. One particularly vocal DMT explorer who adopted this neuro-reductionist approach, James Kent (Pickover, 2005, pp.104-105), appears to have taken a more ambiguous stance recently (Kent, 2010) by considering the entities simply as information generators. For Kent (2010), the question of the entities' reality is redundant given that they generate real information, and sometimes this seemingly goes beyond the experient's available sphere of knowledge (like psi). Nevertheless, according to Kent the entities cannot be trusted to always tell the truth and must be regarded as tricksters.

II – *Psychological/ Transpersonal*: The entities communicated with appear alien but are unfamiliar aspects of ourselves (Turner, 1995), be that our reptilian brain or our cells, molecules or sub-atomic particles (Meyer, 1996). Alternatively, McKenna (1991, p. 43), suggests, "We are alienated, so alienated that the self must disguise itself as an extraterrestrial in order not to alarm us with the truly bizarre dimensions that it encompasses. When we can love the alien, then we will have begun to heal the psychic discontinuity that [plagues] us."

II – *Other worlds*: DMT provides access to a true alternate dimension inhabited by independently existing intelligent entities. The identity of the entities remains speculative, but they may be extraterrestrial or even extra-dimensional alien species, spirits of the dead or time travellers from the future (Meyer, 1996). A variation on this is that the alternate dimension, popularly termed *hyperspace* (e.g., Turner, 1995), is actually just a four-dimensional version of our physical reality (Meyer, 1996). The hyperspace explanation is one of the conclusions drawn by Evans-Wentz (1911/2004, p.482) following his massive folkloric study of 'the little people' (i.e., elves, pixies, etc.) and ties in somewhat with the extra-dimensional percepts discussed earlier:

> It is mathematically possible to conceive fourth-dimensional beings, and if they exist it would be impossible in a third-dimensional plane to see them as they really are. Hence the ordinary apparition is non-real as a form, whereas the beings, which wholly sane and reliable seers claim to see when exercising seership of the highest kind [perhaps under the influence of endogenous DMT], may be as real to themselves and to the seers as human beings are to us here in the third-dimensional world when we exercise normal vision.

Clearly, no amount of speculation will reveal the true nature of such DMT 'visions' nor their entities and the ontological debate remains wide open without a scientific approach. At this juncture, parapsychology, and psychical research in particular, can lend over a century's worth of similar such enquiry to the issue. A case in point comes from a proposal by computer scientist Rodriguez (2007) to experimentally prove or disprove the entities' existence. Grossly simplified, Rodriguez (2007) suggests obtaining from the entities solutions to complex mathematics puzzles that are unknown to the DMT participant communicating with them. Regrettably, this ingenious method for testing the reality of DMT entity encounters is subject to a number of flaws, aside from the huge assumptions involved in expecting our supposed hyper-intelligent beings having the desire to cooperate and make themselves 'proven'. The most crippling problem for Rodriguez' test, however, is the *super psi* hypothesis, which has long proved difficult to surmount in parapsychological attempts to validate the existence of

discarnate entities considered to be spirits of the dead, e.g. those apparently communicating via trance mediums. The problem is that, because psi has no theoretical or even apparent limits, it remains a possibility that any information provided by ostensibly discarnate entities may actually be due to the 'super' psi of the receiver (e.g., the medium or DMT explorer) receiving the information directly from an earthly incarnate source (e.g., see Braude, 2002, for a comprehensive discussion).

A parallel debate aptly demonstrates how the super psi problem applies to Rodriguez' (2007) proposal. The living chess grandmaster Victor Korchnoi ostensibly played a high level game of chess with the deceased Hungarian grandmaster Géza Marcóczy via a non-chess playing automatic-writing medium (Eisenbeiss & Hassler, 2006), assuming no fraud was involved. Good evidence was presented that none other than a grandmaster of Marcóczy's standing, of which few if any are living, could have maintained that standard of playing over 47 moves, and so Neppe (2007) dismissed the super-psi hypothesis, but failed to consider the possibility that Korchnoi himself was the (living) source of such psi information (Breederveld, 2008). Such is the power of the super-psi hypothesis that it supersedes what would otherwise appear to be good evidence for post-mortem survival of the human personality: a similar curse awaits any such attempts to test the reality of DMT entities through ordinary informational means, be that maths puzzles, chess or otherwise.

One alternative approach to investigating the ontology of shamanic entity encounters considers similarities in independent reports concerning the characteristics of particular entities, especially those encountered naïvely and without any cultural context from which the characteristics of the entity could be derived (Luke, 2008a). For instance, one such being that commonly appears to naïve DMT users is an entity consisting of multiple entwined serpents covered in multitudinous eyes, often forming a Fibonacci spiral-like geometrical shape. Obscure references to a similar mythological entity, sometimes identified as the angel of death, also exist in various cultural cosmologies, possibly indicating the transcultural nature of this entity (Luke, 2008a). Such data pose challenging questions as to whether the entity is culturally mediated – which seems unlikely given the obscurity of the cultural references – or a culture-free universal feature of DMT activation (naturally or artificially) in the brain, with possible incorporeal origins. A recent conversation with a 5-year old boy who described this exact entity and its activity in exquisite detail had me wondering whether the boy was a) generating an extremely elaborate spontaneous hoax, b) deeply psychic, or c) had genuinely encountered this entity on a regular basis during dreams and hypnogogia as he said he had (Luke, 2017). The evidence favoured one of the latter explanations.

A similar phenomenological triangulation approach could fruitfully be made with other types of entities commonly encountered with DMT and ayahuasca, such as the bizarre preponderance of praying mantises (Luke, 2008b). It might be possible by such means to determine how statistically improbable is the occurrence of these shared visions. Such a methodology has its limitations, of course, nevertheless upon inspection of the literature it appears that such an approach has rarely been applied to the study of apparently collective visions and may point the baffled DMT ontologist in an enlightening direction, and this if the basis of an ongoing phenomenological analysis of discreet and complete experimental DMT datasets currently being undertaken by the author and colleagues. For further speculations and discussions among leading academics from different fields on the possible nature of DMT entities see Luke and Spowers (2018).

6. Alien abduction

The alien abduction experience is “a dynamic, elaborate and involved experience, rich in contextual detail” (Apelle, Lynn, Newman & Malaktaris, 2014, p.214), which usually involves the experiencer “waking up paralyzed with a sense of a strange figure or figures present, missing time,… balls of light” – features consistent with sleep paralysis – along with memories of abduction, usually to somewhere interpreted as an alien spacecraft, and subjected to complex physical/psychological procedures. Typical features are capture, examination, communication with abductors (usually telepathically), an otherworldy journey, theophany, return and aftermath (Bullard, 1987). For an overview of theories explaining the experience see Apelle et al (2014). Prevalence figures are hard to ascertain, but certainly many thousands of Americans, in particular, believe they have been abducted by aliens (Apelle et al., 2014). There are no figures available for the prevalence of the experience with psychedelics and no known systematic research has been done.

Psychedelic explorer McKenna (1991) posited that the visions of 4HO-DMT (psilocin) and of aliens and UFOs originated from the same source. Strassman (2001) developed this idea further and suggested that spontaneous endogenous DMT fluctuations could be at the root of alien abduction experiences as they share the same newly found fearlessness of death and visions of energy tunnels, or cylinders of light, in common with DMT experiences. Following the use of ayahuasca Severi (2003) also noted the similarity between NDEs, traditional psychedelic-induced shamanic initiations, alien abduction experiences, and heightened psychic sensitivity, as have previous researchers (e.g. Harvey-Wilson, 2001; Ring, 1989, 1992). However, Barušs (2003) notes that, despite the similarities, DMT and alien abduction experiences lack specific commonalities, such as the absence with DMT of the classic *grays* (alleged small gray aliens). Nevertheless, Hancock (2005) argues that there are substantial similarities between aliens and 'elves', whether induced through DMT or else appearing in historic-folkloric legends and testimonies, speculating that the latter also have a DMT-induced aetiology and, adopting the theory proposed by Vallee (1969), that these elves are the prototype encounter/abduction experiences. It should be noted that few experiencers ever doubt the reality of their encounters with either aliens (Mack, 1999) or DMT entities (Strassman, 2001).

Furthermore, an insectoid alien, and especially praying mantis alien, sub-category might be added to Shanon’s (2002) bestiary of ayahuasca/DMT entities (Luke, 2008b, 2011). Ever since Leary’s (1966) account of his DMT encounter with metallic and bejewelled Venutian crickets, reports abound of mantid-like creatures performing exotic surgical operations and probe insertions on DMT experients, as well as those on psilocin (4HO-DMT), in a manner reminiscent of alien abduction cases (e.g., Kottmeyer, 1999; Mack, 1999). Concurrently, though probably starting somewhat later with Strieber (1987), mantises became a growing motif in the alien abduction literature, and one assumes that this was virtually independent from the DMT literature at this time – at least no one appears to have joined up the dots on insectoid encounters until Pickover (2005). For example, there was an article about the increasing presence of praying mantises in alien abduction cases in the 1990s, which were dubbed the ‘greying’ mantises as they appeared so often in people’s abduction experiences (Kottmeyer, 1999). However, this article was essentially entirely naïve to the DMT literature of this era, or at least it appears so, and yet we find a concordance between the alien abduction and DMT experiences, not least with this motif of the praying mantis, and with the elf-like characters too.

7. Sleep paralysis

The similarity between alien abduction experiences and sleep paralysis has been noted for some time (Hufford, 1982), and sleep paralysis has even been championed as an explanation for these bizarre experiences (Blackmore, 1998). Sleep paralysis is a relatively common parasomnic experience involving "a transient conscious state of involuntary immobility occurring immediately prior to falling asleep or upon wakening" and is accompanied by hypnogogic or hypnopompic perceptions such as an "evil presence,... auditory and visual hallucinations, pressure on the chest,… suffocating, chocking, floating, out-of-body, and flying sensations" (Cheyne, Rueffer & Newby-Clark, 1999, p.319-320).

There are no published statistics and almost no direct commentaries on sleep paralysis and psychedelics, though it is worth noting that disrupted sleep patterns due to the stimulant effects of drugs can increase the incidence. It is apparent, however, that some of the DMT experiences reported in Strassman's (2001) study, particularly the negative ones, share several features in common with sleep paralysis, particularly the sense of presence, reports of one's chest being crushed, strange whistling, whining, and whirring sounds (as also occur in OBE/NDEs), and the terrifying paralysis of both body and vocal chords. Alien abduction experiences and NDEs are also associated with sleep paralysis (see Sherwood, 2002), and indeed Strassman (2008) later noted the apparent relationship between sleep paralysis and DMT experiences, although caution has been raised about claiming too many anomalous experiences can be explained by DMT, as this ultimately explains nothing (Luke, 2008b). Certainly further phenomenological analysis and a direct comparison of experiences is needed. Nevertheless, there certainly warrants something to research here regarding a DMT aetiology for sleep paralysis.

Curiously, experiential reports from research programs in the 1950s and 1960s indicate that the endogenous 5-hydroxy-DMT (bufotenine), a very close relative to DMT with similar neurochemistry, might be considered as a chemical co-factor in such experiences, along with DMT. Much like DMT, bufotenine is reported on occasion to cause feelings of constriction in the throat and the crushing of one's chest, as well as anxiety and fear reactions (Shulgin & Shulgin, 1997; Torres & Repke, 2006), much like sleep paralysis. Additionally, in South America and the Caribbean the entheogenic cohoba snuff is made from one of the few traditionally-used plants in which bufotenine is active, *Piptadenia peregrina*, and is used specifically to contact spirits (Cohen, 1970; Torres & Repke, 2006), perhaps somewhat like the sensed presences of sleep paralysis and numerous DMT experiences.

However, Ott (2001) has pointed out that the circulatory crises in the earlier bufotenine research were most likely due to psychological factors caused by the enforced nature of the experiments – conducted as they were on psychiatric patients and prisoners with limited consent – because such experiences were absent during Ott's own extensive self-experimentation, and nor do indigenous users of plants containing bufotenine worry about or report respiratory arrest (Torres & Repke, 2006). In any case the breathing difficulties reported in sleep paralysis may be more to do with the paralysis of conscious bodily functions caused by being asleep, and the inability to inhale at will (which might in turn be partly responsible for causing the experience to be so terrifying). Furthermore, sensed presence, as opposed to direct perception of an entity, as often occurs with sleep paralysis, may be more common with other substances, such as *Salvia divinorum* (e.g., Addy, 2010; Arthur, 2010), or indeed in other non-drug induced altered states, such as that occurring within anechoic darkroom chambers, which induce sensed presences in about 10% of people spending approximately two-hours alone in the chamber (Luke, Timmermann, Kaelen & Bell-

Langford, 2019). As with many of these experience syndromes, however, further systematic phenomenological research is needed.

8. Interspecies communication

While alien entities and malevolent presences may occasionally be experienced on psychedelics, encounters with plant 'spirits' are much more commonly reported and are one of the core experiences among traditional practitioners of psychedelic shamanism (e.g., Beyer, 2009), which is always animistic (Narby, 2006). Survey results show that encountering the spirit or intelligence of the ingested plant or fungus was the most widely reported of a range of 17 transpersonal experiences occurring with those taking psilocybin-containing mushrooms, ayahuasca, *Salvia divinorum* and *Amanita muscaria* (Luke & Kittenis, 2005). On average, when people had such plant/substance encounter experiences they were reported to occur "often" with *Psilocybe* mushrooms, San Pedro and peyote cactus, and "occasionally" with the other plants mentioned, and were reported to occur under the influence by 42% of people using psychoactive substances generally (Luke & Kittenis, 2005), rising to up to 70% of people under the influence of ayahuasca (Luke, 2009).

Interestingly, however, some people reported this experience with DMT and occasionally LSD too, the former of which is usually consumed as a plant extract and the latter of which is a semi-synthetic molecule. There were no reports in the survey of people encountering the spirit/intelligence of purely synthetic molecules like ketamine, dextromethorphan (DXM) or MDMA (Luke & Kittenis, 2005) revealing a graded relationship between the notion of sentience and the idea of life (Luke, 2006a). In interviews for his 100th birthday, LSD discoverer Albert Hofmann, having never revealed as much before, indicated that LSD had spoken to him and asked him to discover it (Luke, 2006b).

When people do dialogue with Nature on psychedelics, there is often an ecological message, as might be expected, rebuking humanity for its widespread destruction of natural habitats (Krippner & Luke, 2009; Luke, 2013a). Such messages appear to be particularly vocal from psychedelic fungi, and interpreting humanity's many dialogues on the mushroom experience mycophile Andy Letcher (2007) termed these mushroom-mediated encounters with discarnate spirit entities the *animaphany*. He warned, however, that these experiences largely go ignored because, in a Foucauldian sense, they offer a resistive discourse to that of the societally legitimated explanations of what occurs under the influence of such plants and fungi, in 'the West' at least (Foucault, 2006). Being based solely on the effects of mushrooms on others, the legitimated discourses typically take a pathological, psychological or prohibitory stance, and so the subjective animaphany appears to transgress a fundamental societal boundary, communicating with spirits, which subsequently becomes labelled as madness. But which is the more mad, communicating with the spirits of Nature or sitting back while Earth descends rapidly into the greatest wave of mass extinction in 65 million years, which at some estimated rates (Pimm, Russell, Gittleman, Brooks, 1995) would see all species on Earth extinct within the next 700 years?

As much as the experience of animaphany is quite common with plant psychedelics, there were until recently no published statistics available on how many people having had that experience are re-orientated to be more ecologically minded than before. In a survey I conducted (Luke & Yanakieva, 2016) on the contribution of psychedelic experiences to eco-consciousness. Nearly 80% of the 150 psychedelic using respondents reported that their use of psychedelics had increased their subsequent degree of interaction with nature, with almost

none saying it had reduced their interaction. Indeed, *all* of the respondents reported that their connection with nature had increased following their use of psychedelics, and more than 60% said that their concern had also increased. These figures compare quite well with respondents in a different survey (Ring, 1992), that found that 70-80% of those having near-death experiences (NDEs), and 80-86% of those having UFO encounter and/or alien abduction experiences had increased ecological concerns following their experience, giving some support to notion that there is an overlap between NDEs, traditional psychedelic-induced shamanic initiations, alien abduction experiences, and heightened psychic sensitivity (Harvey-Wilson, 2001; Ring, 1989, 1992; Severi, 2003).

Interestingly, in our survey, the substance most commonly reported to increase connection was psilocybin-containing mushrooms, which resulted in increased eco-connectedness in almost half of all mushroom users. Furthermore, approximately one third of magic mushroom users reported encounter experiences with the spirit or intelligence of the ingested mushroom, while some 16% reported encounters with animal spirits or communicating with animals whilst high, and 10% reported the experience of being transformed into another species – an experience reported by a full quarter of all ayahuasca users (Luke & Yanakieva, 2016).

One thing that seems apparent now since conducting the first survey exploring psychedelic-induced changes in eco-consciousness (Luke & Yanakieva, 2016) – now that there is some data on the subject rather than just anecdote – is that, according to self-report, psychedelics do indeed tend to increase user's interaction with, connection to, and concern for Nature. Indeed, a recent open-label psilocybin treatment study for depression found that 'nature relatedness' significantly increased relative to baseline following the ingestion of psilocybin, with changes remaining significant when measured again up to 12 months later (Lyons & Harris, 2018). A survey by Forstmann and Sagioglou (2017) similarly found that lifetime use of psychedelics was significantly associated with nature relatedness in terms of self-identification with nature and the desire to be in natural environments, and that the influence of nature relatedness on pro-environmental behaviour was mediated by the lifetime use of psychedelics.

Further to that, those taking psychedelics (especially organic ones) say that their experiences not only changed their attitudes but also directly changed their eco-orientated behaviour. In our survey (Luke & Yanakieva, 2016), *the majority* of psychedelic users reported adjusting their diet (presumably towards organic, raw, vegetarian or vegan) and increasing gardening as a result of their psychedelic experiences. Some 16% reported changing their entire careers to more eco-oriented ones, such as switching to studying PhDs in botany (reported by two people in the sample), and 19% also reported becoming more actively engaged in ecological activism.

In a recent article written by a doctor of molecular biophysics turned eco-activist and founder of one of the UK's fastest growing social movements, Extinction Rebellion, Gail Bradbrook (2019) indicates how her experiences with iboga and ayahuasca gave her the template for forming the radical environmental action group fighting against anthropogenic species extinction, ecocide and climate change. During her psychedelic experiences she had prayed for 'the codes for social change' and upon returning from her psychedelic quest quickly met the climate activist and doctoral researcher of effective radical campaign design Roger Hallam who offered her what he specifically also called the "codes for social change", and together they formed Extinction Rebellion. In a time of such global ecological crisis psychedelics might just have an essential role in literally 'saving the planet', and the

importance of interspecies relationships in this endeavour should not be overlooked but, rather, strongly regarded as an important tool for hope, inspiration and environmental action.

9. Possession

Possession can be defined as "…the hold over a human being by external forces or entities more powerful than she. These forces may be ancestors or divinities, ghosts of foreign origin, or entities both ontologically and ethnically alien...*Possession,* then, is a broad term referring to an integration of spirit and matter, force or power and corporeal reality, in a cosmos where the boundaries between an individual and her environment are acknowledged to be permeable, flexibly drawn, or at least negotiable..." (Boddy, 1994, p. 407).

Given the relative propensity with which a large proportion of those taking psychedelic substances have entity encounters it may be somewhat surprising then that the report of involuntary possession and the practice of voluntary possession (usually termed incorporation) are quite rare (Luke, 2014). Survey research indicates that 19% of people using psychoactive drugs have had mediumistic experiences under the influence, however this was also the most typical transpersonal experience with alcohol, of all drugs, although occurred only with 1-2% of drinkers (Luke & Kittenis, 2005). Reports of mediumstic experience on ayahasuca was reported by 40% of users (Luke, 2009b). However communication with the dead does not imply possession, and reports of spontaneous states of apparently psychedelically-induced possession have not been surveyed, but a few cases are evident, if quite rare (Luke, 2014). Alternatively the practice of incorporation (sometimes called trance possession) under the influence of psychedelics is somewhat more widespread within shamanic cultures but is also quite an exception.

In a survey of 42 different shamanic-like groups from across the globe (Peters & Price-Williams, 1980) some 69% practiced some form of spirit possession, but of these only two groups (7%) are particularly renowned for their use of psychoactive plants: the tobacco-using Akawaio and the Amanita muscaria mushroom-using Chukchi (Luke, 2014). An educated estimate would put the proportion of shamanic cultures utilising psychedelic possession at 5%, a figure which can be halved if indigenous tobacco use is discounted as psychedelic (Luke, 2014). Furthermore, among shamanic groups there is a tendency for incorporation to be practised more in sub-Saharan Africa and psychedelic plant shamanism to be practiced more in the Americas (Bourguignon, 1976; Schultes & Hofmann, 1992). Taxonomical analysis of phenomenological variables among culturally disparate groups practicing traditional magico-religious healing also identifies somewhat distinct categories (Winkelman, 1990). Those termed shamans or shaman-healers made use of psychedelic plants and magical flight, whereas those termed mediums did not make use of psychedelics and (all but one group) engaged in 'possession trance' (incorporation).

Of course, there are some other examples of indigenous groups who utilise psychedelic plant shamanism in conjunction with incorporation, but these seem to be the exception rather than the rule. Besides the two already mentioned, a preliminary search of the relevant literature only reveals three more (Luke, 2014). The Yanomami of Venezuela (e.g., Jokic, 2008) who utilise 'epena' or 'yopo' snuff (usually derived from *Anadenanthera peregrina* seeds), and incorporate various hekura spirits. The second is the Mitsogho people of Gabon who utilise both iboga (*Tabernanthe iboga*) and incorporation in their rituals (Maas & Strubelt, 2003), although this is apparently reserved for female Ombwiri (or Ombudi) trance possession initiates only, who may use the iboga to assist in their vision of the healing genies (Goutarel,

Gollnhofer, & Sillans, 1993). The final group is not a traditional indigenous shamanic group but a modern religious movement that fuses the Brazilian syncretic Christian ayahuasca church, Santo Daime, with the Afro-Brazilian trance possession cult Umbanda, giving rise to a super-syncretic eclectic new religious practice called Umbandaime (Dawson, 2012), which utilises incorporation within ayahuasca use.

One theory put forward for the apparent preference for 'magical flight' over incorporation among shamans (Eliade, 1972) is that shamanism is not about relinquishing control to the spirits but about controlling them so they can do one's bidding (McKenna, 1992). Indeed, in the case of the Akawaio and Yanomami, their incorporation often involves the control of multiple spirits simultaneously rather than the simple 'one host one spirit' typical of ritual incorporation practices, and the concept of controlling spirits rather than communicating with them is key (Luke, 2014). So apparent psychedelic incorporation is not your typical mediumstic trance possession among traditional shamanic groups, and conversely the modern urban practice of Umbandaime, although having shamanic origins, is more a religious than a shamanic practice. Ultimately, this religionising of the shamanic practice of ayahuasca use along the dimension, delineated by Winkelman, arising as shamanism moves from nomadic and hunter-gatherer groups towards sedentary politically integrated 'mega-citizens' may be indicative of a prototypical supersyncretic suburban shamanism of the future (Luke, 2014).

10. Psi: Telepathy, precognition, and clairvoyance and psychokinesis

So far, the experiences discussed in this paper, with the exception of synaesthesia, have all offered anomalies not just of the rare kind, but also of the kind that might "contravene assumptions about reality" (Holt et al., 2012, p.2), especially if they are taken at face value. Nevertheless, all of these anomalous experiences have numerous problems associated with determining their fundamental reality, and debates abound, but no theories are conclusively supported. How, then, is it possible to discern the true ontological nature of these extraordinary experiences? Psi experiences (telepathy, precognition, and clairvoyance and psychokinesis) are no less controversial, perhaps more so, however, they are much more amenable to controlled scientific testing, and, even if disputed, clear interpretable scientific data can support hypotheses or not. Of course, most of those conducting psi research would say that there is good evidence for psi overall when the meta-analyses of various research strands are considered (e.g., Radin, 2006), whereas critics, who typically do not conduct such experimental work, would say that the evidence is not sufficient (e.g., French, 2010). See Krippner and Friedman (2010) for a balanced debate. In any case, the veridicality or not of psychedelic psi experiences may shed some light on the veracity of other anomalous psychedelic experiences, for if people are having genuine psi experiences on psychedelics, as shamans would claim, then some of these other anomalous experiences may also be genuine, i.e., as they appear at face value (Luke, 2011).

The following paragraphs explore the evidence for psychedelic psi, although it must be pointed out there are very few reports of psychokinesis (PK) – the direct control of matter with the mind – and virtually no experimental research, so the term psi here refers only to the receptive and informational forms – telepathy, clairvoyance and precognition – once known collectively as extrasensory perception (ESP). Unlike PK, which is reported to occur under the influence by only 22% of psychoactive drug users (Luke & Kittenis, 2005) there is ample data available to indicate that such psychedelic ESP experiences are quite prevalent. For example, the traditional divinatory and shamanic use of psychedelic plants is widely reported in the historical, anthropological, and ethnobotanical record (for a review see Luke, 2012).

Later, as these substances became discovered, invented and researched by 'Western' explorers and scientists many of them also reported psychedelic ESP experiences (e.g., Osmond, 1961; Wasson & Wasson, 1957) and prospective psychedelic users were warned they might expect such an experience (Leary, Metzner, & Alpert, 1964).

Outside of laboratory research the initial context in the developed world for using psychedelics was within psychotherapy and practically every psychedelic psychotherapist who has written about their work has reported the occurrence of ESP, and indeed other anomalous experiences, within therapy (for a review see Luke, 2012). At one time it was estimated that ESP occurs with good supporting evidence in about 2% of such therapy sessions, which is a considerably higher incidence than that reported to have occurred in non-psychedelic psychotherapy (Luke & Friedman, 2010). Among the general public, surveys consistently indicate those reporting anomalous experiences are significantly more likely to have used psychedelic substances, with more frequent use associated with a greater likelihood of an experience (Luke, 2012). Of those reporting the use of psychedelics, percentages for reported psi experiences actually occurring under the influence ranged from 18% (psi experiences on mind-expanding drugs in India; Usha & Pasricha, 1989a, 1989b) up to 83% (telepathy experiences on cannabis in 1970s California; Tart, 1993). The most common experiences were telepathy.

A consistent trend in the literature indicates that anomalous experiences tend to occur far more with psychedelics than with other psychoactive substances. In surveys the consistent correlation of psychedelic use with paranormal experiences, belief, and fearlessness tended to be either greatly reduced or reversed with respect to the non-psychedelic substances of cocaine, heroin, and alcohol, supporting the same trend in individual reports and folklore (Luke, 2012). Experiences of telepathy were most commonly associated with cannabis, and, to a lesser extent, with LSD, and particularly with MDMA, a drug which is characterized by its capacity to induce empathic experiences. Group telepathy experiences, specifically, were also consistently reported with DXM, an NMDA-antagonist like ketamine. Precognition experiences were less common and occurred with most classic psychedelics but were not particularly typical to any one substance, whereas clairvoyance, although only somewhat more common than precognition, was most likely to occur with cannabis, LSD and psilocybin (Luke & Kittenis, 2005).

Although it is recognized that subjective reports are not scientifically rigorous in establishing the veridical nature of these experiences, they enhance our understanding and offer a rich phenomenological spectrum of evidence around which to orient further research. Furthermore, the similarity in reports between those occurring spontaneously in exploratory, therapeutic, and accidental contexts and those induced intentionally in the traditional ritual context gives further credence to the shamanic use of these substances for paranormal purposes.

With regard to controlled research on the efficacy of psychedelics to induce ESP, there have been only 17 separately published experimental projects that have been conducted – primarily with LSD or psilocybin, but also with mescaline, marijuana, *Amanita muscaria,* and, recently, ayahuasca. The results of these experiments, which began in the 1950s, varied in their degree of success, most likely in relation to the methodology involved (for a review see Luke, 2012). The most successful experiments tended to utilize participants experienced with the use of psychedelics and also incorporated free-response testing procedures with open-ended mentation regarding their internal state, rather than forced-choice guessing scenarios that

tended to be repetitive and thus rather boring under the influence. In retrospect, it is easy to see how the more naïvely designed projects lost any hope of sensibly testing for anything, let alone psi, once their inexperienced participants began succumbing to the mystical rapture of their first trip.

Overall, few firm conclusions can be drawn concerning the induction of genuine psi with psychedelics because of the lack of systematically controlled experiments, although, at best, the results suggest a promising line of enquiry, which after a long hiatus is now resuming with better methodology (Luke, 2009b, 2017). Furthermore, this approach is useful for understanding the neurobiological processes that may be at work during anomalous experiences, whether they are genuinely paranormal or not.

Summary & Conclusions

While there is a basic overview available here of the induction of anomalous experiences with psychedelic substances it is clear that systematic study in this area is at a nascent stage or, as with extra-dimensional percepts, barely even started. This is somewhat unfortunate because by exploring psychedelics there may be a lot to be learned about the neurobiology involved in these various anomalous experiences, as is proposed by the DMT and ketamine models of NDE. However, one important thing seems apparent from the data, and that is that altered states of consciousness, as opposed to psychedelic chemicals *per se*, seem to be key in the induction of such experiences, at least where they are not congenital: for every experience presented here, and more, can also occur in non-psychedelic states. As such, it may well be the states produced by psychedelics and other means of inducing ASCs that are primary, not the neurochemical action. Of course all states of consciousness probably involve changes in brain chemistry, such as occurs with the simple change of CO_2 in blood induced by breathing techniques or carbogen (Meduna, 1950), but there are many states and many neurochemical pathways and yet so many of these can give rise to the same experience syndromes as described in this essay. Indeed, it should be remembered that the experiential outcome of an ASC is determined not just by substance (which could be any ASC technique) but by set and setting too (Leary, Litwin & Metzner, 1963).

Curiously, recent brain imaging research with psilocybin has demonstrated that, counter to received neuroscientific wisdom, no region of the brain was more active under the influence of this substance but several key hub regions of the cortex – the thalamus, anterior and posterior cingulate cortex (ACC & PCC), and medial prefrontal cortex (mPFC) – demonstrated *reduced* cerebral blood flow (Carhart-Harris et al., 2012). Similar findings have been demonstrated with other ASCs, such as with experienced automatic writing trance mediums (Peres et al., 2012). These findings seem to support Dietrich's (2003) proposal that all ASCs are mediated by a transient decrease in prefrontal cortex activity, and that the different induction methods – be it drugs, drumming, dreaming, dancing or diet – affect how the various prefontal neural pathways steer the experience. In this sense then, there are many mechanisms for a general altered state, in which many anomalous experiences are possible, but which ultimately have their own flavour in line with the method of induction.

These brain imaging studies and other evidence (e.g., see Kastrup, 2012; Luke, 2012), also tentatively support Aldous Huxley's (1954) extension of Henri Bergson's idea that the brain is a filter of consciousness and, according to Huxley, that psychedelics inhibit the brain's default filtering process thereby giving access to mystical and psychical states. In any case, even if specific neurobiological processes can be identified in the induction of specific

anomalous experiences, or even states, does not mean to say that a reductionist argument has prevailed, because as Huxley also stated, psychedelics are the occasion not the cause – the ontology of the ensuing experience still needs fathoming whether the neurobiological mediating factors are determined or not. Ultimately, the importance of these anomalous experiences may be determined by what we can learn about ontology, consciousness and our identity as living organisms, and by what use they may be in psychotherapy, one's own spiritual quest, and as catalysts for personal transformation and healing (Roberts & Winkelman, 2013).

References

Addy, P. H. (2010). *That deep internal voice: Controlled administration of Salvia divinorum.* Unpublished PhD thesis, Institute of Transpersonal Psychology, Palo Alto, CA.

Apelle, S., Lynn, S. J., Newman, L., & Malaktaris, A. (2014). Alien abduction experiences. In E. Cardeña, S. J. Lynn and S. Krippner (Eds.), *Varieties of Anomalous Experience: Examining the Scientific Evidence* (2nd ed.)(pp.213-240). Washington, DC: American Psychological Association.

Arthur, J. D. (2010). *Salvia divinorum: Doorway to thought-free awareness*. Rochester, VT: Park Street Press.

Barbosa, P. C. R., Giglio, J. S., and Dalgalarrondo, P. (2005). Altered states of consciousness and short-term psychological after-effects induced by the first time ritual use of ayahuasca in an urban context in Brazil. *Journal of Psychoactive Drugs,* 37 (2), 193-201.

Barker, S. A., Borjigin, J., Lomnicka, I., & Strassman, R. (2013). LC/MS/MS analysis of the endogenous dimethyltryptamine hallucinogens, their precursors, and major metabolites in rat pineal gland microdialysate. *Biomedical Chromatography, 27*, 1690–1700.

Barušs, I. (2003). *Alterations of consciousness: An empirical analysis for social scientists*. Washington, DC: American Psychological Association.

Beyer, S. V. (2009). *Singing to the plants: A guide to mestizo shamanism in the Upper Amazon*. Albuquerque, NM: University of New Mexico Press.

Billcock, V. A., & Tsou, B. H. (2012). Elementary visual hallucinations and their relationship to neural pattern formation. *Psychological Bulletin, 138*, 744-774.

Blackmore, S. J. (1982). Have you ever had an OBE: The wording of the question. *Journal of the Society for Psychical Research, 51*, 292-302.

Blackmore, S. J. (1986). Spontaneous and deliberate OBEs: A questionnaire survey. *Journal of the Society for Psychical Research, 53*, 218-224.

Blackmore, S. (1998). Abduction by aliens or sleep paralysis? *Skeptical Inquirer, 22*, 23-28.

Boddy, J. (1994). Spirit possession revisited: Beyond instrumentality. *Annual Review of Anthropology*, 23, 407-434.

Bourguignon, E. (1976). *Possession*. San Francisco, CA: Chandler & Sharp.

Bradbrook, G. (2019). Do psychedelics hold the key to social change? *Emerge* (online). http://www.whatisemerging.com/opinions/psychedelics-and-social-change

Brang, D., & Ramachandran, V. S. (2008). Psychopharmacology of synesthesia: The role of serotonin S2a receptor activation. *Medical Hypotheses, 70*, 903-904.

Braude, S. E. (2002). The problem of super-psi. In F. Steinkamp (Ed.), *Parapsychology, philosophy and the mind: Essays honouring John Beloff* (pp. 91-111). Jefferson, NC: McFarland.

Breederveld, H. (2008). Chess with the dead? [letter to the editor]. *Journal of the Society for Psychical Research, 72*, 62.

Bressloff, P. C., Cowan, J. D., Golubitsky, M., Thomas, P. J., & Wiener, M. C. (2002). What geometric hallucinations tell us about the visual cortex? *Neural Computation, 14*, 473– 491.

Bullard, T. E. (1987). *UFO abductions: The measure of a mystery*. Mount Rainier, MD: Fund for UFO Research.

Cardeña, E. (2005). The phenomenology of deep hypnosis: Quiescent and physically active. *International Journal of Clinical and Experimental Hypnosis, 53*, 37-59.

Cardeña, E., & Alvarado, C. (2014). Anomalous self and identity experiences. In E. Cardeña, S. J. Lynn and S. Krippner (Eds.), *Varieties of Anomalous Experience: Examining the Scientific Evidence* (2nd ed.)(pp.175-212). Washington, DC: American Psychological Association.

Cardeña, E., Lynn, S. J., & Krippner, S. (2014). Introduction: Anomalous experiences in perspective. In E. Cardeña, S. J. Lynn and S. Krippner (Eds.), *Varieties of Anomalous Experience: Examining the Scientific Evidence* (2nd ed.)(pp.3-20). Washington, DC: American Psychological Association.

Carhart-Harris, R. L., Erritzoe, D., Williams, T., Stone, J. M., Reed, L. J., Colasanti, A., Tyacke, R. J., …Nutt, D. J. (2012) Neural correlates of the psychedelic state as determined by fMRI studies with psilocybin. *Proceedings of the National Academy of Science, 109*, 2138– 2143.

Cheyne, J. A., Rueffer, S. D., & Newby-Clark, I. R. (1999). Hypnagogic and hypnopompic hallucinations during sleep paralysis: Neurological and cultural construction of the night-mare. *Consciousness and Cognition, 8*, 319-337.

Cohen, S. (1970). *Drugs of hallucination*. St. Albans, Herts., UK: Paladin.

Corazza, O. (2008). *Near-death experiences: Exploring the mind-body connection*. London: Routledge.

Corazza, O. (2010). Exploring space consciousness and other dissociative experiences: A Japanese perspective. *Journal of Consciousness Studies, 17*(7/8), 173-190.

Cott, C., & Rock, A. (2008). Phenomenology of *N,N*-dimethyltryptamine use: A thematic analysis. *Journal of Scientific Exploration, 22* (3), 359-370.

Cowan, J. (2013*). A model of how geometric hallucinations are generated in the brain*. Invited lecture for the Imperial College and Beckley Foundation conference on Scientific Research with Psychedelic Drugs, Imperial College, London, 12th June.

Dawson, A. (2012). Spirit possession in a new religious context: The Umbandaization of Santo Daime. *Nova Religio: The Journal of Alternative and Emergent Religions, 15*(4), 60-84.

Dean, J. G., Liu, T. L., Huff., S., Sheler, B., Barker, S., Strassman, R., Wang, M. M., & Borjigin, J. (2019). Biosynthesis of extracellular concentrations of *N,N*-dimethyltryptamine (DMT) in mammalian brain. *Scientific Reports, 9*: 9333.

DeGracia, D. J. (1995). *Do psychedelic drugs mimic awakened kundalini? Hallucinogen survey results*. Private publication. Retrieved on 09/09/13 from http://www.csp.org/practices/entheogens/docs/kundalini_survey.html

Dietrich, A. (2003). Functional neuroanatomy of altered states of consciousness: The transient hypofrontality hypothesis. *Consciousness and Cognition, 12*, 231–156.

Domino, E. F., Warner, D. S. (2010). Taming the ketamine tiger. *Anesthesiology, 113*, 678-684.

Dronfield, J. (1996.) The vision thing: Diagnosis of endogenous derivation in abstract arts. *Current Anthropology, 37*(2), 373-391.

Eisenbeiss, W., & Hassler, D. (2006). An assessment of ostensible communications with a deceased grandmaster as evidence for survival. *Journal of the Society for Psychical Research, 70*, 65-97.

Eliade, M. (1972). *Shamanism: Archaic techniques of ecstasy.* Princeton, NJ: Princeton University Press. (Originally published in French in 1951).
Ermentrout, G. B., & Cowan, J. D. (1979). A mathematical theory of visual hallucination patterns. *Biological Cybernetics, 34,* 137–150.
Evans-Wentz, W. Y. (2004). *The fairy-faith in Celtic countries.* Franklin Lakes, NJ: Career Press. (originally published in 1911).
Forstmann, M., & Sagioglou, C. (2017). Lifetime experience with (classic) psychedelics predicts pro-environmental behaviour through an increase in nature relatedness. *Journal of Psychopharmacology, 31*(8), 975-988.
Foucault, M. (2006). *History of madness* (J. Murphy & J. Khalfa, Trans.; J. Khalfa, Ed.). London: Routledge.
Fracasso, C., & Friedman, H. (2011). Near-death experiences and the possibility of disembodied consciousness: Challenges to prevailing neurobiological and psychosocial theories. *NeuroQuantology, 9,* 41-53.
French, C. C. (2010). Reflections of a (relatively) moderate skeptic. In S. Krippner and H. L. Friedman (Eds.), *Debating psychic experiences. Human potential or human illusion?* (pp.3-64). Santa Barbara, CA: Praeger.
Froese, T., Woodward, A., & Isegami, T. (2013). Turing instabilities in biology, culture, and consciousness? On the enactive origins of symbolic material culture. *Adaptive Behaviour, 21*(3), 199-214.
Gallimore, A., & Luke, D. (2015, forthcoming). DMT research from 1956 to the end of time. In D. King, D. Luke, B. Sessa, C. Adams and A. Tollen (Eds), *Neurotransmissions: Psychedelic essays from Breaking Convention II.* London: Strange Attractor Press.
Goutarel, R., Gollnhofer, O., & Sillans, R. (1993). Pharmacodynamics and therapeutic applications of iboga and ibogaine. *Psychedelic Monographs & Essays, 6*, 70-111.
Greyson, B. (2000). Near-death experiences. In E. Cardeña, S. J. Lynn, & S. Krippner (Eds.), *Varieties of anomalous experience: Examining the scientific evidence* (pp. 315-352). Washington, DC: American Psychological Association.
Greyson, B. (2014). Near-death experiences. In E. Cardeña, S. J. Lynn and S. Krippner (Eds.), *Varieties of Anomalous Experience: Examining the Scientific Evidence* (2nd ed.)(pp.333-367). Washington, DC: American Psychological Association.
Griffiths, R. R., Hurwitz, E. S., Davis, A. K., Johnson M. W., & Jesse, R. (2019). Survey of the subjective "God encounter experiences": Comparisons among naturally occurring experiences and those occasioned by classic psychedelics psilocybin, LSD, ayahuasca, or DMT. PLoS ONE, 14(4), e0214377
Griffiths, R. R., Richards, W. A., McCann, U., & Jesse, R. (2006). Psilocybin can occasion mystical-type experiences having substantial and sustained personal meaning and spiritual significance. *Psychopharmacology, 187,* 268-83.
Grinspoon, L., & Bakalar, J. (1979). *Psychedelic drugs reconsidered*. New York: Basic Books.
Grof, S. (2000). *Psychology of the future: Lessons from modern consciousness research.* Albany, NY: State University of New York Press.
Grossenbacher, P. G. (1997). Perception and sensory information in synaesthetic experience. In S. Baron-Cohen & J. E. Harrison (Eds.), *Syneaesthesia: Classic and contemporary readings* (pp. 148-172). Oxford: Blackwell.
Grosso, M. (1976). Some varieties of out-of-body experience. *Journal of American Society for Psychical Research, 70,* 179-193.
Hancock, G. (2005). *Supernatural: Meetings with the ancient teachers of mankind*. London: Century.
Hartman, A. M., & Hollister, L. E. (1963). Effect of mescaline, lysergic acid diethylamide

and psilocybin on color perception. *Psychopharmacologia, 4*, 441-451.
Harvey-Wilson, S. (2001). Shamanism and alien abductions: A comparative study. *Australian Journal of Parapsychology, 1*, 103-116.
Helmholtz, H., von, (1925). Helmholtz's treatise on physiological optics (Translated from the third German edition of *Handbuch der physiologischen optik*, by J. P.C. Southall). Washington, DC: The Optical Society of America.
Hofmann, A. (1983). *LSD my problem child: Reflections on sacred drugs, mysticism, and science*. Los Angeles: Jeremy P. Tarcher.
Holt, N. J., Simmonds-Moore, C., Luke, D., & French, C. C. (2012). *Anomalistic psychology*. Basingstoke, UK: Palgrave Macmillan.
Hubbard, E. M., Brang, D., & Ramachandran, V. S. (2011). The cross-activation theory at 10. *Journal of Neuropsychology, 5*, 152-177.
Hufford, D. J. (1982). *The terror that comes in the night*. Philadelphia, PA: University of Pennsylvania Press.
Huxley, A. (1954). *The doors of perception*. London: Chatto & Windus, Ltd.
Jacob, M. S., & Presti, D. E. (2005). Endogenous psychoactive tryptamines reconsidered: An anxiolytic role for dimethyltryptamine. *Medical Hypotheses, 64*, 930-937.
Jansen, K. L. R. (1990). Neuroscience and the near-death experience: Roles for the NMDA-PCP receptor, the sigma receptor, and the endopsychosins. *Medical Hypotheses, 31*, 25-29.
Jansen, K. L. R. (1997). Response to commentaries on "The ketamine model of the near-death experience…". *Journal of Near-Death Studies, 16*, 79-95.
Jansen, K. [L. R.] (2001). *Ketamine: Dreams and realities*. Sarasota, FL: Multidisciplinary Association for Psychedelic Studies.
Jansen, K. [L. R.] (2004). What can ketamine teach us about ordinary and altered states of consciousness? *Consciousness Research Abstracts from the Toward a Science of Consciousness Conference, Tucson, Arizona*, 90.
Jokic, Z. (2008). Yanomami shamanic initiation: The meaning of death and postmortem consciousness in transformation. *Anthropology of Consciousness, 19* (1), 33-59.
Kastrup, B. (2012). A paradigm-breaking hypothesis for solving the mind-body problem. *Paranthropology, 3* (3), 4-12.
Kent, J. L. (2010). *Psychedelic information theory*. Seattle, WA: PIT Press.
Kjellgren, A., & Norlander, T. (2000-2001). Psychedelic drugs: A study of drug-induced experiences obtained by illegal drug users in relation to Stanislav Grof's model of altered states of consciousness. *Imagination, Cognition and Personality, 20* (1), 41-57.
Klüver, H. (1926). Mescal visions and eidetic vision. *American Journal of Psychology, 37*(4), 502-515.
Kottmeyer, M. S. (1999). Graying mantis. *The REALL News* (online), 7 (5) – retrieved 17 September, 2010 from http://www.reall.org/newsletter/v07/n05/graying-mantis.html
Krippner, S., & Friedman, H. L. (Eds.) (2010). *Debating psychic experiences. Human potential or human illusion?* Santa Barbara, CA: Praeger.
Krippner, S., & Luke, D. (2009). Psychedelics and species connectedness. *Bulletin of the Multidisciplinary Association for Psychedelic Studies, 19*(1), 12-15.
Lang, A. (1893). *The secret commonwealth of elves, fauns & fairies: A study in folk-lore & psychical research*. London: David Nutt.
Leary, T. (1966). Programmed communication during experiences with DMT (dimethyltryptamine). *Psychedelic Review 8*, 83-95.
Leary, T., Litwin. G. H., & Metzner, R. (1963). Reactions to psilocybin administered in a supportive environment. *Journal of Nervous and Mental Disease, 137*, 561-573.
Leary, T., Metzner, R., & Alpert, R. (1964). *The psychedelic experience: A manual based on*

the Tibetan book of the dead. New York: University Books.
Letcher, A. (2007). Mad thoughts on mushrooms: Discourse and power in the study of psychedelic consciousness. *Anthropology of Consciousness, 18* (2), 74-98.
Lewis-Williams, J.D., & Dowson, T.A. (1988). The signs of all times: Entoptic phenomena in Upper Paleolithic art. *Current Anthropology*, 29, 201–245.
Liester, M. B. (2013). Near-death experiences and ayahuasca-induced experiences: Two unique pathways to a phenomenologically similar state of consciousness. *Journal of Transpersonal Psychology, 45*(1), 24-48.
Luke, D. (2006a). A tribute to Albert Hofmann on his 100th birthday: The mysterious discovery of LSD and the impact of psychedelics on parapsychology. *Paranormal Review, 37*, 3-8.
Luke, D. (2006b). Spirit molecule? [letter to the editor]. *Paranormal Review, 39*, 33.
Luke, D. (2008a). Disembodied eyes revisited: An investigation into the ontology of entheogenic entity encounters. *Entheogen Review: The Journal of Unauthorized Research on Visionary Plants and Drugs, 17* (1), 1-9 & 38-40.
Luke, D. P. (2008b). Inner paths to outer space: Journeys to alien worlds through psychedelics and other spiritual technologies by Rick Strassman et al. [book review]. *Journal of Scientific Exploration, 22*, 564-569.
Luke, D. (2009a). Near-death experiences: Exploring the mind-body connection, by Ornella Corazza [book review]. *Journal of Parapsychology, 73, 175-180.*
Luke, D. P. (2009b). *Telepathine (ayahuasca) and psychic ability: Field research in South America.* Paper presented to Transpersonal Psychology Section of the British Psychological Society, 13th Annual Conference, Scarborough.
Luke. D. P. (2010). Rock art or Rorschach: Is there more to entoptics than meets the eye? *Time & Mind: The Journal of Archaeology, Consciousness and Culture,* 3 (1), 9-28.
Luke, D. (2011). Discarnate entities and dimethyltryptamine (DMT): Psychopharmacology, phenomenology and ontology. *Journal of the Society for Psychical Research, 75*, 26-42.
Luke, D. P. (2012). Psychoactive substances and paranormal phenomena: A comprehensive review. *International Journal of Transpersonal Studies, 31, 97-156.*
Luke, D. (2013a). Ecopsychology and the psychedelic experience. *European Journal of Ecopsychology, 4*, 1-8.
Luke, D. (2013b). So long as you've got your elf: Death, DMT and discarnate entities. In A. Voss and W. Rowlandson (Eds.), *Daimonic imagination: Uncanny intelligence* (pp.282-291). Cambridge: Cambridge Scholars Publishing.
Luke, D. (2014). Psychedelic possession: The growing incorporation of incorporation into ayahuasca use. In J. Hunter and D. Luke (Eds.) *Talking with the spirits: Ethnographies from between the worlds* (pp.229-254). Brisbane, Australia: Daily Grail Publishing.
Luke, D. (2017). Otherworlds: Psychedelics and exceptional human experience. London: Muswell Hill Press.
Luke, D. (2019). Eco-consciousness, species connectedness and the psychedelic experience. In J. Hunter (Ed.), Greening the paranormal: Exploring the ecology of exceptional experience (pp.181-188). London: August Night Press.
Luke, D., & Friedman, H. (2010). The neurochemistry of psi reports and associated experiences. In S. Krippner, and H. Friedman (Eds.), *Mysterious minds: The neurobiology of psychics, mediums and other extraordinary people* (pp.163-185). Westport, CT: Greenwood / Praeger.
Luke, D. P., & Kittenis, M. (2005). A preliminary survey of paranormal experiences with psychoactive drugs. *Journal of Parapsychology, 69*(2), 305-327.
Luke, D., & Spowers, R. (Eds.) (2018). *DMT dialogues: Encounters with the spirit molecule.*

Rochester, VT: Park Street Press.
Luke, D., & Terhune, D. B. (2013). The induction of synaesthesia with chemical agents: A systematic review. *Frontiers in Psychology, 4:*753.
Luke, D., Terhune, D., & Friday, R. (2012*).* Psychedelic synaesthesia: Evidence for a serotonergic role in synaesthesia*. Seeing and Perceiving, 25,* 74.
Luke, D., Timmermann, C., Kaelen, M., & Bell Langford, B. (2019). The anechoic darkroom as a psychedelic state. In N. Wyrd, D. Luke, A. Tollan, C. Adams and D. King (Eds.) *Psychedelicacies: More food for thought from Breaking Convention* (pp.185-202). London: Strange Attractor Press.
Luke, D., & Yanakieva, S. (2016, June). *The transpersonal psychedelic experience and change in ecological attitude and behaviour.* Paper presented at the International Conference on Psychedelics Research, Stichting Open, Amsterdam, 3rd-5th June.
Lyons, T., & Carhart-Harris, R. (2018). Increased nature relatedness and decreased authoritarian political views after psilocybin for treatment-resistant depression. *Journal of Psychopharmacology, 32*(7), 811-819.
McKenna, T. (1991). *The archaic revival.* San Francisco: Harper.
McKenna, T. (1992). *Food of the gods: The search for the original tree of knowledge - A radical history of plants, drugs, and human evolution*. New York: Bantum.
Maas, U., & Strubelt, S. (2003). Music in the Iboga initiation ceremony in Gabon: Polyrhythms supporting a pharmacotherapy. *Music Therapy Today (online), 4* (3).
Mack, J. E. (1999). *Passport to the cosmos: Human transformation and alien encounters*. New York: Three Rivers.
Marks, L. (2014). Synesthesia: A teeming multiplicity. In E. Cardeña, S. J. Lynn and S. Krippner (Eds.), *Varieties of Anomalous Experience: Examining the Scientific Evidence* (2nd ed.)(pp.79-108). Washington, DC: American Psychological Association.
Martial, C., Cassol, H., Charland-Verville, V., Pallavicini, C.,.. & Tagliazucchi, E. (2019). Neurochemical models of near-death experience: A large study based on the similarity of written reports. *Consciousness & Cognition, 69,* 52-69.
Meduna, L. J. (1950). The effect of carbon dioxide upon the functions of the brain. In L. J. Meduna (Ed.), *Carbon dioxide therapy*. Springfield, Illinois: Charles Thomas.
Meyer, P. (1994). Apparent communication with discarnate entities induced by dimethyltryptamine (DMT). In T. Lyttle (Ed.), *Psychedelics* (pp. 161-203). New York: Barricade Books.
Milán, E.G., Iborra, O., Hochel, M., Rodríguez Artacho, M. A., Delgado-Pastor, L. C., Salazar, E., & González-Hernández, A. (2012). Auras in mysticism and synaesthesia: A comparison. *Consciousness and Cognition, 21*(1), 258.
Moody, R. (1989). *The light beyond*. New York: Bantam.
Morse, M. L., Venecia, D., & Milstein, J. (1989). Near-death experiences: A neurophysiologic explanatory model. *Journal of Near-Death Studies, 8,* 45-53.
Neppe, V. M. (2006). A detailed analysis of an important chess game: Revisiting 'Marcóczy versus Korchnoi.' *Journal of the Society for Psychical Research, 71,* 129-147.
Osmond, H. (1961). New techniques of investigation. In Anon. (Ed.), *Proceedings of Two Conferences on Parapsychology and Pharmacology* (pp. 76-78). New York: Parapsychology Foundation.
Ott, J. (2001). Pharmanopo-psychonautics: Human intranasal, sublingual, intrarectal, pulmonary and oral pharmacology of bufotenine. *The Journal of Psychoactive Drugs, 33,* 273-281.
Palmer, J. (1979). A community mail survey of psychic experiences. *Journal of the American Society for Psychical Research, 73,* 221- 251.
Paqueron, X., Leguen, M., Rosenthal, D., Coriat, P., Willer, J. C., & Danziger, N. (2003). The

phenomenology of body image distortions induced by regional anaesthesia. *Brain, 126*, 702-712.
Parker, A. (2001). What can cognitive psychology and parapsychology tell us about near-death experiences? *Journal of the Society for Psychical Research*, *65*, 225-240.
Peres, J. F., Moreira-Almeida, A., Caixeta, L., Leao, F., Newburg, A. (2012). Neuroimaging during trance state: A contribution to the study of dissociation. *PloS ONE, 7*(11), e49360.
Peters, L., & Price-Williams, D. (1980). Toward an experiential analysis of shamanism. *American Ethnologist, 7*, 397-418.
Pickover, C. (2005). *Sex, drugs, Einstein, and elves*. Smart Publications: Petaluma, CA.
Pimm, S. L., Russell, G. J., Gittleman, J. L. Brooks, T. M. (1995). The future of biodiversity. *Science, 269*, 347-350.
Potts, M. (2012). Does N,N-dimethyltryptamine (DMT) adequately explain near-death experiences? *Journal of Near-death Studies, 31*(1), 3-23.
Radin, D. (2006) *Entangled Minds: Extrasensory Experiences in a Quantum Reality*, Pocket Books, New York.
Ring, K. (1980). *Life at death*. New York: Coward, McCann & Geoghegan.
Ring, K. (1989). Near-death and UFO encounters as shamanic initiations: Some conceptual and evolutionary implications. *ReVision, 11* (3), 14-22.
Ring, K. (1992). *The Omega Project: Near-death experiences, UFO encounters and mind at large*. New York: William Morrow & Co.
Ring, K., & Cooper, S. (2008). *Mindsight: Near-death and out-of-body experiences in the blind* (2nd ed.). New York: iUniverse.
Roberts, T. B., & Winkelman, M. J. (2013). Psychedelic induced transpersonal experiences, therapies, and their implications for transpersonal psychology. In H. L. Friedman and G. Hartelius (Eds.), *The Wiley-Blackwell handbook of transpersonal psychology* (pp.459-479). Hoboken, NJ: John Wiley and Sons.
Rodriguez, M. A. (2007). A methodology for studying various interpretations of the *N,N*-dimethyltryptamine-induced alternate reality. *Journal of Scientific Exploration, 21*(1), 67-84.
Rogo, D. S. (1984). Ketamine and the near-death experience. *Anabiosis: The Journal of Near-Death Studies, 4*, 87-96.
Roney-Dougal, S. (2001). *Walking between the worlds: Links between psi, psychedelics, shamanism, and psychosis*. Unpublished manuscript, Psi Research Centre, Glastonbury, UK.
Sai-Halász, A., Brunecker, G., & Szára, S. (1958). Dimethyltryptamine: a new psycho-active drug. *Psychiatria et neurologia, 135***,** 285-301 (unpublished 1960 English translation by W. H. Everhardy and edited in 2011 by S. Szára, pp.1-13).
Satori (2003). *Golden salamanders*. Retrieved on 9th June, 2009 from http://www.erowid.org/experiences/exp.php?ID=24260
Schultes, R. E., & Hofmann, A. (1992). *Plants of the Gods: Their sacred, healing, and hallucinogenic powers*. Rochester, VT: Healing Arts Press.
Scotto (2000). *A very intense education*. Retrieved on 9th June, 2009 from http://www.erowid.org/experiences/exp.php?ID=1767
Severi, B. (2003). Sciamani e psichedelia. [Shamans and psychedelics]. *Quaderni de Parapsychologia, 34*, 36.
Shanon, B. (2002). *The antipodes of the mind: Charting the phenomena of the ayahuasca experience*. Oxford: Oxford University Press.
Sherwood, S. (2002). Relationship between the hypnogogic/hypnopompic states and reports of anomalous experiences. *Journal of Parapsychology, 66*, 127-150.

Shulgin, A. T, & Shulgin, A. (1997). *TIHKAL: The continuation*. Berkeley, CA: Transform Press.
Simner, J., & Bain, A. E. (2013). A longitudinal study of grapheme-color synesthesia in childhood: 6/7 years to 10/11 years. *Frontiers in Human Neuroscience. 7*:603.
Simner, J., Mulvenna, C., Sagiv, N., Tsakanikos, E., Witherby, S. A., Fraser, C., Scott, K., & Ward, J. (2006). Synaesthesia: The prevalence of atypical cross-modal experiences. *Perception, 35*, 1024-1033.
Simpson, L., & McKellar, P. (1955). Types of synaesthesia. *Journal of Mental Science*, 101, 141-147.
Smythies, J.R. (1956). *Analysis of perception*. London: Routledge and Kegan Paul.
Smythies, J. R. (2011). Ketamine, Bergson and NDEs. *Journal of the Society for Psychical Research, 75*, 148-150.
Strassman, R. (2001). *DMT: The spirit molecule: A doctor's revolutionary research into the biology of near-death and mystical experiences*. Rochesta, VT: Park Street Press.
Strassman, R. (2008). The varieties of the DMT experience. In R. Strassman, S. Wojtowicz, L.E. Luna and E. Frecska, *Inner paths to outer space: Journeys to alien worlds through psychedelics and other spiritual technologies* (pp.51-80). Rochester, VT: Park Street Press.
Strieber, W. (1987). *Communion: A true story*. New York: Avon Books.
Studerus, E. (2013). *Psilocybin-induced altered states of consciousness: Tolerability, assessment, and prediction.* Saarbrücken, Germany: Südwestdeutscher Verlag für Hochschulschriften.
Tart, C. (1971). *On being stoned: A psychological study of marijuana intoxication*. Palo Alto, CA: Science and Behavior Books.
Tart, C. T. (1993). Marijuana intoxication, psi, and spiritual experiences. *The Journal of the American Society for Psychical Research, 87*, 149-170.
Terhune, D. B., Luke, D. P., & Cohen Kadosh, R. (2017). The induction of synaesthesia in non-synaesthetes. In O. Deroy (Ed.), *Sensory blending: On synaesthesia and related phenomena* (pp.215-247). Oxford: Oxford University Press.
Terhune, D. B., Luke, D. P., Kaelen, M., Bolstridge, M., Feilding, A., Nutt, D., Carhart-Harris, R., Ward, J. (2016). A placebo-controlled investigation of synaesthesia-like experiences under LSD. *Neuropsychologia, 88,* 28-34.
Thomas, S. (2004). Agmatine and near-death experiences. Retrieved November 25, 2005, from http://www.neurotransmitter.net/neardeath.html
Timmermann, C., Roseman, L., Williams, L., Eritzoe.,.. & Carhart-Harris, R. (2018). DMT models the near-death experience. *Frontiers in Psychology, 9*:1424.
Torres, C. M., & Repke, D. B. (2006). *Anadenanthera: Visionary plant of ancient South America*. New York: Haworth Herbal Press.
Turner, D. M. (1995). Exploring hyperspace. *Entheogen Review: The Journal of Unauthorized Research on Visionary Plants and Drugs, 4*(4), 4-6.
Usha, S., & Pasricha, S. (1989a). Claims of paranormal experiences: I. Survey of psi and psi-related experiences. *Journal of the National Institute of Mental Health and Neurosciences (India), 7* (2), 143-150.
Usha, S., & Pasricha, S. (1989b). Claims of paranormal experiences: II. Attitudes toward psychical research and factors associated with psi and psi-related experiences. *Journal of the National Institute of Mental Health and Neurosciences (India), 7* (2), 151-157.
Vallee, J. (1969). *Passport to Magonia*. Chicago: Henry Regnery Company.
Wasson, R. G., & Wasson, V. P. (1957). *Mushrooms, Russia, and history* (2 vols.). New York: Pantheon.
White, R. A., & Brown, S. V. (1997). Classes of EEs/EHEs. In R. A. White (Ed.),

Exceptional human experience: Background papers II (pp. 43-45). New Bern, NC: EHE Network.

Wilkins, L. K., Girard, T. A., & Cheyne, J. A. (2011). Ketamine as a primary predictor of out-of-body experiences associated with multiple substance use. *Consciousness and Cognition, 20*, 943-950.

Winkelman, M. (1990). Shaman and other "magico-religious" healers: A cross-cultural study of their origins, nature and social transformations. *Ethos, 18*(3), 308-352.

Yanakieva, S., Luke, D.P., Jansari, A., & Terhune, D. T. (2019). Acquired synaesthesia following 2C-B use. *Psychopharmacology, 236*, 2287-2289.