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This is your brain on death: a comparative analysis of a near-death experience and subsequent 5-Methoxy-DMT experience


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Introduction: Much research has focused on the modeling of the near-death experience (NDE) by classical and atypical psychedelics; however, to date, no study has reported on the relationship between the NDE and the experience induced by the highly potent, endogenous psychedelic drug 5-Methoxy-DMT (5MeO-DMT). This article presents a case study of an individual who is popularly documented to have had a profound near-death experience while in a coma caused by bacterial meningoencephalitis. Additionally, the individual also subsequently underwent an experience with 5MeO-DMT.

Methods: A semi-structured interview was conducted with the subject concerning his experiences with both the NDE and 5MeO-DMT. A basic thematic analysis was performed on both the original text describing the NDE as well as the interview itself, which mainly focused on the subject's experience with 5MeO-DMT. This analysis was organized to identify both the similar and different emergent themes between the two states, with a particular emphasis on the subject's perceptions of the similarities and differences between the experiences.

Results: There is a very high level of comparability between the original NDE and psychedelic experiences in general, including shared characteristics such as entering other worlds, meeting menacing or benevolent entities, experiencing synesthesia, perinatal regression, and lucid dreamlike properties. Much comparability was also identified with the 5MeO-DMT experience, in particular the major mystical experiential domains, such as ego dissolution, but especially transcendence of time and space. However, there were also a few unique themes (life review, the deceased, and the threshold) that emerged

in the NDE that were not present in the 5MeO-DMT experience or other psychedelic experience studies, suggesting that these themes may be more unique to the NDE.

Discussion: c. However, the study also explored the possibility that the unique etiology of the participant's NDE, bacterial meningoencephalitis affecting the neocortex, may have triggered similar downstream neural activity as that initiated by psychedelic agents through pyramidal neuronal activation. This hypothesis is presented with appropriate caveats and acknowledged as speculative.

Introduction

The case study presented in this article focuses on a 54-year-old Caucasian man from North America, who is popularly recognized (Alexander, 2012) and clinically documented (Khanna et al., 2018) for having had a near-death experience (NDE). **The subject originally reported a score of 29 out of 32 on the Near-Death Experience Scale (NDES). The subject's NDE occurred during a 1-week coma period from 10th to 6th November 2008, caused by a high-fatality bacterial meningoencephalitis. During this time, the subject had Glasgow Coma Scale scores ranging from 6 to 11 (<9 = deep coma; further clinical details are reported in the study by Khanna et al. (2018). This article provides a systematic and comparative qualitative analysis of his NDE and subsequent experience with 5-methoxy-*N,N*-dimethyltryptamine (5-MeO-DMT), a potent endogenous psychedelic drug**. While the primary focus was on the potential of this substance as a model of the NDE, this analysis also considers its possible role in inducing the NDR.

5-MeO-DMT

5-MeO-DMT (hereafter called 5MeO) is a fast-acting indoleamine that has the greatest affinity for the 5HT-1A site; it is found in the *yopo* snuff, which is derived from the Anadenanthera bean of the Amazonian basin and contains other compounds such as *N,N*-DMT and bufotenin. This drug is also present in the bufotoxin of the Bufo Alvarius toad found in the Sonoran desert (alongside bufotenin). **In total, 15 studies have putatively identified the presence of 5-MeO-DMT in the urine, blood, and cerebrospinal fluid (CSF) in a subset of human subjects (Ermakova, 2023), and Smythies et al. (1979) and Corbett et al. (1978) detected it in CSF using more reliable GC-MS methods. In addition, Szabo et al. (2014) found that treatment of inflamed dendritic cells with 5 MeO resulted in suppression of pro-inflammatory cytokines and inflammatory T cell production, and elevated anti-inflammatory cytokines. Although the physiological roles of the substance are not yet known, these findings are suggestive of endogenous functions and clinical potential, at least in immunomodulation.**

Recent studies have indicated that 5-MeO-DMT has the acute effect of reliably inducing mystical-type experiences and may have therapeutic applications that are highly comparable to the NDE. In fact, vaporized butotoxin, which contains 5-MeO-DMT, has been shown to induce "complete" mystical experiences in over 75% of individuals who use it. The intensity of these experiences is equivalent to reports of high-dose psilocybin use (Barsuglia et al., 2018a). Such mystical experiences from synthetic 5MeO, as well as the enduring effects of meaningfulness, spirituality and wellbeing, are also found to be significantly

higher when conducted within a safe and supportive structured setting (Sepeda et al., 2019). This is echoed by the use of "benefit enhancement" strategies elevating acute mystical experiences and long-term sense of personal meaning and spiritual significance (Lancelotta and Davis, 2020).

Studies conducted in naturalistic settings across Europe have demonstrated improvements in life satisfaction, depression, and anxiety after individuals experienced 5MeO. These improvements were typically sustained for up to 4 weeks, most of which were found to be positively correlated with the level of ego dissolution experienced during the 5MeO experience (Uthaug et al., 2019). In this study, affect and non-judgement improved for at least 1 week after the experience and were positively correlated with the quality of the psychedelic experience. Moreover, salivary levels of cortisol and pro-inflammatory IL-6 were reduced after the experience (Uthaug et al., 2020). ***Furthermore, an online survey of users who used 5-MeO-DMT in structured group settings found that improvements in depression and anxiety were associated with a greater reported sense of enduring meaningfulness and spirituality (Davis et al., 2019). A case study on the enhancement in mood and cessation of alcohol use after 5MeO administration (albeit subsequent to Ibogaine administration) in an individual with alcohol abuse has also been reported (Barsuglia et al., 2018a) Here, these changes were associated with increased perfusion via PET imaging in brain regions related to substance disorders and classical psychedelic action (such as the caudate, putamen, insula, cerebellum, and temporo-occipital areas). Treatment of inflamed dendritic cells with 5 MeO suppressed pro-inflammatory cytokines and inflammatory T cell production and elevated anti-inflammatory cytokines (Szabo et al., 2014). Ermakova et al. (2022) produced a recent narrative review of research with 5-MeO-DMT, whereas Reckweg et al. (2022) reviewed the pharmacology, subjective effects, and therapeutic promise of the substance, including the three completed and eight ongoing clinical trials. **The single published Phase 1 trial by Reckweg et al. (2021) identified significant increases after dose escalation from 2 to 18 mg 5-MeO-DMT in peak and mystical experiences, albeit seemingly without alteration in cognition and wellbeing.**

The rationale for the study

The pharmacologically analogous *N,N*-DMT (hereafter, DMT) experience has been rigorously associated with the NDE (Timmermann et al., 2018), as have many other classical or atypical psychedelics (ketamine: Corazza, 2008; Martial et al., 2019). Prior analyses of the DMT experience from a field study have referenced comparability with the NDE (Michael et al., 2021, 2023) and systematically compared the qualitative content of the DMT experience and the NDE [Michael et al., (in submission)]. However, no prior studies have examined the relationship between the 5-MeO-DMT experience and the NDE. The present article, therefore, aims to be the first to assess the convergence or divergence between 5-MeO-DMT and the NDE via comparative qualitative analyses, primarily psychometric analysis. They also discussed how this relates to the link between DMT and the NDE and which substance may simulate the experiential features of the NDE more closely. **Other than Grof's (1994) report finding high comparability between LSD and a subsequent NDE, no other study has systematically reported on persons experiencing both a classical psychedelic and a near-death experience, as well as their personal reflections of comparability.**

Methods

Recruitment

The first author of the present case study met the participant after their presentation at an academic conference (Beyond the Brain, 2018) and was informed of the participant's experience with 5-MeO-DMT. Upon asking if he was interested in taking part in a planned study to investigate the experiences of those with both near-death experiences and DMT or analogous experiences, he requested that this author contact his personal secretary. Participant information and a consent form were sent to the individual, and after acceptance, a video call was scheduled to conduct the interview.

Procedure

A semi-structured interview was conducted with the participant to discuss the nature of his 5-MeO-DMT experiences and their comparability to his initial NDE. The interview took place on 13th November 2019, which was 22 months after the participant's psychedelic experience.

The interview duration was 1 h and 21 min. Interview questions commenced with "*Please describe in as much detail as possible your experience with 5-MeO-DMT*," with subsequent probing questions including, for instance, "*Was there any kind of sensorial or visual experiential structure as well [in your 5-MeO]?*" "*Can I ask for an elaboration of what you refer to as the 'counterfactual'...?*" "*I [also] wonder what your comments would be in terms of the threshold of no return that comes up with NDEs?*" A more comprehensive list of questions can be found in the Supplementary material.

The interviewee reported having three experiences with venom from the Sonoran Desert Toad that were administered via a glass pipe. **The doses escalated over time, with the experience deemed by him to be "the most significant" being focused on during the interview. The interviewee also reported experiencing highly "similar but more powerful effects at (sic) higher dose." The date of this chosen experience was 21st January 2018, and the dose was 46 mg. The setting was described as "In a comfortable private home setting with close friends."**

Analysis

A thematic analysis (Braun and Clarke, 2006) was performed on the published NDE account, as reported by the participant in a popular book (Alexander, 2012), as well as on the novel interview focusing on the latter 5-MeO-DMT experience. This was conducted using Microsoft Word, entailing the listing of many specific codes, which were subsequently collated into broader final theme headings, with this process being completed first with the NDE and then with the 5-MeO-DMT experience. The analysis was inductive, deriving themes purely from transcript data. Finally, identifications of each theme's presence in either one of the experiences or both lead to their final categorization as either similar or different.***nu

The participant was also asked to provide an indication on a given scale of how similar the experiences appeared, and the NDE Scale (Greyson, 1983) was also administered, with the participant answering regarding his experience with 5MeO

and, separately, his near-death experience. This quantitative add-on enabled the provision of a structured comparison of the generic, phenomenological structure as a complement to the richer qualitative analyses.

Ethics

The present study, including the interview with the participant who experienced the NDE, was approved by the University of Greenwich Research Ethics Committee (Ref. 18.5.5.17).

Results

Qualitative analysis

This analysis section is divided first into similar and later into different sets of emergent themes between the experiences, where every theme is accompanied by exemplary quotes from both the NDE and 5MeO (inclusions of “(?)” within quoted excerpts denote the partial audibility of the previous word). A diagrammatic summary of the themes extant in both states and their overlap is given in Figure 1. Importantly, given the unique ability of the experiment to comment from a first-person perspective on both states, their personal perceptions regarding similarities and differences are diffusely expressed. Finally, narrative commentary regarding the experiences is also integrated throughout (mainly in the section pertaining to *differences*, comparing given NDE excerpts to psychedelic phenomenology). In the continuation of the qualitative analysis, after the quantitative description, this commentary eventually encompasses other possible, not necessarily mutually exclusive, mechanisms of this and other NDEs. A particular focus on the said mechanisms will help the present study take a more neurophenomenological orientation, examining how the unique etiology of this case and potentially similar cases may mirror and produce comparable effects to how psychedelics dysregulate higher cortical networks and may, as such, echo the neural and computational action of psychedelics.

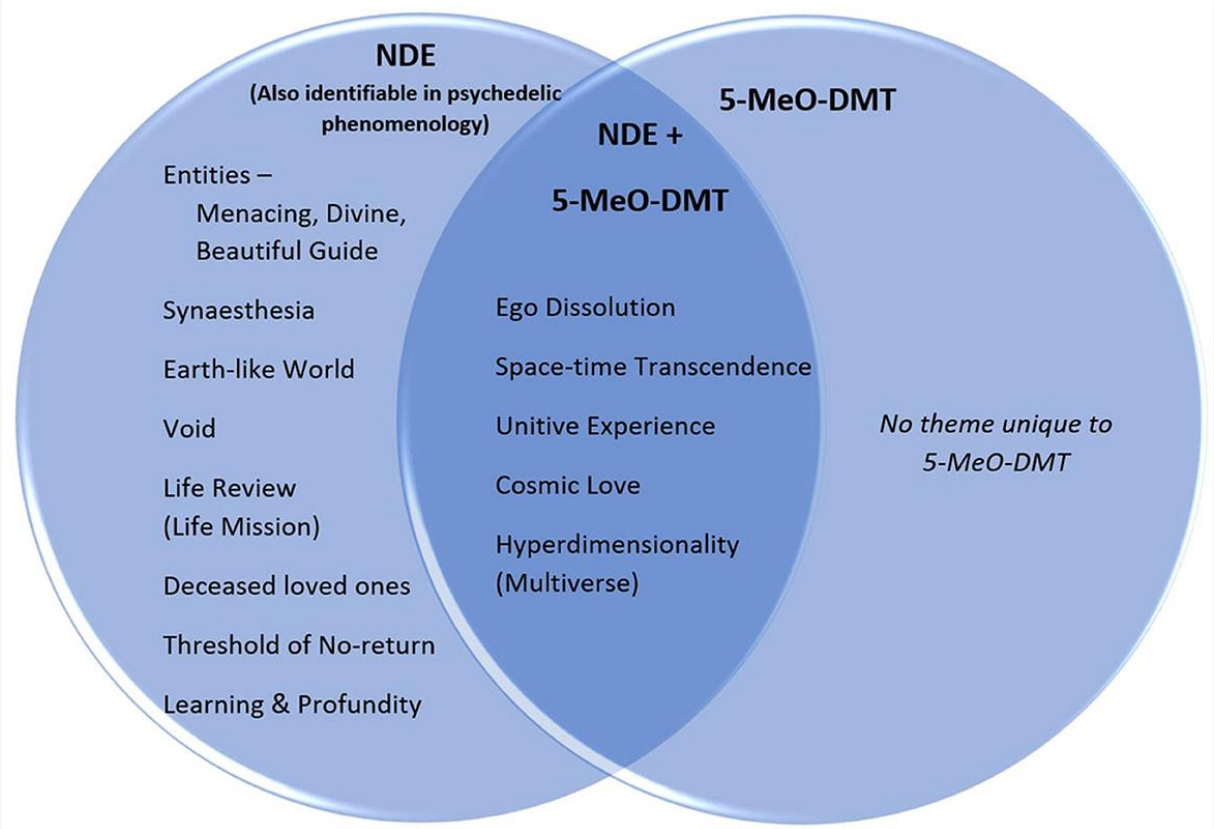

Figure 1. Themes present in either the near-death experience, or 5-MeO-DMT experience reported by *Nikoli*, or their overlap. All features of 5-MeO-DMT experience also present in NDE experience.

Similarities

Ego dissolution

Near-death experience—Original text (hereafter, "NDE")

Early in his NDE report, *Nikoli* recounts that his state of consciousness "was without memory or identity—like a dream… [I] was a lone point of awareness." Later, he explains

"I had no real center of consciousness. I didn't know who or what I was or even *if* I was. I was simply… there, a singular awareness in the midst of a soupy, dark, muddy nothingness… most [other NDErs] remembered their earthly identities while away from their earthly forms… They were aware that their living relatives were still [on earth]… met friends and relatives who had died before them… Many… have reported engaging in life reviews… I experienced none of these events… How could I… not realize that on earth I was a doctor, husband and father?... I was in a position similar to that of someone with partial but beneficial amnesia. That is, a person who has forgotten some key aspect about him or herself, but who benefits from having forgotten it… It allowed me to go deep… without having to worry about what I was leaving behind… I had come from nowhere and had no history, so I fully accepted my circumstances… And because I so completely forgot my mortal identity, I was granted full access to the true cosmic being I really am (and we all are)."

What is articulated throughout here as "partial but beneficial amnesia" is virtually identical to what is referred to in the psychedelic sphere as "ego death." That is, the annihilation, though temporary, of the sense of one's individuated self and all of its concomitant autobiographical memories often gives rise to an experience of being a "cosmic being." The benefits of this are made abundantly clear by the great number of publications on the psychedelic-induced mystical experience, with the dissolution of ego as a key dimension and being the primary predictor of therapeutic or other advantageous effects (e.g., Griffiths et al., 2008; Barsuglia et al., 2018b; Haijen et al., 2018; Roseman et al., 2018; Kettner et al., 2019).

5MeO experience—Interview, including comparison (hereafter, "5MeO")
Nikoli describes that in his NDE, particularly in the context of comparing its *similarity* with the 5MeO episode, "my ego-mind was gone… [only] that inner observer, the neutral observer… the voice in your head, our little ego-mind, is not who we are and is not our consciousness… [it] is little more than a parlor trick, pay it no mind… that awareness within…is the part of us which expands tremendously when liberated from the shackles of brain and body at physical death."

Time or space-time transcendence
Despite the significant similarities in terms of time transcendence in the excerpts below, there is a dissimilarity in that we see the description of "geometric patterns," further qualified as transforming, evolving, and inter-locking, as well as an emphasis on the mechanistic details of how time works, which were characteristic of his 5MeO experience and *not* the NDE:

NDE
"I (whatever "I" was) had always been there and would always continue to be."

"…the vagaries of time in these worlds beyond… continued to hold… ponder how time lays itself out in dreams… "before" or "after" become tricky designations. You can be in one part of a dream and know what's coming, even if you haven't experienced it yet."

5MeO
"…the 5MeO was [more] profoundly, richly imbued with the witnessing of the interleaving of time and space and how they're really one. And this incredible… seeing [of] the interleaving, it was almost like you could see all the various elements of space time and all the possible permutations, and they simply seemed to come into a locking fashion. I could watch the whole thing evolve… I could really see those geometric patterns that included what I call *counterfactuals*, in other words the possibilities that were there for a choice but that my will as a higher soul rejected. But I could still see them, I could see the possibilities… pathways of actualities."

"…you could basically see cause and effect over time and across space, but you can see them all 'at once'. In many ways its reminiscent of… [the] life review situation [which, strictly, *Nikoli's* NDE did not include]… It's showing us our notion of the linear flow of time in these bodies in 4D space-time is in so many ways fabricated, it's there as a narrative to lay down a pathway that sets a stage for us to face life's circumstances… and for me the 5MeO gave me a glimpse of how all of that works. It was like having a microscope in my [NDE's] *Core* realm journey and being able to

look at why things appeared the way they did in my NDE, and see the mechanism of it. And the mechanism wasn't as apparent during the NDE, just all of the lessons, all the flow, the relationships, the big picture was very clear. But if anything, the 5MeO, what it gave me in addition is that ability to witness that interleaving—like all of these very fancy tiles that would come together and self-form each other in this evolving set of patterns… it was much more micro-focused on the interleaving of time and space."

Indeed, complex fractal imagery in flux, providing an apparent window into the mechanics of the universe, is a classic feature of psychedelic phenomenology, especially in the case of *N,N*-DMT (Michael et al., 2021). However, his NDE account does report other stereotypical psychedelic visual motifs, as he and a guide "were riding along together on an intricately patterned surface, alive with indescribable and living colors—the wing of a butterfly… all of the [butterflies] together…were a river of life and color moving through the air."***nu

Nikoli then elaborates on this overlap in the experience of time, referring to its implications in his NDE for reincarnation:

"[The realm in the NDE] with earth-like features but also deep spiritual features, had also what I call 'deep time'… [this] has to do with the much bigger ordering of progression of our souls and evolution of all consciousness, and that's what's occurring in that level, that *Gateway* valley… an ordering of things like reincarnation, where we improve ourselves with every incarnation, going through the life review, then planning the next set of challenges for the next incarnation."

"It was a very visual experience, the way I saw it deep in coma… it was a tapestry, and the word that comes to mind is Indra's net. But it was this beautiful tapestry of interwoven silver and golden fibers that represented lifelines of higher soul journeys. And I saw this rich interweaving in life reviews and how that was part of the metallic garnishing at the highest points of those peaks of the weaving of those life reviews. Another way it was presented to me was this absolutely glorious… flying vision, and I could see the fish down under water, that was our material realm, going under the illusion of 4D and Earth time, and then popping up out of the waters when our higher soul leaves the body, reunites with higher souls up in the air above the water, all in this much greater illumination of what's going on, and trading of information—then *boom*, diving back into the water again for the next incarnation."

Although the 5Meo experience featured geometric arrays of time space that were absent in the NDE, the NDE still included clear visual representations of lifelines, which were described as "tapestry-like" and composed of fibers of light. Moreover, while visually symbolic imagery such as the flying-fish metaphor was absent in the 5MeO experience, the NDE featured archetypal symbolism, such as the lifelines, that is characteristic of deep psychedelic journeys.

Unitive experience

The picture he offers below of his NDE is heavily redolent of an *in-utero* regressive experience, discussed directly in the below segment on potential mechanisms:

NDE

“…there was no difference between “me” and the… half-familiar element that surrounded me. But this… boundary less immersion gave way to… feeling like I was… trapped in it.”

Nevertheless, he expounds on this to evoke a profound unitive experience and realizations as to the deeply intertwined nature of things, which he expresses to be a fundamental reflection of his 5MeO experience:

“Everything was distinct, yet everything was also a part of everything else, like the rich and intermingled designs on a Persian carpet [again, evoking the ‘tapestry' not unlike the geometry of the 5MeO, or psychedelic experiences generally]… The world of time and space in which we move… is tightly and intricately meshed within these higher worlds… all worlds are part of the same overarching divine Reality. From those higher worlds one could access any time or place in our world.”

5MeO

“…the 5MeO, if I had to put it on a scale, was much more aligned with the deepest aspects of the NDE in terms of the oneness… [It was] a very strong…unification, the oneness of dualism… the [5MeO] DMT certainly had the quality of bringing those dualities together, so you realize they're just a spectrum, and the polarizations in essence didn't exist in their own right.”

He continues:

“*…the Core realm [of the NDE], its oneness, the origin of all experience and the cross-over of the awareness of the universe and the universe itself—to me in all of my psychedelic experiences… the thing that most matches up with that is the 5MeO* [Italics mine].”

However, *Nikoli* caveats this primary parallel with a difference in degree: “[The 5MeO was] like looking through a little peephole, as opposed to being full-bore swimming and being immersed in the Pacific ocean of being completely into that oneness experience [of the NDE].”

The following excerpt about his NDE demonstrates the concept of “anthogenesis” (generating the divine within), in which one experiences an equivalence between their own consciousness and that of the divine, where “entheogen” is technically another denotation for psychedelic medicines, which *Nikoli* states is tantamount to love itself:

“Oneness with God, in that *Core* realm, my awareness, higher soul experience, was one of becoming identical with that God force, in terms of creative possibilities… conscious awareness at its root is that God force, that so many experience in an NDE as a force of pure love and pure wholeness and healing.”

Cosmic love

This love, of more divine quality, is also extended to an encounter *Nikoli* shares with a girl whom he does not recognize:

NDE

“She looked at me… It was not a romantic look. It was not a look of friendship. It was… somehow beyond… all the different types of love we have down on earth. It was something higher, holding all these other kinds of love within itself.”

He goes on to elaborate on his encounter with her in one realm, then with an orb, identifying it as the same girl, in yet another realm in which “Om,” the Source of all things, resided. The primacy of love was once again a core communication:

“Through the Orb, Om told me that there is not one universe but many—in fact, more than I could conceive—but that love lay at the center of them all… in the larger picture love was overwhelmingly dominant, and it would ultimately be triumphant.”

“If I had to boil [the message] down further, to just one word, it would (of course) be, simply: *Love*. In its purest and most powerful form, this love is… *unconditional*. This is the reality of realities, the incomprehensibly glorious truth of truths that lives and breathes at the core of everything that exists.”

Nikoli explicitly points out the consistency between NDEs and psychedelics in general in the following quote in terms of the profound love that can be felt, which is itself inextricably intertwined with the sense of unity discussed above (and in the final quote). Interestingly, however, one difference he alludes to here is that the NDE appears more personal, illustrating the content of one's life (such as via the review), compared to the 5MeO, which may have been more transpersonal, conveying the mechanisms transcending immanent reality:

5MeO
“…one [can] witness the bigger picture [in] an NDE [vs 5MeO]; how one's life had unfolded and feel the emotional power of one's actions and thoughts on others because that's another hallmark of the life review… you experience it more from the emotional viewpoint of those around you… And that's why the life review is so important for course-correction between lives—you're more treating the golden rule as it's meant to be part of the rule of the universe, to treat others with love. *And the one thing NDErs see and is certainly common in psychedelic experiences, is that sense of love and connectedness, and we start to feel intimately part of each other. To me that's an important lesson from NDEs that also comes into this world via many psychedelic experience* [Italics added].”

We receive glimpses in this final one of themes to be expounded on below; those of hyperdimensionality, as well as experiences of light, a sense of being taught, and a communicating guide. The latter three do not seem to be particularly inherent, the guide especially so, to the 5MeO trip (albeit these are certainly well-known to occur in the psychedelic space):

“…becoming one with that love force, and kind of leaving all the dualities behind, that was that *Core* realm… in that core realm I had that *Oversphere*, this higher-dimensional multiverse as a kind of teaching tool, and this sense of this brilliant light brighter than a million stars, and an interpreter or a translator, and then all of this happening in an infinite realm that was overflowing with unconditional love. Again that's something… I think people can get through… the psychedelic experience, this more loving and connectedness.”

Hyperdimensionality, multiverse

In the 5-MeO, as we see in the following, we not only comparably gleam a sense of universal plurality as in the NDE, but also the shared themes of unity, as well as receiving teachings from and about the cosmos:

NDE
“I saw the abundance of life throughout the countless universes, including some whose intelligence was advanced far beyond that of humanity. I saw there are countless higher dimensions.”

5MeO
“…our minds can simultaneously experience much bigger swathes of time and space. It points to my NDE, the entire higher dimensional multiverse throughout infinite dimensional space in all of eternity and infinity, was this tiny little *Oversphere*, there as an instructive tool in the setting of pure oneness with the divine.”

Also identified as consistent between the two states was the professing of ineffability.

Differences

The following excerpts for each theme are either singularly from *Nikoli's* NDE report (appearing in roughly chronological order) or from the interview comparing the NDE to his 5MeO experience. Therefore, they are not directly contrasted as above, as they do not have counterparts in the other experience. Every theme heading here highlights the theme's presence in the *near-death experience* rather than in the 5MeO experience, illustrating the apparent differences between the two. However, references to other *N,N*-DMT experiences or other relevant literature are made to demonstrate the potential for the quoted near-death content to still be present in the realm of psychedelic phenomenology, even if not specifically in the context of 5MeO experiences.

Menacing entities (only in NDE, as with all the following headings)
Certain encounters with entities of a more hostile disposition were reported in his NDE rather than the 5MeO experience (as with all the following themes in this section):

“Grotesque animal faces bubbled up out of the muck, groaned… rhythmic chants… terrifying and weirdly familiar… The more I began to feel like a ‘me'… the more the faces… became ugly and threatening… movement around me became less visual and more tactile, as if reptilian, wormlike creatures were crowding past.”

In a detailed content analysis of the *N,N*-DMT experience from an observational field study, Michael et al. (2021) discovered that 8% of the 36 participants reported encountering “fearsome” beings, and another 8% reported encountering reptilian entities. Participant *LR*, specifically, reported a tactile-visual experience of “cosmic centipede”-like creatures “crawling around” him.

Synesthesia
Experiences that reflected the blending of the normally separate sensory modalities were a vivid element of *Nikoli's* NDE (also evocative of the sense of unity):

“It radiated fine filaments of white-gold light… the darkness around me began to splinter… I heard… a living sound, like the richest, most complex, most beautiful piece of music.”

“…flocks of transparent orbs … a glorious chant, came down from… the winged beings… The sound was palpable and almost material, like a rain that you can feel on your skin… Seeing and hearing were not separate… I could hear the visual beauty of the silvery bodies of those scintillating beings above, and I could see the surging, joyful perfection of what they sang… you could not look or listen to anything in this world without becoming a part of it.”

The description of synesthetic, scintillating orbs is remarkably similar to Kastrup's experience in an “altered state” (which, though not explicitly divulged, is classically DMT-esque and reminiscent of McKenna's lectures on DMT), as quoted in Kripal (2020). Katrup reported experiencing a “geometric world which expresses information through Christmas ball-like globes, or ‘Kandinsky scintilla' (referring to the abstract artist Kandinsky, who was known to be synesthetic). Synesthesia, particularly audio-visual, has also recently been shown to be very common with psychedelics, especially LSD (Luke et al., 2022).”

Divine being

In this study, we observed a highly synesthetic quality that seemed to bind together visual, tactile, auditory, and emotional components. Additionally, the text also conveyed a sense of the “omnipresence” of a powerful being, as well as some instances of “telepathic communication:”

“A divine breeze… shifting the world around me into an even higher octave, a higher vibration… I began wordlessly putting questions to this wind—and to the divine being I sensed at work behind or within it… the answer came instantly in an explosion of light, color, love and beauty that blew through me like a crashing wave… They answered [me], but in way that bypassed language… I was able to instantly and effortlessly understand.”

These features were also identified in 14% (synesthesia) and 36% (omnipresence) of Michael et al.'s (2021) DMT interviews from the aforementioned naturalistic study.

Earth-like world

The other world that *Nikoli* entered during his NDE elicited imagery of a utopian and arcadian earth:

“Below me there was countryside. It was green, lush… It was earth… but at the same time it wasn't… I was flying, passing over trees and fields, streams and waterfalls, and… people… children, too, laughing and playing… [They] sang and danced… I'd see a dog running and jumping among them… They wore simple yet beautiful clothes… the colors… had the same kind of living warmth as the trees and flowers.”

Michael et al.'s (2021) study found that 11% of DMT participants described “natural landscapes,” which were often described as “earthly yet divinized mirror-images of the earth” (Shushan, 2018). The participants' *EM* and *RH*, in particular, described the landscapes as “just like one of those… ancient Babylonian gardens” and “a garden of

extraordinary beauty." Furthermore, as with *Nikoli*, they also expressed an animistic and life-infused quality to the physical environment.

Beautiful guide

We will revisit an encounter with the girl in the NDE, who manifested in the form of an orb and provided support to *Nikoli* during his journey, emitting a loving energy:

"Someone was next to me: a beautiful girl with high cheek-bones and deep blue eyes… The girl's outfit… had the same overwhelming, super-vivid aliveness… Without using any words, she spoke to me [again, conveying telepathic communication]… and I instantly understood that it was true… The message had three parts: "You are loved and cherished, dearly, forever. You have nothing to fear. There is nothing you can do wrong."

"I had the Orb as my companion… [which] was a kind of "interpreter" between me and this extraordinary presence surrounding me… the Orb [who in fact was (the girl on the butterfly-wing)] was guiding me."

"…the "voice" of this Being was warm and… personal… It knew me deeply, and overflowed with… compassion, pathos… even irony and humor."

Similarly, the majority of the beings encountered in Michael et al.'s (2021) report were also "enchanting" (56%), often "benevolent" (28%), and a major role served was also as a "guide" (14%). The function of these entities as "teachers" (25%), who were also "familiar" (28%), is similarly echoed in *Nikoli's* portrayal of his companion.

Void

An emergence into a space that seemed at once like an abyssal emptiness and yet suffused with nurturing light eventually occurred:

"…an immense void, completely dark, infinite in size, yet also infinitely comforting. Pitch black as it was, it was also brimming over with light… "Om" was the sound I remembered hearing associated with that omnipotent, omniscient and unconditionally loving God."

Moreover, at least 14% of Michael et al.'s (2021) accounts mention such a "void"-like environment as this. More saliently, though, in another series of experiments involving both DMT and NDEs [Michael et al. (in review)]. This "Dazzling Dark" environment is mentioned in *Nikoli's* book description; it is a term originally used by Wren Lewis (1995) to describe his own NDE in awakening from "a vast blackness that was somehow radiant, a kind of infinitely concentrated aliveness or pure consciousness." It is closely reminiscent of *DA's* change experience (*N,N*-DMT mixed with MAOI-containing herbs): "everything went black, but still shimmering and vibrating… this sensation that I was in space… yet at the same time that it was the same thing as the white light."

Life review (life mission), deceased loved ones

An evaluation of one's life, as described in *Nikoli*'s NDE, is here connected to the moment of meeting deceased loved ones, which highlights the importance of relationships. These themes are not typically reported as being intrinsic to psychedelic experiences, according to Nikoli:

“…encountering souls of departed loved ones or profound life reviews where you realize the life review's really not about you but about your inter-relationships with others—those are the pieces that in general seem to be shallow in psychedelic drug experiences, especially the parts that line up more with one's life mission.”

Threshold of no-return
Nikoli identified what he “would call that ‘threshold' with what he ‘saw between the *Gateway* valley, which had a tremendous number of earth-like features.' also qualifying that that would be where a life review would happen, reunited with the souls of departed loves.”

Regarding these former two themes (life review and deceased), associated with the latter (threshold), the conjecture regarding their being shallow with psychedelics has been quantitatively supported. For instance, Greyson (2014) demonstrated that the features of seeing the deceased, having a life review, and coming to a border were characteristic of NDEs when compared to a measure of mystical experience. This is mirrored in Michael et al.'s (in review) finding that these same three items scored the lowest when the NDE scale was applied to DMT experiences. This, however, does not mean they are absent. For example, Michael et al. (in review) also include the life review and encountering the dead in 6% of DMT experiences each. This being so, the threshold was not exhibited in Michael et al. (in review), suggesting it as an especially unique symbol to the near-death experience, given its obvious symbolic denotation of the irreversibility of death. However, again in Michael et al.'s (in review) series of DMT & NDE experiments, *SR* reports in his change experience a “metal gate with gaps” that he was prevented from going through by a feminine entity as if signaling “you're not ready yet.”

Learning, profundity
As mentioned above, in the quote below, *Nikoli* again asserts a possible distinction between NDEs delivering more personal insights and more transpersonal content being the domain of psychedelics. Most saliently, though, *he* here alludes to the real possibility that it is the artifact of their having limited psychedelic exposure that may be the reason for opining in this way (and by extension, about other differences):

“I gave up drinking in ‘91, I'm a recovering alcoholic, the fact I was adopted so I spent a lot of my life thinking at some deep level, not consciously, that I wasn't worthy of life because my birth mother left me behind when I was 11 days old. So those deep knowings of oneness with the universe, of why that addiction would be there in the first place, all that stuff was very apparent through the wisdom of the NDE [compared to the 5MeO]… the 5MeO after my NDE… definitely taught me some interesting factors about the nature of reality, but whether they offered me any of the really deep knowledge of my personal journey, my higher soul's work with this universe, to me it's not so apparent. *Maybe if I had a more dedicated programme and I continued using them, then that would be one thing* [Italics mine].”

This idea of making these distinctions, such as revelations into one's personal tribulations, being related to limited awareness of psychedelics is especially born out in his seemingly not being cognizant of psychedelics' therapeutic effectivity in trauma and addiction. Specifically, research suggests this is not only due to neurobiological interactions but also subjective experiences, such as insights and life reviews (Schenberg et al., 2017; Wolff et al., 2019; Davis et al., 2021).

Also identified as inconsistent between the experiences was the special emphasis on hyper-reality in the NDE. However, this is an almost ubiquitous appraisal of the DMT space.

Descriptive quantitative analysis

To quantify the comparability of the participant's subjective appraisal of the two states, *Nikoli*'s response to the following two questions suggested *low* similarity, underscoring the many qualitative differences explored above. However, this is despite the profound convergences observed in several domains:

i) How similar was your 5MeO-DMT and near-death experience? (1 = completely different; 10 = identical).
Answer: 2.
ii) What is the extent of your belief (if any) in the production/occasioning of your NDE being due to endogenous psychedelic-like brain chemicals, such as 5MeO-DMT (1 = absolutely impossible; 10 = absolutely definite).
Answer: 2.

From Figure 2, it can be seen that the NDE was rated highest for virtually all scale items (resulting in a total of 31/32), excluding the “threshold of no return,” which was only present to a certain degree. The psychedelic experience from the 5MeO-DMT, however, was rated substantially lower on almost all features (scoring only 9/32 in total). The emergence into some other realm and distortion in time were scored maximally, with separating from the body and the only other clearly mystical feature of peace/joy being also partially present (along with enhancements in thoughts and senses). In short, it might be concluded, though from this singular case study, that the 5MeO state is only a poor model for the NDE;it simulates it in only a small cluster of mostly shallow ways.

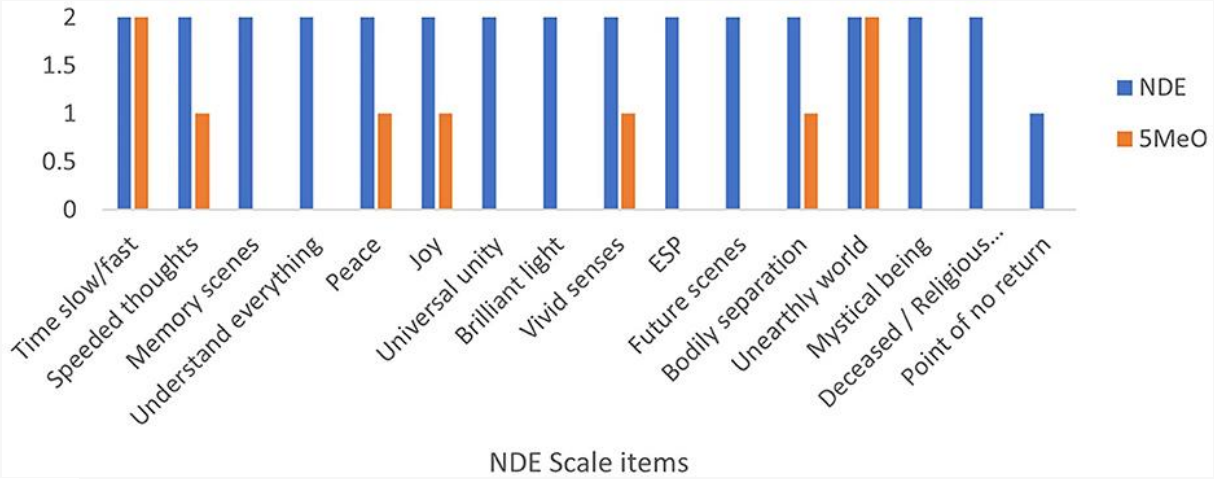

Figure 2. Scores from the near-death experience scale compared between the 5MeO-DMT and near-death experience.

These psychometric results align somewhat with the wealth of interview data examined above, such as the elaborate descriptions of the transcendence of time taking place within a space entirely distinct from waking reality and with an emotional valence of apparently total positivity transpiring in both of the two states. However, from the qualitative analyses, it should be readily observable that *Nikoli*'s 5MeO experience did, at least in part, also consist of a sense of receiving insights and indications of the experient's personal life trajectories, such as the “counterfactuals”

mentioned, but especially, the lack of endorsement of universal unity is disjointed with the qualitative report. While the credibility of the participant is not being questioned, these discontinuities could suggest the superiority of such in-depth semi-structured interviews in extracting richer, and thus more complete (and possibly more accurate) experiential data. Although quantitative scales can provide valuable insights, they have inherent limitations due to their allowing only fixed-answer responses with possibly ambiguous labels and descriptors. In this case, this may have incurred an over-estimation of the differences between two experiences. This, perhaps, is indicative of the strength of mixed methods results for necessary mutual complementation.

However, there are various similarities between the quantitative and qualitative results. For instance, bot reports did not mention the experiences of light and ESP, demonstrating significant convergent by feature absence. However, the NDE included evidence of other beings or religious/deceased spirits, while the 5MeO experience did not. These divergences may represent the most robust differences between the two states, and after accounting for possible discrepancies in quantitative scoring, they may be considered the most important distinguishing features. When considering such findings in the context of the literature, the experience of brilliant light is often strongly associated with the 5MeO experience, although it was not found (during scoring or interview) in the present study. The lack of other presences during the 5MeO experience, however, is particularly well-substantiated by existing extant data, as the phenomenology of this psychedelic is typically characterized by a non-dual and “contentless” nature, which differs from entity encounters classically transpiring during NDEs, where meetings with the dead are one of the commonest features (Charland-Verville et al., 2014).

Qualitative analysis continued: potential mechanisms

The following analysis uses quotes from both the NDE account and the subsequent interview to explore potential mechanisms for the emergence of certain aspects of *Nikoli's*, as well as other individuals' NDEs.

Psychedelics, lucid dreaming, and mind-manifestation

While the focus of this article is on evaluating the 5MeO drug experience, particularly as a useful model for NDEs, the term “psychedelic” refers to the act of “manifesting of the mind.” Sensory experiences are determined by both psychical content and the dissolution of boundaries between one's outer phenomenal world and inner experience, and this highlights the relevance of dreaming in relation to NDEs. On two occasions, *Nikoli* has already compared his NDE to a dream; however, it is especially pertinent to consider lucid dreaming, wherein the dreamer is not only aware that he is dreaming but can manipulate their mind-constructed environments. *Nikoli* himself is aware of the connection between this phenomenon and NDEs: “…those who've become good at lucid dreaming, that's a little more the kind of engagement you get with the universe in an NDE.” However, as you can see below, he does not comment on how his own NDE reports are compellingly resounding of lucid dreamlike behavior and could suggest shared mechanisms between the two. Importantly, the endogenous psychedelic model is not incompatible with a lucid-dream view, as indeed, serotonergic psychedelics are known to simulate lucid dream content (Sanz and Tagliazucchi, 2018):

“I felt a sense of sadness unlike any I'd ever known. Emotions are different up there… deeper, more spacious—they're not just inside but outside as well. Imagine that every time your mood changed here on earth, the weather changed instantly… That your tears would bring on a torrential downpour, and your joy would make the clouds instantly disappear… how much more vast and consequential changes of mood feel like up there, how strangely and powerfully what we think of as “inside” and “outside” don't really exist at all. So it was that I, heartbroken, now sank into… an actual sinking.”

“I had to learn to navigate it on my own, which I did by acknowledging those musical melodies that could conjure up various portals between levels.”

“I actually had some control over my course… I was no longer trapped in this lower world. *With concerted effort, I could move back up to the higher planes…* I found myself wishing for the *Spinning Melody* to return… the gorgeous music, and the spinning ball of light emitting it, blossomed into my awareness… and I began to rise… *to know and be able to think of something is all one needs in order to move toward it…* [Italics mine] I accomplished this back-and-forth movement from the… *Earthworm's Eye-view*… to the *Gateway* and [then] to… the *Core* any number of times.”

Interestingly, the “spinning melody” in *Nikoli's* experience, which involved a highly synesthetic orchestration of both sound and light that he used to “move” between realms, has similarities to the experiences of those with depression who have reported experiencing “up-lifting,” healing, and novel music in their lucid dreams (Sackwild and Stumbrys, 2021).

Perinatal regression

The reactivation of pre-, post-natal, or *in-utero* memories has been proposed by Grof (1985, 2019) as a framework for certain psychedelic experiences, including the “basic perinatal matrices” 1–4, which have also been theorized as a model for NDE production. The following several excerpts are not only exceptionally uncanny in terms of their evocation of the experience from the perspective of a fetus but are explicitly articulated using such perinatal terminology, yet this possible explanation is not mentioned. Therefore, the endogenous psychedelic model and a perinatal regression explanation for NDEs are not mutually exclusive, as both can be conducive to such regressions:

In his NDE, *Nikoli* first found himself in an “underworld,” which he later characterizes as the “Earthworm's Eye-view,” composed of “visible darkness… Transparent… blurry, claustrophobic, suffocating.” A “deep, rhythmic pounding” also accompanied him, which was “*like a heart-beat…* as if a giant, subterranean blacksmith is pounding an anvil.” This space was primitive in nature, “*as if I had regressed back to…the very beginnings of life*.” He also recalls “conceptualizing that I might or might not survive.” Eventually he witnesses something “like roots, and *a little like blood-vessels in a vast, muddy womb*. Glowing a dark, dirty red… in a timeless red-brown sea” [Italics added].

After his synesthetic-like scene of emerging into light, which dispelled the dark (accompanied by otherworldly music), *Nikoli* recounts a classic NDE sequence that largely inspired the perinatal model of NDEs, with the sound and transportation being especially DMT-esque: “An opening. I was no longer looking at the slowly spinning

light at all, but through it… I began to move up. Fast. There was a whooshing sound, and in a flash I went through the opening and found myself in a completely new world. The strangest, and most beautiful world I'd ever seen. Brilliant, vibrant, ecstatic, stunning… *I felt like I was being born. Not reborn, or born again. Just… born"* [Italics added].

After elucidating his *Core* experience, encompassing darkness suffused with light, he continues: "My situation was…*akin to that of a fetus in a womb… with the silent partner of a placenta, which nourishes it and mediates its relationship to the everywhere present, yet… invisible mother* [Italics added]. In this case, the "mother" was God, the Creator, the Source… This Being was so close, there seemed to be no difference at all between God and myself."

Similarly, the following two excerpts illustrate what could be interpreted as a *shamanic rebirth* (Winkelman, 2002, 2010) or the *Deus Ex Machina* (an ancient motif displaying divine salvation or supernatural rescue):

In this initial primitive world, *Nikoli* becomes aware of a smell, "like feces, a little like blood, and a little like vomit… of biological death," then reports that suddenly something emerges from the dark and that he would "never be able to… come anywhere close to describing how beautiful [this entity] was." Incidentally, St John (2015) expands on contemporary and aboriginal Australian experiences of DMT often plunging the experiencer into such grotesque, blood/vomit/skeleton permeated landscapes in such a context as the "shamanic ordeal."

The following rebirth imagery, especially, is also entangled with the above lucid dream model, where deliberate attention or intention may drive a significant shift in (seemingly) external experience:

"I would fall and tumble out of that sanctum sanctorum, that *Core* realm of pure oneness with the divine back down to the *Earthworm's Eye-view*, and it was only by remembering the musical notes of the *Melody* that I could then conjure up the portals that… enabled me to re-ascend… into that *Gateway* valley… and then witnessing those angelic choirs above… served as a portal to higher levels."

Cortical disinhibition and the anarchic brain

The below excerpts from the subject exemplify that their view on the NDE's potential induction via such endogenous chemicals is not purely predicated on the similarities of their phenomenology, but upon more subjective opining on the available neuroscience, leading to discussions of philosophy of mind. Finally, a more nuanced, novel neural approach is taken in the analysis, but with certain caveats which themselves then provoke the resurfacing of the challenges of the origin of consciousness.

"[The neocortex] is a (sic) 6 layered system, and even disrupting the superficial two layers is enough to destroy the functional integrity of the system because the superficial layers are very important at (sic) the integration across the neocortex. The deeper [subcortical] structures are more about relationships between that part of the neocortex, the thalamus and [themselves]."

This former statement points to the inherent lateral interwiring within the columnar architecture of the neocortex, where significant damage to the surface laminae

interrupts the functioning of the lower ones. The latter comment implies that if indeed these neocortical laminae are more fully disrupted, this itself prevents the full functioning of the subcortical areas (e.g., the thalamus and the basal ganglia), given their reliance on the relationship with the neocortex. These sentiments are repeated in an appendix to *Nikoli*'s original documentation of his NDE. If this is accurate, which may be signified by the excessive meningeal enhancement (inflammation) and sulci obscuration by purulent (puss-filled) CSF, as well as pin-point and unresponsive pupils suggesting brainstem damage (Khanna et al., 2018). Then, this presents a challenge to any sufficient neural explanatory framework. Given the lack of detailed and direct enough data to confirm this, however, other models, such as that delineated at length later in this section or psychedelic action on the cortico-striatal-thalamic-cortical loops (Vollenweider and Smallridge, 2022), involving higher-order reception, such as frontal, instead allow fuller expression in lower-order systems.

“The important thing to keep in mind here is as a materialist neurosurgeon like I was before my coma, you have a certain set of assumptions [which]… can be your undoing… as if the brain creates consciousness. Whereas, if you simply move away from that one step and say, well the brain's not creating consciousness, but it is serving as a filter, it is limiting primordial consciousness and allowing it to express in a here and a now and sense of self… consciousness is something that exists, and what we're looking at is mechanisms to detach it from the here and now, and what I would say is a much more fundamental way to detach your consciousness from the here and now has to do with manipulations at that *lower brainstem level*… And when we do things up in the neocortex say with serotonin 2A interactive drugs, then we're altering the filter function, and it's been known for ages that altering the filter can alter the residual ‘what we experience as consciousness.' But in many ways we're talking about traversing the veil and getting to consciousness on the other side of that filtering mechanism [i.e., the brain].”

In such contemplation, the participant appears to express a non-materialist perspective. That is, such damage to his neocortex allowed a total detachment of his consciousness to experience, which greatly expanded awareness in a way that is comparable to agonism at the serotonin (5HT) 2A cortical receptors, which also results in a similar reversal of the filtration of mind and where an interruption at the more basic brainstem level instead represents (somehow) a yet even more efficient mode of achieving this (presumably where total brainstem disruption, i.e., brain death, is the most fundamental liberation). This brings up a diametric opposition of ontologies, yet it is predicated on the same neuroscientific matter of neural mechanisms, i.e., higher cortical or 5HT-2A-mediated disinhibition of mental content. That is, *Nikoli*'s own view is equivalent to a transcendentalist “transmission” theory of the brain in which consciousness is filtered from a non-material source, and the alternative is the conventional model in which consciousness is filtered while still being intrinsically brain-generated.

In this frame, what could amount to a debate on the “hard problem” of consciousness, i.e., from *where* does consciousness originate, either the brain itself or another undefined trans-material source, would arise if not for a slightly more nuanced appraisal of the neural mechanisms. Generally, any disruption of the filtering mechanisms leads to, and any resultant “heightened consciousness” is a derivative of, the *disinhibition* of deeper, normally constrained neural networks. More specifically, the “anarchic brain” or REBUS (Relaxed Beliefs under Psychedelics) model (Carhart-Harris and Friston, 2019) attempts to unify the entropic brain theory

based on psychedelic neuroscience (Carhart-Harris et al., 2014; Carhart-Harris, 2018) and the free energy principle based on the brain as a predictive processor. The model clarifies that when psychedelics agonize the layer 5 pyramidal neurons' 5HT-2A receptors, the brain undergoes a disintegration of the Default Mode Network (DMN), which is itself a higher-cortical connector hub, thus leading to a release of lower, which is otherwise inhibited circuits, as well as the desegregation of otherwise disconnected non-local networks. Computationally, such higher-level cortical tissues encode top-down "priors," representing prior knowledge of the world as learned through developmental history and generating the brain's internal model of the environment. These priors serve to inhibit bottom-up, incoming sensory data in the case where the generative model is consistent with such extrinsic information. Where these sources are incongruent, the bottom-up data represent "errors," which are not inhibited and serve to update the internal model. Under 5HT-2A agonism, like psychedelics, however, the respective weighting between these top-down and bottom-up signals is fundamentally disrupted, and the brain is less capable of predicting or explaining the cause of one's immediate experience, and so the error signals, tantamount to raw sensory information, flood one's consciousness. As such, Huxley's "reducing valve" of the nervous system is reversed, and the "mind at large" is liberated.

In this way, if certain manifest overlaps with the NDE and the 5MeO or other psychedelic experiences do not directly argue for the release of such neurochemicals, alternative triggers that converge on the same or similar ultimate neural mechanism are still entirely possible. One novel conclusion of this study points to the unique etiology of conditions such as meningoencephalitis of the higher laminae of the neocortex, possibly constituting such a convergent mechanism. That is, in effect, it may simulate similar downstream neural activity as that underpinning classical serotonergic psychedelics' neural mechanism of action. As such, the top-down cortical disinhibition of major high-level cortical nodes in the psychedelic instance, triggered by 5HT-2A agonism of layer 5 pyramidal cells, and in the meningoencephalitis case, triggered by damage to neocortical laminae including such a layer, would lead to the release of bottom-up intrinsic cortical/subcortical information, thereby "passing up" the neural hierarchy and finally converging on a massive expansion of conscious experience. Alternatively expressed, top-layer impairments in the cortical hierarchy interrupt their capacity to construct and downwardly transmit accurate predictions, thus amounting to failures in predicting and suppressing error signals (sensory input). This then enables the errors' unrestrained propagation up the hierarchy and increases sensitivity to extrinsic or intrinsic informational input. The cortex's natural response here to minimize the errors via updating the generative world model becomes futile, instead leading to a more entropic neural and fluid phenomenal state, which is precisely like the worlds inhabited by those after ingesting psychedelic substances (moreover, in reference to *Nikoli's* preference for brainstem manipulation for such consciousness expansion, theoretically, stimulation at such deeper sites as the brainstem could mimic any intrinsic activity release from otherwise inhibitive higher, inhibiting cortices).

This type of model, where impairment of more evolutionarily recent cortices results in an (initially counter-intuitive) elevation in conscious experience, echoes similar reports in the literature. This includes the finding that those with traumatic brain injury with lesions specific to the middle-superior temporal, but especially the dorsolateral prefrontal cortex, scored significantly higher than controls on mysticism measures, underscoring the causal role of executive regions in downregulating mystical

experience (Cristofori et al., 2016). Additionally, resection during brain tumor surgery of the inferior posterior parietal lobes (constituting the lateral node of the DMN), including the inferior parietal lobule (left hemisphere) and the angular gyrus (right hemisphere), increased the reporting of self-transcendence, involving constructs such as unity, space, and timelessness (Urgesi et al., 2010). This is also consistent with the widely popularized case of Bolte-Taylor's "stroke of insight," where an infarction disabling much of her left hemisphere (normally exerting a dominant inhibitory effect on the right) leads to a profound mystical experience of selfless unity (Taylor, 2009). Similarly, many reports of acquired savant syndrome, wherein after traumatic brain injury or dementias (e.g., frontotemporal), some individuals present with specially developed cognitive or artistic capacities, are likely also relatable to the disinhibition of lower-level structures due to the inactivation of higher, inhibitive zones such as the prefrontal cortex (Takahata and Kato, 2008). This itself is equally compatible with the predictive coding frame, where such disinhibition is equivalent to disrupted high-level predictions, leading to increased sensory data/error (Gallimore, *personal communication, 1st March 2022*). Such studies also highlight that the encephalitis of this case is only one of these other exemplary conditions in which the above disinhibition processes occur and, similarly, that these processes may be a core undergirding mechanism for NDEs caused by brain trauma (e.g., Hou et al., 2013) and virtually all other NDEs whose aitiology eventually converges on neural anoxia; hence, the near-universality of phenomenological features across NDEs.

However, this proposition, as applied to the case of *Nikoli*'s NDE, is not without its caveats, such as the possibility of at least some component of the neocortex still being necessary for the reception of any released intrinsic activity, as well as that pointed out by *Nikoli* that even superficial damage to the top-most neocortical laminae may undermine their entire functional integrity. As the neocortical damage in this case appears highly diffuse and non-selective, there may not be the necessary preservation of minimal neocortical function for the construction and experience of any type of inner world (Gallimore, *personal communication, 1st March 2022*). This possibility, compounded by the fact that any deeper subcortical zones, despite their preservation, are not computationally sufficient to account for the patently exceedingly elaborate phenomenology of the present NDE, makes for a notable challenge for a fully explanatory, neurally mechanistic model. While other authors (Khanna et al., 2018; Greyson, 2021) have argued that the damning medical data, such as the *structural* CT scan report, is sufficient to claim the inadequacy of the brain to drive this particular NDE, the glaring lack of any *functional* imaging tools (EEG/PET/fMRI) employed during *Nikoli*'s hospital stay precludes the full legitimacy of this statement (Michael, 2021).

Other neural mechanisms

Further to the putative neural contributions to the near-death experience, not noted in previous reports on this participant's NDE (e.g., Khanna et al., 2018), is the possible role of the seizure with which the patient first presented upon entry into the emergency room. All of the complex partial, absence, and generalized effects demonstrated by the present case have been shown by Danielson et al. (2011) to co-occur with significant reductions in the activity and functioning of the default mode network (DMN) via discharges that result in the inhibition of arousal-promoting nuclei that otherwise help to drive the DMN. The disintegration of the DMN and concomitant network desegregation under the influence of psychedelics, as discussed above, are

considered to be the primary functional connectivity changes undergirding the drugs' psychoactive profile, with initial evidence for this in the form of reduced oxygen perfusion in the DMN under psilocybin (Carhart-Harris et al., 2012). As such, in line with the present analysis' argument for the substantial phenomenological resonances between the NDE and 5MeO and other psychedelic states, although no direct evidence has been provided for similar alterations in DMN activity during near-death, it is highly plausible due to the said resonances. The generalized seizure, presented by *Nikoli* at the very onset of his meningoencephalitis illness, may feasibly be yet another key neurobiological correlate, for he subsequently reported an NDE. The fact that such epileptic activity may be highly associated with NDE-like states is suggested by an overlap between ictal and NDE (Blackmore, 1998; Hoepner et al., 2013; Greyson et al., 2014) or other mystical phenomenology (Coles, 2013; King et al., 2019) and the physiology of seizure, especially temporal activity, being linked to reporting NDEs (Britton and Bootzin, 2004) or other florid dreamlike states (Carhart-Harris, 2007).

However, his NDE has been “placed” instead on hospital days 1–5 when GCS scores indicated a deep coma, ranging from 6 to 7, as he accurately reported “bedside visits from non-family members from an out-of-body perspective.” However, this is not entirely logical, as this perceptual report can only temporally situate the out-of-body perceptions of his physical surroundings, which may be entirely dislocated from his wider NDE; indeed, this is suggested by his not reporting an out-of-body experience (OBE) at the onset of his NDE, which is otherwise characteristic of most NDEs (Charland-Verville et al., 2014). As such, the NDE could have occurred in a less compromised brain state. Nevertheless, the reporting of such anomalous phenomena as these reputedly veridical OBEs as part of his NDE account, which also includes an alleged “peak in Darien” experience, in which he encountered a presence he only subsequently identified as an unknown deceased family member, gestures toward parapsychological events that are not accommodated by the present neural models and so also toward the need for further investigations of such challenging features (beyond the scope of the present article).

Additionally, the emphases placed by *Nikoli* on so-called “counterfactuals,” which occurred mainly in his NDE but also in the 5MeO trip, where he reported witnessing a vast tapestry representing alternative life trajectories, including future pathways such as those based on a range of prior decisions, may also have some neurobiological explanation. Van Hoeck et al. (2013) reported that compared to the episodic memory of the negative past and the imagining of positive future events, counterfactual cognition (constructing different and better future outcomes from past events) was associated with more extensive activation of the medial temporal lobe (e.g., core memory circuits), the medial prefrontal cortex (e.g., theory of mind), as well as additional recruitment of the bilateral inferior parietal lobes, which include the angular gyrus (e.g., body schema, attention, declarative memory, and language). The latter two regions, incidentally, directly overlap with the nodes of the DMN, and the former is intrinsically associated. The precise mechanisms underlying *Nikoli's* subjective visualization of the said counterfactuals, in the highly intricate form described, cannot be readily accounted for. However, the above-delineated neuroimaging data, compounded by the quintessential effects of psychedelics being to “reveal the mind,” can provide a working framework. An analogy to this may be the kaleidoscopic hallucinatory displays, which are a product of occipital disinhibition, in which you are “basically seeing your own visual architecture” (Cowan, 2013).

Discussion

Core comparability resides in mystical experience

Taken together, various similarities can be observed between the participant's original, naturally occurring NDE and the psychoactive experience elicited by 5MeO-DMT, such as ego dissolution, unitive experience, cosmic love, ineffability, and most evidentially from the above analysis, transcendence of time and space, especially the experience of “counterfactuals” (linear time transforming into an expanded view of alternate life trajectories), by which hyperdimensionality may also be encompassed. This suggests that NDE and 5MeO share commonalities in the domains of the mystical experience, particularly in five of its categorized dimensions (with cosmic love resonating with the “bliss” factor (MacLean et al., 2012).

Similarly, while numerous themes of *Nikoli's* NDE were identified as being different from his own 5MeO experience, they are still either characteristic of, or sufficiently common in, other psychedelic experiences, especially *N,N*-DMT, and some were also reported with 5MeO, including the void or profound learning. These themes include encounters with divine or menacing beings, otherworldly experiences often resembling earth, voids, synesthesia, life reviews, encounters with deceased loved ones, thresholds, and learning.

Elaboration on responses by previous authors

Considering this, Harris (2014)—prior to *Nikoli*'s experimentation with 5-MeO-DMT—represents a previous comparison of the subjects' NDE with an analogous DMT state. He details a similar argument that the imagery in his original NDE report, contrary to *Nikoli's* protestation of it “not being in the same ballpark” of a psychedelic experience, is “the stitching on the same ball” and perfectly reproducible by an *N,N*-DMT trip. Although, to be more nuanced, as indicated by the present analysis, the more dualistic (*I-It*) experiences surrounding *Nikoli*'s *Gateway* realm are more inducible via such DMT trips. However, the special evocation of the NDE by his 5MeO experience, i.e., the profound mystical and non-dual (*I-thou*) dimensions, especially in the *Core* realm, may suggest that endogenous 5MeO could contribute specifically to these subjective motifs, leading to a model in which different endogenous chemicals have differential contributions to separate phenomenological domains.

Harris (2014) also made an important observation that, though *Nikoli* states in his book that loss of cortical activity is “clear from critical global involvement documented by CT scans,” activity can only be appropriately determined by functional vs. structural imaging (Michael, 2021). However, he also cites that 50–70% of cortical activity remains in comatose patients, where although half of the normative cortical activity may remain, it is crucially the processes of network co-activation, complexity, and information integration that are largely considered pivotal for the sustaining of consciousness (Seth et al., 2011), which may well have been insufficiently maintained given the encephalitic damage. Despite this, such functional data is not available, and in light of the hypotheses speculated in the *Anarchic Brain* segment above, the reduction of high-level networks may indeed elevate such lower hierarchical entropy and integration, in turn mediating high-intensity conscious experience, as seen under psychedelics (Carhart-Harris and Friston, 2019). Moreover, in countering *Nikoli*'s argument that the cortex is what is assumed to be

requisite for consciousness, and yet he was disabled during his NDE, Harris reminds us that “no one thinks that consciousness is just a matter of the cortex;” however, the “content” of consciousness, such as the baroque, multisensorial, and narrativized NDE *Nikoli* reports, is considered to rest upon cortical integrity, while “wakefulness” itself is mediated by the brainstem nuclei (Martial et al., 2020).

Returning to Harris's (2014) appraisal, his point that endogenous DMT requires only a few minutes of brain activity to engender an “eternal experience” is salient and especially pertinent because the fact that anybody remembers their NDE necessarily suggests that neural structures are required for short-term memory formation and long-term consolidation. Presumably, the structures that are active during retrieval that mirror the original structures active at encoding must have been at least sufficiently functional during the critical period for the subsequent re-recruitment of those same memory traces during recall. This presents a significant challenge to any notion of non-local consciousness during the NDE, given the problem of a lack of encoding substrates despite eventual retrieval, supporting the “shut down” or “reboot” timing for the experience.

Proposed mechanistic models

Even while accepting these striking similarities, this in itself does not immediately justify a model in which the dying brain produces endogenous psychedelics (which 5-MeO-DMT and *N,N*-DMT both are), thus accounting for the phenomenological overlay. As discussed above, phenomenology also remarkably echoes lucid dreams as well as perinatal regression (where the latter mirrors only certain features, such as primitivity, boundarylessness, and rebirth). All the psychedelic, dream, and perinatal perspectives, however, are not mutually exclusive, given psychedelics and lucid dreams' ability to partially reproduce each other and psychedelics' induction of perinatal experience.

Importantly, however, while the initial triggers may all be independent, the end-point neural mechanisms may be highly similar between each of them. This is especially concerning the already elaborated concept that endo-psychedelics need not be implicated in the near-death state, or in this case, a meningoencephalitis-induced coma, as they may both converge on the down-stream mechanism of a release of suppressed, intrinsic bottom-up information.

However, it should be noted that there are caveats to this theory, as a sufficiently intact neocortex may still be required to process the released data and preserve the function of deep-brain subcortical regions.

Psychedelic experiential repertoire

Despite the similarities in phenomenology, the participant was insistent that his NDE and psychedelic experiences were insufficiently similar, and thus, endogenous psychedelics did not play a role in the induction of his NDE. This is reflected in his very low quantitative appraisal of 2/10 for both similarity and likely psychedelic induction. This opinion may be in part due to the lack of adequate personal experience of, as well as overall familiarity with, psychedelics (*Nikoli* himself admits only one other less significant experience with *N,N*-DMT and some lower-dose LSD and mescaline trips in his adolescence). Thus, he may be less equipped to draw the extant and extensive parallels in the same way that the subculture of the psychedelic

community *is*, which has developed a nuanced vocabulary to parse these transcendent states.

Implications for consciousness

Ultimately, despite this novel neural model of the neocortical damage simulating the expanded consciousness resulting from psychedelic action, this is not necessarily incongruent with a transcendentalist interpretation of this striking near-death experience. This is a “neurological” conception (Strassman, 2014), which is consistent with the transmission theory of the brain and consciousness and may be complemented by another more nuanced neurobiological perspective. While this proposed model does constrain the need to invoke some trans-material source of consciousness, the “hard problem” remains, given the apparent gap between the physical substrate, even the computational mechanisms of the brain and subjective awareness. However, the free energy principle attempts to bridge this gap (Solms, 2021), for instance, via the predictive processing of interoceptive input (Solms and Friston, 2018), which is not necessarily reliant on cortical but deep brainstem mechanisms regulating affective states, where the modeling of “feeling” may instead be pivotal for engendering conscious experience. Many other theories of consciousness applied to psychedelic action also approach the closing of this gap, such as cortico-thalamo-cortical loops (Preller et al., 2019) and cortico-claustrum connectivity (Stiefel et al., 2014; Barrett et al., 2020). However, this is critiqued as helping to explain only the contents (the “easy problem”) vs. the appearance of phenomenal consciousness (Yaden et al., 2021).

Limitations

Finally, one limitation of the present study is that the participant has limited prior experience with psychedelic drugs. This may have resulted in a lack of the conceptual repertoire necessary to recognize the overlap between his own and, indeed, others' NDE and 5MeO/psychedelic experiences and, therefore, the potential inducibility of NDEs by endogenous psychoactive chemicals. Importantly, this may highlight the possibility of inexperienced individuals understating the role of such chemicals in driving near-death or similar spontaneous states, which is a tendency of many authors or commentators in the field of near-death studies or its community. Future studies may thus benefit from recruiting those with a greater experiential repertoire. In spite of this limitation, the interpretations *Nikoli* provides in understating this possibility should be recognized, where he emphasizes the shallowness of his 5MeO trip compared to the profundity of his NDE. Another limitation, not unrelated, may be any ideological biases that *Nikoli* may hold that may lead him to such a conclusion. This is alluded to in many of his above statements, wherein, as a direct transformation in metaphysical beliefs after his NDE (as also identified after psychedelic experiences, Timmermann et al., 2021; Nayak and Griffiths, 2022), he eventually rejected mechanistic neuroscience in favor of a transcendentalist/post-physicalist paradigm, thereby driving a potential prejudice against a reductive account of his NDE, as implied, yet not entirely mandated, by a neuropharmacological model. These limitations are also partly a side effect of employing a single case study to delineate the psychedelic-NDE relationship, which similarly inherently limits the range of qualitative content generated, and as such, further studies are warranted of either a between-subjects comparison of the different experience types (Michael et al., in review) or within-subjects amongst those

reporting both (as herein; Michael et al., in review). The scant population, however, in this latter camp was one reason for the single case study.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by University of Greenwich Research Ethics Committee (Ref. 18.5.5.17). The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

PM: conceptualization, data curation, formal analysis, and writing the original draft. PM, DL, and OR: methodology and review and editing. DL and OR: supervision. PM and DL: funding acquisition. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1083361/full#supplementary-material

References

Alexander, E. (2012). *Proof of Heaven*. New York, NY: Simon and Schuster.

Google Scholar

Barrett, F. S., Krimmel, S. R., Griffiths, R., Seminowicz, D. A., and Mathur, B. N. (2020). Psilocybin acutely alters the functional connectivity of the claustrum with brain networks that support perception, memory, and attention. *NeuroImage* 218, 116980. doi: 10.1016/j.neuroimage.2020.116980

PubMed Abstract | CrossRef Full Text | Google Scholar

Barsuglia, J., Davis, A. K., Palmer, R., Lancelotta, R., Windham-Herman, A. M., Peterson, K., et al. (2018b). Intensity of mystical experiences occasioned by 5-MeO-DMT and comparison with a prior psilocybin study. *Front. Psychol*. 9, 1–6. doi: 10.3389/fpsyg.2018.02459

PubMed Abstract | CrossRef Full Text | Google Scholar

Barsuglia, J. P., Polanco, M., Palmer, R., Malcolm, B. J., Kelmendi, B., and Calvey, T. (2018a). A case report SPECT study and theoretical rationale for the sequential administration of ibogaine and 5-MeO-DMT in the treatment of alcohol use disorder. *Progr. Brain Res*. 242, 121–158. doi: 10.1016/bs.pbr.2018.08.002

PubMed Abstract | CrossRef Full Text | Google Scholar

Blackmore, S. (1998). Experiences of anoxia: Do reflex anoxic seizures resemble near-death experiences? *J. Near-Death Stud.* 17, 120. doi: 10.17514/JNDS-1998-17-2-p111-120

CrossRef Full Text | Google Scholar

Braun, V., and Clarke, V. (2006). Using thematic analysis in psychology. *Qualit. Res. Psychol*. 3, 77–101. doi: 10.1191/1478088706qp063oa

CrossRef Full Text | Google Scholar

Britton, W. B., and Bootzin, R. R. (2004). Near-death experiences and the temporal lobe. *Psychol. Sci*. 15, 254–258. doi: 10.1111/j.0956-7976.2004.00661.x

PubMed Abstract | CrossRef Full Text | Google Scholar

Beyond the Brain conference, CentrEd, Excel, 3rd–4th Nov. London.

Carhart-Harris, R. (2007). Waves of the unconscious: The neurophysiology of dreamlike phenomena and its implications for the psychodynamic model of the mind. *Neuropsychoanalysis* 9, 183–211. doi: 10.1080/15294145.2007.10773557

CrossRef Full Text | Google Scholar

Carhart-Harris, R. L. (2018). The entropic brain—revisited. *Neuropharmacology* 142, 167–178. doi: 10.1016/j.neuropharm.2018.03.010

PubMed Abstract | CrossRef Full Text | Google Scholar

Carhart-Harris, R. L., Erritzoe, D., Williams, T., Stone, J. M., Reed, L. J., Colasanti, A., et al. (2012). Neural correlates of the psychedelic state as determined by fMRI studies with psilocybin. *Proc. Natl. Acad. Sci. U. S. A*. 109, 2138–2143. doi: 10.1073/pnas.1119598109

PubMed Abstract | CrossRef Full Text | Google Scholar

Carhart-Harris, R. L., and Friston, K. J. (2019). REBUS and the anarchic brain: Toward a unified model of the brain action of psychedelics. *Pharmacol. Rev*. 71, 316–344. doi: 10.1124/pr.118.017160

PubMed Abstract | CrossRef Full Text | Google Scholar

Carhart-Harris, R. L., Leech, R., Hellyer, P. J., Shanahan, M., Feilding, A., Tagliazucchi, E., et al. (2014). The entropic brain: A theory of conscious states informed by neuroimaging research with psychedelic drugs. *Front. Hum. Neurosci*. 8, 1–22. doi: 10.3389/fnhum.2014.00020

PubMed Abstract | CrossRef Full Text | Google Scholar

Charland-Verville, V., Jourdan, J. P., Thonnard, M., Ledoux, D., Donneau, A. F., Quertemont, E., et al. (2014). Near-death experiences in non-life-threatening events and coma of different etiologies. *Front. Hum. Neurosci*. 8, 1–8. doi: 10.3389/fnhum.2014.00203

PubMed Abstract | CrossRef Full Text | Google Scholar

Coles, A. (2013). *Temporal Lobe Epilepsy and Dostoyevsky Seizures: Neuropathology and Spirituality*. Royal College of Psychiatrists Spirituality Special Interest Group.

Google Scholar

Corazza, O. (2008). *Near-Death Experiences: Exploring the Mind-Body Connection*. London: Routledge.

Google Scholar

Corbett, L., Christian, S. T., Morin, R. D., Benington, F., and Smythies, J. R. (1978). Hallucinogenic N-methylated indolealkylamines in the cerebrospinal fluid of psychiatric and control populations. *Br. J. Psychiatry* 132, 139–144. doi: 10.1192/bjp.132.2.139

PubMed Abstract | CrossRef Full Text | Google Scholar

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

Google Scholar

Cristofori, I., Bulbulia, J., Shaver, J. H., Wilson, M., Krueger, F., and Grafman, J. (2016). Neural correlates of mystical experience. *Neuropsychologia* 80, 212–220. doi: 10.1016/j.neuropsychologia.2015.11.021

PubMed Abstract | CrossRef Full Text | Google Scholar

Danielson, N. B., Guo, J. N., and Blumenfeld, H. (2011). The default mode network and altered consciousness in epilepsy. *Behav. Neurol*. 24, 55–65. doi: 10.1155/2011/912720

PubMed Abstract | CrossRef Full Text | Google Scholar

Davis, A. K., Barrett, F. S., So, S., Gukasyan, N., Swift, T. C., and Griffiths, R. R. (2021). Development of the psychological insight questionnaire among a sample of people who have consumed psilocybin or LSD. *J. Psychopharmacol*. 2021, 269881120967878. doi: 10.1177/0269881120967878

PubMed Abstract | CrossRef Full Text | Google Scholar

Davis, A. K., So, S., Lancelotta, R., Barsuglia, J. P., and Griffiths, R. R. (2019). 5-methoxy-N,N-dimethyltryptamine (5-MeO-DMT) used in a naturalistic group setting is associated with unintended improvements in depression and anxiety. *Am. J. Drug Alcohol Abuse* 45, 161–169. doi: 10.1080/00952990.2018.1545024

PubMed Abstract | CrossRef Full Text | Google Scholar

Ermakova, A. (2023). “Naturally-occurring 5-MeO-DMT: a review of plants, animals and fungi,” in *Breaking Convention: The 6th International Conference on Psychedelic Consciousness* (Exeter: Exeter University).

Google Scholar

Ermakova, A. O., Dunbar, F., Rucker, J., and Johnson, M. W. (2022). A narrative synthesis of research with 5-MeO-DMT. *J. Psychopharmacol*. 36, 273–294. doi: 10.1177/02698811211050543

PubMed Abstract | CrossRef Full Text | Google Scholar

Greyson, B. (1983). The near-death experience scale: Construction, reliability, and validity. *J. Nervous Mental Dis*. 171, 369–375. doi: 10.1097/00005053-198306000-00007

PubMed Abstract | CrossRef Full Text | Google Scholar

Greyson, B. (2014). Congruence between near-death and mystical experience. *Int. J. Psychol. Religion* 24, 298–310. doi: 10.1080/10508619.2013.845005

CrossRef Full Text | Google Scholar

Greyson, B. (2021). After: A doctor explores what near-death experiences reveal about life and beyond. *St. Martin's Essentials* 2021, 184–194. doi: 10.17514/JNDS-2021-39-3-p184-194

CrossRef Full Text | Google Scholar

Greyson, B., Fountain, N. B., Derr, L. L., and Broshek, D. K. (2014). Out-of-body experiences associated with seizures. *Front. Hum. Neurosci.* 8, 1–11. doi: 10.3389/fnhum.2014.00065

PubMed Abstract | CrossRef Full Text | Google Scholar

Griffiths, R. R., Richards, W. A., Johnson, M. W., McCann, U. D., and Jesse, R. (2008). Mystical-type experiences occasioned by psilocybin mediate the attribution of personal meaning and spiritual significance 14 months later. *J. Psychopharmacol*. 22, 621–632. doi: 10.1177/0269881108094300

PubMed Abstract | CrossRef Full Text | Google Scholar

Grof, S. (1985). *Beyond the Brain Birth, Death, and Transcendence in Psychotherapy*. New York, NY: State University of New York Press.

Google Scholar

Grof, S. (1994). Alternative cosmologies and altered states. *Noetic Sci. Rev.* 1994, 32.

PubMed Abstract | Google Scholar

Grof, S. (2019). *Psychology of the Future: Lessons from Modern Consciousness Research*. New York, NY: State University of New York Press.

Google Scholar

Haijen, E. C. H. M., Kaelen, M., Roseman, L., Timmermann, C., Kettner, H., Russ, S., et al. (2018). Predicting responses to psychedelics: A prospective study. *Front. Pharmacol.* 9, 897. doi: 10.3389/fphar.2018.00897

PubMed Abstract | CrossRef Full Text | Google Scholar

Harris, S. (2014). *Waking Up: A Guide to Spirituality Without Religion*. New York, NY: Simon and Schuster.

Google Scholar

Hoepner, R., Labudda, K., May, T. W., Schoendienst, M., Woermann, F. G., Bien, C. G., et al. (2013). Ictal autoscopic phenomena and near death experiences: A study of five patients with ictal autoscopies. *J. Neurol*. 260, 742–749. doi: 10.1007/s00415-012-6689-x

PubMed Abstract | CrossRef Full Text | Google Scholar

Hou, Y., Huang, Q., Prakash, R., and Chaudhury, S. (2013). Infrequent near death experiences in severe brain injury survivors—A quantitative and qualitative study. *Ann. Indian Acad. Neurol*. 16, 75–81. doi: 10.4103/0972-2327.107715

PubMed Abstract | CrossRef Full Text | Google Scholar

Kettner, H., Gandy, S., Haijen, E. C. H. M., and Carhart-Harris, R. L. (2019). From egoism to ecoism: Psychedelics increase nature relatedness in a state-mediated and context- dependent manner. *Int. J. Environ. Res. Public Health* 16, 245147. doi: 10.3390/ijerph16245147

PubMed Abstract | CrossRef Full Text | Google Scholar

Khanna, S., Moore, L. E., and Greyson, B. (2018). Full neurological recovery from *Escherichia coli* meningitis associated with near-death experience. *J. Nervous Mental Dis*. 206, 744–747. doi: 10.1097/NMD.0000000000000874

PubMed Abstract | CrossRef Full Text | Google Scholar

King, L. N., Roe, C. A., and Spencer, M. (2019). “An IPA study of anomalous experiences in temporal lobe epilepsy,” in *62nd Annual Convention of the Parapsychology Association* (Paris).

Google Scholar

Kripal, J. (2020). *The Flip: Epiphanies of Mind and the Future of Knowledge.* New York, NY: Bellevue Literary Press.

Google Scholar

Lancelotta, R. L., and Davis, A. K. (2020). Use of benefit enhancement strategies among 5-methoxy-N,N-dimethyltryptamine (5-MeO-DMT) users: Associations with mystical, challenging, and enduring effects. *J. Psychoactive Drugs* 52, 273–281. doi: 10.1080/02791072.2020.1737763

PubMed Abstract | CrossRef Full Text | Google Scholar

Luke, D. P., Lungu, L., Friday, R., and Terhune, D. B. (2022). The chemical induction of synaesthesia. *Hum. Psychopharmacol.* 2022, e2832. doi: 10.31234/osf.io/s6eh3

CrossRef Full Text | Google Scholar

MacLean, K. A., Leoutsakos, J. M. S., Johnson, M. W., and Griffiths, R. R. (2012). Factor analysis of the mystical experience questionnaire: A study of experiences occasioned by the hallucinogen psilocybin. *J. Sci. Study Religion* 51, 721–737. doi: 10.1111/j.1468-5906.2012.01685.x

PubMed Abstract | CrossRef Full Text | Google Scholar

Martial, C., Cassol, H., Charland-Verville, V., Pallavicini, C., Sanz, C., Zamberlan, F., et al. (2019). Neurochemical models of near-death experiences: A large-scale study

based on the semantic similarity of written reports. *Consciousness Cogn*. 69, 52–69. doi: 10.1016/j.concog.2019.01.011

PubMed Abstract | CrossRef Full Text | Google Scholar

Martial, C., Cassol, H., Laureys, S., and Gosseries, O. (2020). Near-death experience as a probe to explore (disconnected) consciousness. *Trends Cogn. Sci*. 24, 173–183. doi: 10.1016/j.tics.2019.12.010

PubMed Abstract | CrossRef Full Text | Google Scholar

Michael, P. (2021). Commentary on “after: A doctor explores what near-death experiences reveal about life and beyond” by Bruce Greyson. *J. Near-Death Stud.* 39, 161–183. doi: 10.17514/JNDS-2021-39-3-p161-183

CrossRef Full Text | Google Scholar

Michael, P., Luke, D., and Robinson, O. (2021). An encounter with the other: A thematic and content analysis of DMT experiences from a naturalistic field study. *Front. Psychol*. 12, 720717. doi: 10.3389/fpsyg.2021.720717

PubMed Abstract | CrossRef Full Text | Google Scholar

Michael, P., Luke, D., and Robinson, O. (2023). An encounter with the self: A thematic and content analysis of the DMT experience from a naturalistic field study. *Front. Psychol*. 14, 1002. doi: 10.3389/fpsyg.2023.1083356

PubMed Abstract | CrossRef Full Text | Google Scholar

Michael, P., Luke, D., and Robinson, O. (in review). *Smokable “vine of the dead”: Two case studies of experiencers of both a changa near-death experience.*

Google Scholar

Michael, P., Luke, D., and Robinson, O. (in submission). *An encounter with death: Comparative thematic analyses of the DMT experience the near-death experience.*

Google Scholar

Nayak, S. M., and Griffiths, R. R. (2022). A single belief-changing psychedelic experience is associated with increased attribution of consciousness to living and non-living entities. *Front. Psychol*. 2022, 1035. doi: 10.3389/fpsyg.2022.852248

PubMed Abstract | CrossRef Full Text | Google Scholar

Preller, K. H., Razi, A., Zeidman, P., Stämpfli, P., Friston, K. J., and Vollenweider, F. X. (2019). Effective connectivity changes in LSD-induced altered states of consciousness in humans. *Proc. Natl. Acad. Sci. U. S. A*. 116, 2743–2748. doi: 10.1073/pnas.1815129116

PubMed Abstract | CrossRef Full Text | Google Scholar

Reckweg, J., Mason, N. L., van Leeuwen, C., Toennes, S. W., Terwey, T. H., and Ramaekers, J. G. (2021). A phase 1, dose-ranging study to assess safety and

psychoactive effects of a vaporized 5-methoxy-N,N-dimethyltryptamine formulation (GH001) in healthy volunteers. *Front. Pharmacol*. 12, 3340. doi: 10.3389/fphar.2021.760671

PubMed Abstract | CrossRef Full Text | Google Scholar

Reckweg, J. T., Uthaug, M. V., Szabo, A., Davis, A. K., Lancelotta, R., Mason, N. L., et al. (2022). The clinical pharmacology and potential therapeutic applications of 5-methoxy-N,N-dimethyltryptamine (5-MeO-DMT). *J. Neurochem*. 162, 128–146. doi: 10.1111/jnc.15587

PubMed Abstract | CrossRef Full Text | Google Scholar

Roseman, L., Nutt, D. J., and Carhart-Harris, R. L. (2018). Quality of acute psychedelic experience predicts therapeutic efficacy of psilocybin for treatment-resistant depression. *Front. Pharmacol.* 8, 974. doi: 10.3389/fphar.2017.00974

PubMed Abstract | CrossRef Full Text | Google Scholar

Sackwild, L., and Stumbrys, T. (2021). The healing and transformative potential of lucid dreaming for treating clinical depression. *IJODR* 14, 307–319.

Google Scholar

Sanz, C., and Tagliazucchi, E. (2018). The experience elicited by hallucinogens presents the highest similarity to dreaming within a large database of psychoactive substance reports. *Front. Neurosci*. 12, 1–19. doi: 10.3389/fnins.2018.00007

PubMed Abstract | CrossRef Full Text | Google Scholar

Schenberg, E. E., de Castro Comis, M. A., Alexandre, J. F. M., Chaves, B. D. R., Tófoli, L. F., and da Silveira, D. X. (2017). Treating drug dependence with the aid of ibogaine: A qualitative study. *J. Psychedel. Stud*. 1, 10–19. doi: 10.1556/2054.01.2016.002

CrossRef Full Text | Google Scholar

Sepeda, N. D., Clifton, J. M., Doyle, L. Y., Lancelotta, R., Griffiths, R. R., and Davis, A. K. (2019). Inhaled 5-methoxy-N,N-dimethyltryptamine: Supportive context associated with positive acute and enduring effects. *J. Psychedel. Stud.* 33, 1–9. doi: 10.1556/2054.2019.033

CrossRef Full Text | Google Scholar

Seth, A. K., Barrett, A. B., and Barnett, L. (2011). Causal density and integrated information as measures of conscious level. *Philos. Trans. Royal Soc. A* 369, 3748–3767. doi: 10.1098/rsta.2011.0079

PubMed Abstract | CrossRef Full Text | Google Scholar

Shushan, G. (2018). *Near-Death Experience in Indigenous Religions*. Oxford: Oxford University Press.

Google Scholar

Smythies, J. R., Morin, R. D., and Brown, G. B. (1979). Identification of dimethyltryptamine and O-methylbufotenin in human cerebrospinal fluid by combined gas chromatography/mass spectrometry. *Biol. Psychiatry* 14, 549–556.

PubMed Abstract | Google Scholar

Solms, M. (2021). *The Hidden Spring: A Journey to the Source of Consciousness*. New York, NY: WW Norton & Company.

Google Scholar

Solms, M., and Friston, K. (2018). How and why consciousness arises: some considerations from physics and physiology. *J. Consciousness Stud*. 25, 202–238.

Google Scholar

St John, G. (2015). *Mystery School in Hyperspace*. Evolver Editions. Berkley, CA.

Google Scholar

Stiefel, K. M., Merrifield, A., and Holcombe, A. O. (2014). The claustrum's proposed role in consciousness is supported by the effect and target localisation of Salvia divinorum. *Front. Integrat. Neurosci*. 8, 1–7. doi: 10.3389/fnint.2014.00020

PubMed Abstract | CrossRef Full Text | Google Scholar

Strassman, R. (2014). *DMT and the Soul of Prophecy: A New Science of Spiritual Revelation in the Hebrew Bible*. New York, NY: Simon and Schuster.

Google Scholar

Szabo, A., Kovacs, A., Frecska, E., and Rajnavolgyi, E. (2014). Psychedelic N,N-dimethyltryptamine and 5-methoxy-N,N-dimethyltryptamine modulate innate and adaptive inflammatory responses through the sigma-1 receptor of human monocyte-derived dendritic cells. *PLoS ONE* 9, e106533. doi: 10.1371/journal.pone.0106533

PubMed Abstract | CrossRef Full Text | Google Scholar

Takahata, K., and Kato, M. (2008). Neural mechanism underlying autistic savant and acquired savant syndrome. *Brain Nerve* 60, 861–869.

PubMed Abstract | Google Scholar

Taylor, J. B. (2009). *My Stroke of Insight*. London: Hachette UK.

Google Scholar

Timmermann, C., Kettner, H., Letheby, C., Roseman, L., Rosas, F. E., and Carhart-Harris, R. L. (2021). Psychedelics alter metaphysical beliefs. *Sci. Rep.* 11, 1–13. doi: 10.1038/s41598-021-01209-2

PubMed Abstract | CrossRef Full Text | Google Scholar

Timmermann, C., Roseman, L., Williams, L., Erritzoe, D., Martial, C., Cassol, H., et al. (2018). DMT models the near-death experience. *Front. Psychol*. 9, 1–12. doi: 10.3389/fpsyg.2018.01424

PubMed Abstract | CrossRef Full Text | Google Scholar

Urgesi, C., Aglioti, S. M., Skrap, M., and Fabbro, F. (2010). The spiritual brain: Selective cortical lesions modulate human self-transcendence. *Neuron* 65, 309–319. doi: 10.1016/j.neuron.2010.01.026

PubMed Abstract | CrossRef Full Text | Google Scholar

Uthaug, M., Lancelotta, R., and Ramaekers, J (2019). A single inhalation of vapor from dried toad secretion containing 5-methoxy-N, N-dimethyltryptamine (5-MeO-DMT) in a naturalistic setting is related to sustained enhancement of satisfaction with life, mindfulness-related capacities, and a decrement of psychopathological symptoms. *Psychopharmacology.* 236, 2653–2666. doi: 10.1007/s00213-019-05236-w

PubMed Abstract | CrossRef Full Text | Google Scholar

Uthaug, M. V., Lancelotta, R., Szabo, A., Davis, A. K., Riba, J., and Ramaekers, J. G. (2020). Prospective examination of synthetic 5-methoxy-N,N-dimethyltryptamine inhalation: Effects on salivary IL-6, cortisol levels, affect, and non-judgment. *Psychopharmacology* 237, 773–785. doi: 10.1007/s00213-019-05414-w

PubMed Abstract | CrossRef Full Text | Google Scholar

Van Hoeck, N., Ma, N., Ampe, L., Baetens, K., Vandekerckhove, M., and Van Overwalle, F. (2013). Counterfactual thinking: An fMRI study on changing the past for a better future. *Soc. Cogn. Affect. Neurosci*. 8, 556–564. doi: 10.1093/scan/nss031

PubMed Abstract | CrossRef Full Text | Google Scholar

Vollenweider, F., and Smallridge, J (2022). Classic psychedelic drugs: Update on biological mechanisms. *Pharmacopsychiatry.* 55, 121–138. doi: 10.1055/a-1721-2914

PubMed Abstract | CrossRef Full Text | Google Scholar

Winkelman, M. (2002). Shamanism as neurotheology and evolutionary psychology. *Am. Behav. Scientist* 45, 1875–1887. doi: 10.1177/0002764202045012010

CrossRef Full Text | Google Scholar

Winkelman, M. (2013). “The integrative mode of consciousness: Evolutionary origins of ecstasy,” in *Ekstasen: Kontexte - Formen - Wirkungen*, eds T. Passie and Wilfreid Belschner (Ergon-Verlag), 67–83.

Google Scholar

Wolff, T. J., Ruffell, S., Netzband, N., and Passie, T. (2019). A phenomenology of subjectively relevant experiences induced by ayahuasca in Upper Amazon vegetalismo tourism. *J. Psychedel. Stud*. 3, 295–307. doi: 10.1556/2054.2019.007

CrossRef Full Text | Google Scholar

Wren Lewis, J. (1995). *The Dazzling Dark: A Near-Death Experience Opens the Door to a Permanent Transformation*. Available online at: https://www.nonduality.com/dazdark.htm (accessed April 1, 2022).

Google Scholar

Yaden, D. B., Johnson, M. W., Griffiths, R. R., Doss, M. K., Garcia-Romeu, A., Nayak, S., et al. (2021). Psychedelics and consciousness: Distinctions, demarcations, and opportunities. *Int. J. Neuropsychopharmacol*. 24, 615–623. doi: 10.1093/ijnp/pyab026

PubMed Abstract | CrossRef Full Text | Google Scholar
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An encounter with the self: A thematic and content analysis of the DMT experience from a naturalistic field study


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Introduction: *N*,*N*-Dimethyltryptamine (DMT) is an endogenous serotonergic psychedelic capable of producing radical shifts in an experience that have significant implications for consciousness and its neural correlates, especially given the "disconnected consciousness" suggested by the "breakthrough" DMT state. Its increasing usage and clinical trial indicate the growing importance of a thorough elucidation of the experience's qualitative content, over and above the phenomenological structure. This is particularly in light of the intensely pervasive effects of DMT occasions in all dimensions of the self, which are often ontologically challenging yet potentially transformative.

Methods: This is the second report on the first naturalistic field study of DMT use exploring its qualitative analysis. Screened, healthy, anonymized, and experienced DMT users were observed during their non-clinical use of the drug at home (40–75-mg inhaled). In-depth semi-structured interviews, inspired by the micro-phenomenological technique, were employed immediately after their experience. This study reports on the thematic and content analysis of one major domain of the breakthrough experiences elicited, the "self"; where analyses of the "other" were previously reported**. A total of 36 post-DMT experience interviews with mostly Caucasian (83%) men (eight women) of a mean of 37 years were predominantly inductively coded.**

Results: Invariably, profound and highly intense experiences occurred. The first overarching category comprised the onset of effects, encompassing super-ordinate themes including sensory, emotion and body, and space-time shifts; the second category comprised bodily effects, encompassing themes including pleasurable, neutral/both, and uncomfortable; the third category comprised the sensorial effects, encompassing open-eye, visual, and cross-modal and other; the fourth comprised the psychological effects,

encompassing memory and language, awareness and sense of self, and time distortions; and the fifth comprised the emotional effects, encompassing positive, neither/both, and challenging experiences. Many further subthemes also illuminate the rich content of the DMT experience.

Discussion: The present study provides a systematic and nuanced analysis of the content of the breakthrough DMT state pertaining to one's personal and self-referential experiences of the body, senses, psychology, and emotions. The resonances both with previous DMT studies and other types of extraordinary experiences, such as the alien abduction, shamanic and near-death experiences, are also elaborated upon. Putative neural mechanisms and their promise as a psychotherapeutic agent, especially owing to deep emotional impact, are discussed.***nu

Introduction

What is DMT?

N,N-Dimethyltryptamine (DMT) is an indolamine and classical psychedelic, which, when exogenously administered, is capable of generating brief, yet fundamental shifts in the structure and content of consciousness. Such serotonergic psychedelics are considered to exert their effects *via* the 5-HT2A receptor, though downstream GABA, glutaminergic and dopaminergic systems may be modulatory (Halberstadt et al., 2017). One essential reason for the interest in this compound is its endogenous nature, including in human beings (Barker et al., 2012), where enzymatic co-localization for DMT synthesis (INMT and AADC) has also been evidenced in mammalian brain tissue (Dean et al., 2019). A more in-depth introduction to psychedelic DMT can be found in the opening of Michael et al. (2021) study.

The precise nature and extent of DMT's physiological functions as an endogenous amine are yet to be fully elucidated. However, mounting evidence gestures to a multitude of roles in the peripheral and central nervous system, entailing possibly fulfilling criteria for being a neurotransmitter and neuromodulator, including at the 5-HT2A site—as well as mitigation of cellular stress in nervous tissue and peripheries, *via* activation of the sigma-1 receptor (Carbonaro and Gatch, 2016; Rodrigues et al., 2019). Its implication in waking consciousness, altered states thereof such as dreaming or psychosis (Dean, 2018), or extraordinary human experiences such as the near-death state or alien abduction (Luke, 2012, 2020) are speculative.

Even greater intricacies of the compound's subjective sphere, including the entity encounter phenomenon in which there has been special interest (Luke and Spowers, 2018, 2022; Davis et al., 2020a; Michael et al., 2021), may be illuminated after reports on continuous infusions of DMT conducted (e.g., Smith, 2021) based on a pharmacokinetic model to sustain peak blood-concentrations (Gallimore and Strassman, 2016). Regarding recent enthusiasm for DMT's clinical potential, such beings may be projections of facets of the broader self with deeply archetypal characteristics, both positive and challenging—which may both be productive (Davis et al., 2020b; Lutkajtis, 2020; Michael et al., 2021) and possibly difficult feature to navigate in the therapeutic process (Hill, 2019; Michael et al., 2021; Whitfield, 2021).

“What is it like to be” on DMT?

Sai-Halasz et al. (1958) represented the first research study with DMT in humans, using mostly 0.8-mg intramuscularly (I.M.) in 30 individuals. The report superficially listed alterations in space perception, body schema (such as depersonalization), time disturbance, loosening of associations/delusional ideation, “ego loss/amnesia”, and euphoria and anxiety. Boszormenyi and Szara (1958) and Turner and Merlis (1959) subsequently administered DMT to psychiatric inpatients, the former to 24 female inpatients (mostly with schizophrenia) with 1–1.5-mg/kg I.M. DMT, documenting similar symptomological fashion: Euphoria, giggling or liveliness; anxiety and agitation; paraesthesia, i.e., abnormal sensations; laughing, sexual ecstasy, and depersonalization; and “over-estimation of time” and thought disorder.

Based on 340 internet DMT trip-reports, Meyer (1992) conceived of experiential levels 1–2 as codifying the threshold and “interior flowing” of consciousness, followed by vivid geometric patterns which may be 2D and pulsating. Strassman et al. (1994), as part of their seminal research with 60 subjects and over 400 doses of I.V. DMT, administered their Hallucinogen Rating Scale (HRS), which was categorized into the six subsections of somaesthesia, affect, perception, cognition, volition, and intensity. Strassman et al. (2008) also conceptualized the experience as encompassing the transpersonal, invisible worlds, and the personal, which pertained to self-related experiences of a deeply individual, but also often challenging nature.

The laboratory investigation into DMT by Timmermann et al. (2019) resulted in a novel and invaluable neurophenomenological report, wherein the phenomenological structure of first-person accounts closely corresponded to third-person electroencephalographic indices, namely the “visual,” “bodily,” and “metacognitive/emotional” domains identified. The present report on the DMT breakthrough experience, which may be defined as producing very strong psychoactive effects (Davis et al., 2020a) such that an emergence of a novel environment transpires, and especially Michael et al. (2021) attention to the experients' incorporation into other worlds, have explicit relevance for the neural substrates of “disconnected consciousness”. This is described by Martial et al. (2020) as subjective states without experience of the external world, that is, internal conscious content while dislocated from the immediate environment.

The rationale for the study

A detailed rationale for the naturalistic field study of DMT upon which this study is based is outlined in Michael et al. (2021) first qualitative analysis. In contrast to the focus in that report on entity encounters, the analysis in the present report is dedicated to the experiential domains pertaining to the s*elf*; that is, a breakthrough experience not into “other worlds” but into the inner world.

Continuing investigations into the DMT experience is necessary in light of growing popular use (Winstock et al., 2014) and interest in the administration of DMT for psychiatric purposes (e.g., Liechti and Ley, 2020; Steiner et al., 2020; D'Souza, 2021; Scheidegger, 2021). Importantly, the present study provides systematic improvements over most of the significant limitations of previous survey and laboratory research on DMT (Strassman, 2001; Cott and Rock, 2008; Timmermann et al., 2018; Lyke, 2019; Davis et al., 2020a). Improvements included utilizing only breakthrough experiences; which were in a quasi-controlled setting; immediate semi-

structured interviews; which used “bracketing” inspired by the micro-phenomenological technique (Petitmengin, 2006); and qualitative vs. phenomenological analysis revealing detailed content in lieu of generic structure (Varela and Shear, 1999).

The present analysis' *self*-associated themes, particularly in the emotional domain, are especially pertinent to the compound's therapeutic capacity. Possible neural mechanisms are also explored, offering an indirect corresponding between phenomenological features and objective neural correlates. Finally, the nature and degree of DMT's mimesis of the near-death experience (NDEs; Strassman, 2001; Timmermann et al., 2018) and the potential for neurochemical contribution acts as the primary focus of Michael et al. (2023, SSRN).

Methods

Design

This study was a field study on DMT usage in naturalistic contexts. The researchers observed individuals taking DMT in a setting of their choice, with a vapourised dose of 40–75 mg and a mean of 54.5 mg (*SD* 9.8). This guaranteed a “breakthrough” experience characterized by entry to an immersive space and rating high subjective intensity [subjective intensity rating peak > 7 (mean 9.5) on a scale of 1–10, where 1 = normal and 10 = too altered to communicate] and was followed by a semi-structured interview when the participant reported being at 1/10 intensity.

For a complete description of the *participants and recruitment, measures and materials, procedure and anonymity*, and *analyses*, refer to the Methods section of the original report (Michael et al., 2021) derived from the naturalistic field study of DMT use upon which the present, second report is based. A summary version of the methods is presented below, including those specific to the current report.

Participants

Volunteers were either convenience or snowball sampled, with inclusion criteria involving at least 1 breakthrough *NN*-DMT experience and other *NN*-DMT or analog experiences (see Table 1), and provided their own DMT supply—and exclusion criteria involving prior psychedelic experiences with lasting difficulties and administration of the SCID-CT (First et al., 2007) indicating current psychiatric health conditions or difficulties, or previously within a recent time frame (in line with Johnson et al., 2008). In total, 47 DMT sessions were totaled in the parent field study, with 36 sessions being the basis of the present analysis, owing to exclusion due to, for instance, reporting no memory, using changa, being classed as aphantasic (see Figure 1, for further details).

Participant number	Pseudonym	Age (range)	Sex	Nationality	First time DMT used	Last time DMT used	Overall times DMT used	% breakthrough DMT experiences
1	MP	45–49	M	White British	2011	11/2016	20	33%
2	TM (3 doses)	30–34	M	White Romanian	2015	11/2016	5–6	100%
3	BB	35–39	M	White British	2013	02/2018	15–20	25%
5	JM	35–39	M	White British (Scottish)	2015	03/2017	12	66%
6	RV	40–44	M	White British	2015	08/2018	1 (+4 AYA)	75%
7	TC	25–29	M	White German	2014	06/2018	10–15	100%
8	HV	35–39	F	Black British (Ghanaian-Egyptian descent)	2016	02/2018	80	<100%
10	GR	25–29	M	White Romanian	2015	2015	2 (+ 4-ACO-DMT)	Once
11	SP (2 doses)	35–39	M	White British	2003	06/2017	10–15	>50%
12	RH (3 doses)	55–59	M	Asian British (Indian descent)	2013	08/2018	Hundreds	75%
14	AZ	25–29	M	Israeli	2013	02/2018	7	>40%
15	ZD	30–34	F	White British	2017	03/2018	20	90%
16	RS	25–29	M	Black British (African descent)	2016	05/2018	40	50%
17	LR	25–29	M	Chinese Italian (Dual)	2010	2011	25	40%
23	AF	40–44	F	White Italian	2018	05/2019	2 (+ 8 AYA, 10 changa)	>75%
24	LG	30–34	M	Mixed British (Sri Lankan-German descent)	2011	07/2019	20	20%
25	AN	25–29	F	White British	2018	07/2019	7	>40%
26	EM	20–24	F	White Romanian	2017	05/2019	10	90%
27	AB	35–39	M	White British	N/A	N/A	10	100%
30	SH	30–34	F	White British	2007	2008	6	50%
32	OR (2 doses)	25–29	M	Brazilian	2012	2018	3 (+ Hundreds AYA)	Once
34	FF	45–49	M	White British	N/A	N/A	10	80%
35	JB	40–44	M	White British	N/A	N/A	8	75%
36	BW	45–49	M	White British	2000	07/2019	3 (+ 4 changa)	Once
40	JA	35–39	M	White British	2014	10/2019	70	>70%
41	AV	45–49	F	Brazilian	2003	06/2019	20	100%
42	MS	55–59	F	Mixed British (Iraqi-Italian descent)	2013	2017	5	100%
43	DD	40–44	M	White British	N/A	N/A	Over hundred	>40%
44	DS	45–49	M	White British	N/A	N/A	Hundred	50%
47	ST	35–39	M	Nigerian	N/A	N/A	3	66%

Average age, 37.4 (range: 23–58), eight women and 22 men, 83% Caucasian (European, South American, Mixed British, Inc. Sri Lankan, Iraqi), 28% Black British, Indian British, Chinese Italian, and African); AYA, ayahuasca; N/A, unprovided (free to withhold information due to illicit activity admission).

Table 1. Participant demographics and DMT experience.

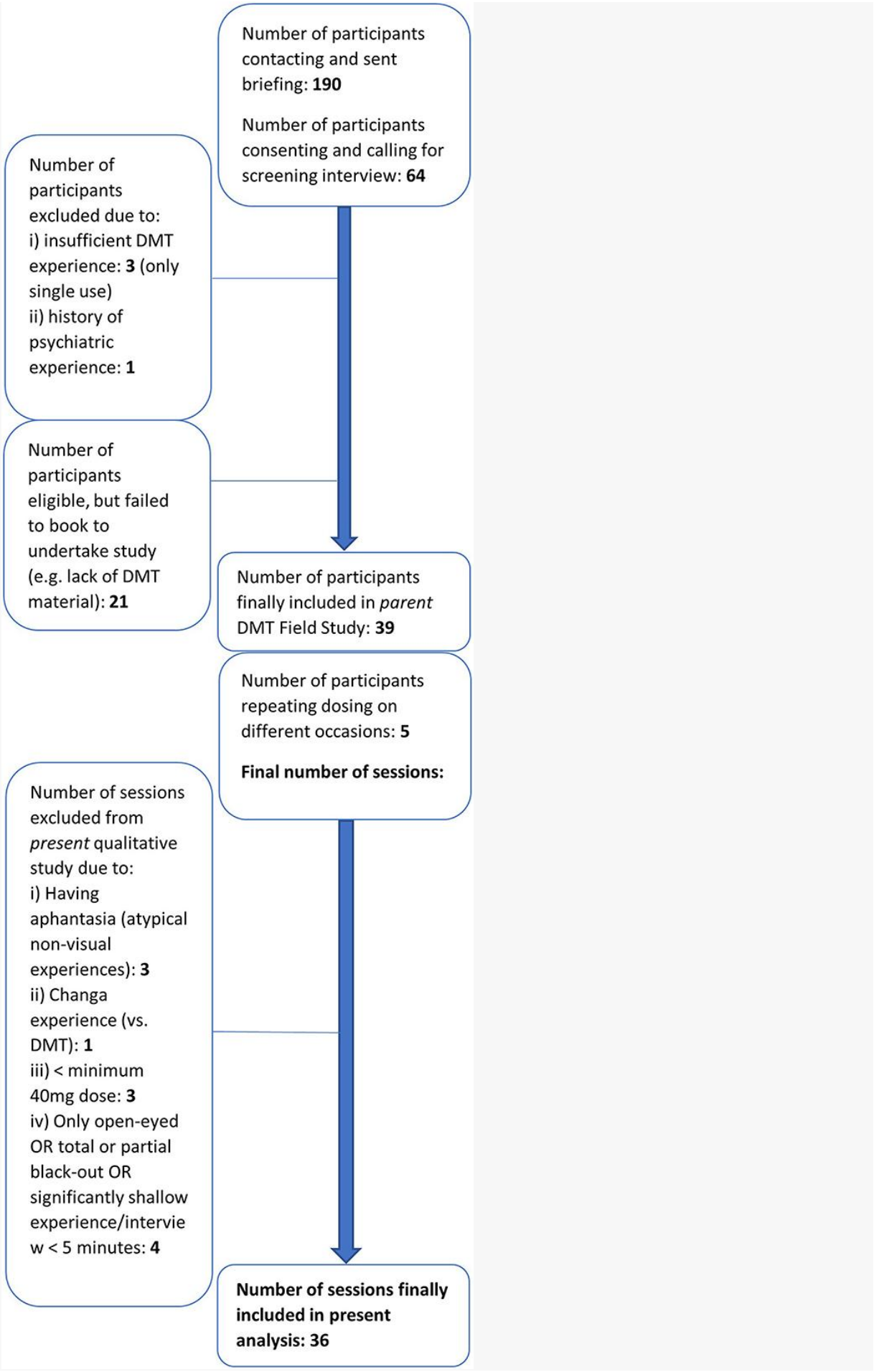
Number of participants contacting and sent briefing: **190**
Number of participants consenting and calling for screening interview: **64**
Number of participants excluded due to:
i) insufficient DMT experience: **3** (only single use)
ii) history of psychiatric experience: **1**
Number of participants eligible, but failed to book to undertake study (e.g. lack of DMT material): **21**
Number of participants finally included in *parent* DMT Field Study: **39**
Number of participants repeating dosing on different occasions: **5**
Final number of sessions:
Number of sessions excluded from *present* qualitative study due to:
i) Having aphantasia (atypical non-visual experiences): **3**
ii) Changa experience (vs. DMT): **1**
iii) < minimum 40mg dose: **3**
iv) Only open-eyed OR total or partial black-out OR significantly shallow experience/interview < 5 minutes: **4**
Number of sessions finally included in present analysis: 36

Figure 1. Participant recruitment flowchart—inclusion, exclusion, and final sample size overall and of the present analysis.

Data collection

A semi-structured interview (SSI) was employed immediately post-experience (see Supplementary material 4, for full interview guide), with interview probes for elaboration spanning domains including sensorial, bodily, emotional, and psychological experiences, what happened at the very start, and any encounter phenomena and visionary landscapes. The SSI most often lasted at least 30 min (approximately ranging from 12 to 75 min).

Analysis

Interviews were audio recorded, fully transcribed, and coded *via NVivo* v.12, where the software facilitated a calculation of frequency per the content theme. Transcripts were subjected to thematic analysis using a hybrid deductive-inductive process, wherein four of the five eventual highest-order, overarching *categories* of the present report were deductively based on, but not identical to, most of the major categories dividing the HRS (including "perception," "somaesthesia," "affect," "cognition"; Strassman et al., 1994). After this point, including the first category ("onset"), all analyses and coding efforts were in accordance with the guidelines as provided by Braun and Clarke (2006), as well as being purely inductive in nature with *super-ordinate themes* and *subthemes* herein elicited by the interview data only (a sixth category comprises "meta-narratives", see Supplementary material 1, which is itself also purely inductively developed).

Ethics

The field study and present analysis were approved by the University of Greenwich Research Ethics Committee (Ref. 17.3.5.15). Given the class-A legal classification of DMT as a controlled substance, strict anonymity of all participants was held throughout. Recruitment and data collection protocols ensured that no personal, identifiable information, such as name, phone number, or address, was shared or recorded, and all reported data were anonymized. Naturalistic field research with psychoactive substances have previously been successfully conducted (ayahuasca: Kuypers et al., 2016; psychometric/neural measures of DMT: Pallavicini et al., 2020).

Results

The following table (Table 2) presents all levels of themes described in the present article's qualitative analysis of the DMT experience—the overarching categories comprising onset, bodily, sensorial, psychological, and emotional. This is except for final subthemes eliciting specific content, which are listed fully in Table 3 in the Supplementary material 2, where extra clarificatory notes for many of the themes can be found. Furthermore, available in the Supplementary material 3 is a graphical representation of the themes. Both in the tables and the ensuing descriptions of themes, **bold** signifies overarching categories (e.g., **onset**); *italics* signify super-ordinate themes (e.g., sensory). In the descriptions of themes only, final subthemes (e.g., "submergence") are flanked by "apostrophes" (and a number of participant

interviews in which final subthemes are present, out of total interviews, are shown in parentheses).

Encounter with the self	
	No. Interviews /36 (%)
Onset: A tumultuous transition in self, space, and time	
Sensory	14 (39)
Emotion and body	15 (42)
Space-time shifts	10 (28)
Bodily: A blissful disembarkation from the body	
Pleasurable	10 (28)
Neutral/both	8 (22)
Uncomfortable	9 (25)
Sensorial: A kaleidoscopic blossoming and blending of the senses	
Open-eye	11 (31)
Visual	27 (75)
Cross-modal and other	14 (39)
Psychological: In inarticulable loosening of the psyche	
Memory and language	31 (86)
Awareness and sense of self	18 (50)
Time distortions	13 (36)
Emotional: A soaring angelic, and fathoming hell, of the soul	
Positive	34 (94)
Neither/both	22 (61)
Challenging	6 (17)
Meta-narratives: Co-creative 'insight into heart and cosmos	
Mind-manifestation	30 (83)
Ontological and emotional breakthrough	27 (75)
Transitions through time	20 (56)

Table 2. Thematic analysis of the DMT experience: an encounter with the self; tabularization of categories, super-ordinate, and mid-level themes explored in the present article—see Supplementary Table 3, for a list of all subthemes.

Onset: A tumultuous transition in self, space, and time

Several themes have been duplicated to appear both in their natural position (such as under sensory or psychological) and again under the category of the onset of the DMT experience, the latter representing those elements that some participants volunteered as the earliest they can recall.

Sensory

A total of 14 participants (39%) described significant *sensory* events at onset, such as sensations of "submergence" (9) resulting from the sheer experiential deluge at the brink of the DMT breakthrough. Thus, LR uses the terminology of there being "many, many ideas and many things coming flooding through", and TM (trip 2) articulates that "it came like a typhoon over me". In his third experience, he reinforces the metaphor:

> "The first part happened too fast, really, too fast, the images were overflowing, I couldn't understand anything... It was like I was in the middle of a tornado, everything was going at unimaginable speed, I couldn't follow anything… maybe a sensation like I was drowned – drowning, but in colors and images".

AN's experience was "slightly oceany in the feel" where she "felt submerged…I felt underwater in some way, or contained by an[sic] energy". This is again redolent of ZD's submergence, who also felt she was *within* some entity:

> "[it] felt like being at the bottom of the swimming pool, like hearing someone stood on the side, saying 'how intense is the experience?'. Yeah, it felt like there were so many layers of things going on at once…that my brain could just not handle it. I was just in so many different experiences at once…
> it was really chaotic, and exhausting…it felt like I was being battered around by loads of different competing currents, some of which trying[sic] to make me go deeper, and some trying to bring me out… energy streams trying to take me in different directions".

"Geometric patterns" (6) were reported to clearly emerge around the trip's very beginning by a minority (much fewer than expected from literature or anecdote, but may be artifactual from many others not volunteering explicitly). RH (trip 2) describes this progression from colorful (basic) patterns to more iconic (complex) imagery:

> "It started with softly opening up patterns, like very beautifully coloured blankets…but then all of a sudden, into the 'death' bit… it would start off with orange triangles, that seemed to open up [into] – would you call it geodesic? – more 3D. Then something beyond! Then out of it would come entities, out of this very fracturedness, I'd be in this completely other world[sic]".

Emotion and body

Immediate sensations in both *emotion and body*, the emotions being of such intensity so as to be bodily manifest, were offered by 15 participants (42%). Some commented on a mild "fear or anxiety" (4), such as "being a scared monkey into this reality" (GR). Several subjects entered the domain of "terror or panic" (six; three of which belonged only to RH). Of important note, five of these six experiences were associated with fear, or mostly sensation, of dying (see Michael et al., 2023, SSRN, for an analysis of DMT's mimicking of the near-death experience), and many of these, in turn,

concurrent with trouble breathing (potentially related to the DMT vapor). Illustratively, in the “horrifying, terrifying, horrible” moment of RH's second trip of the study, he discloses that:

> “I had the terrors for a while because I was in a fairly new place I didn't really recognise, very startling…I remember fighting for breath, thought I was going to throw up at one stage… it's hard to go past the fear in the early stage, a lot of terror…
> I was panicking a bit because it really felt super intense... I was really worried…that I wasn't coming back or something… dying at the beginning, pain, confusion – that really was fucking powerful actually… I seemed to be in what felt like death really”.

To further labor the theme of “labored breathing” (7), again alongside deep fear and felt a threat to life, ZD here fleshes this out:

> “I wanted somebody to rescue me. Fuck, that was so horrible… I felt like I'd lost my breath or something, like a horrible feeling in my chest… I had this sense that I wasn't gonna survive it, a sense of being in [sic]existential crisis which I've never had before. God…
> it was absolute panic in my heart… And I had this sense of there being something outside of me or something outside the experience that could save me, and I don't know whether that's humans – or that's something else”.

“Pain or torture” (2), ever more challenging than above but still coupled with mortal danger to ego, is illustrated by TM (trip 3) uttering that “it was a pretty tormenting experience. I didn't know what was happening, why it was happening, who am I!?... I wasn't aware of myself”.

In terms of instant alterations in bodily awareness, alluded to by TM above continuing that it was “like I was falling down”, GR was alone in expressly reporting a physical expansion (1):

> “in the heart space, sort of a melty, clammy, gluey sensation, just like *whoosh*, you know like how snow melts… Yes, it was like a small sponge [there], then got more spongey – and that transcended my body…it just started to expand beyond my parameters”.

Only a minority (though repeated in the literature) reported “the rush” sensation (5); an adrenal-like response such as the “heart…going ten to the dozen” (BB) and “heat which is rushing through everywhere” (EM), accompanied by an “acceleration feeling at the beginning…like going over a rollercoaster” (JM)—but here divorced from any panic. For example, MP simply proclaims “a kundalini hit at the base of my spine”, and TC relates, “energy is rushing from my body and kind of radiating almost”.

Space-time shifts

Reports pertaining to rapid *Space-time shifts* were given by 10 participants (28%), the most within experiences of “time dilation” (six; vs. 13 reporting similar distortions pervading the entire trip), such as RH's always being thrown into the throes of dying in a void-like scenario which feels “ridiculously long, like, *forever* long”. Sometimes this temporal expansion entwined with the initial inhaling, as ST continues:

> “after I blew out the smoke and it reverted to normal breathing, instead of letting it go on I began to participate in it because it seemed so slowed down into so many different steps I could step in at any time”.

The dissolution of immediate surroundings, the “breakdown of reality” (4) presaging an entry into a new one, is grasped by JM's assertion that “it's very much a deconstruction feeling, things kind of peeling apart if you like”, or BW confirming a

“streaming away of sort of trails…the visual field becomes less and less complex, and more bold outlines and then silhouettes then basic block colours”.

While the vast majority described a sense of some translocation from the worldly to the otherworldly (see Michael et al., 2023, SSRN, for NDE-like themes), a few insisted they were not “going through a tunnel or anything” but rather “just *Bang*, there… arriving ‘immediately at this scene”’ (4) (MP).

Bodily—A blissful disembarkation from the body

Participants did not generally elaborate on many experiential changes within the body, as most, in fact, stipulated feelings of disembodiment (see Michael et al., 2023, SSRN).

Pleasurable

The majority of statements here, by 10 participants (28%), were *pleasurable* in kind, stretching from “pain relief” (2), which can be quite striking such as TM (trip 1) divulging that “because of fibromyalgia, I have almost continuous pain in my joints…after 3 or 4 seconds, it completely disappeared”, or MS's aches and pains which “go away completely… You're not in this world, you're in this other world…[where] you're sort of pain-free, *everything*-free, aren't you!?”, up to the unadulterated body-bliss of “ecstasy” (4). BW, here, embodies more of a “post-orgasmic” (1) aftermath:

> “Like *eeeeh-boosh!!*. And then all that jerkiness afterwards was like the comedown from having just ejaculated… It felt sexual in as much as it feels like it peaked, then post- now I'm just kind of this dribbling, jelly-like twitching thing”.

Neutral or both

Notably, eight cases (22%) mentioned body experiences of a more *neutral* type (either pleasurable or uncomfortable). The spontaneous making of “religious hand signs” (3) such as “instinctive mudras” (JA), or “dancing, moving with this shape, and I notice I like to do [these signs] when I'm in this space, to [the entities], with them. And it does remind me of sort of Hindu mudras” (RH, trip 2).

In both TM's first and second time, he convinced himself of having “convulsions” (3), purely subjectively, as he “was seeing myself here on the sofa…I had seizures for like 10 minutes in my trip!”, or other contortions which he reconstructed in the interview “even more than this, like *The Exorcism*, like bent over… my body reacted…very violently, and I wanted to apologise”.

AZ, sitting in his garden, was the sole participant to feel himself transform, in his case, into plant life in the act of apparent “phytanthropy” (1):

> “Then all of a sudden I could see the entirety of myself placed as the heart of a tree… I could see branches coming out of my torso. And on each branch, there were beings that resembled a bottle with legs, and they were marching back and forth infinitely. Weirdly enough, I could feel all of their movements inside of me”.

Sensorial: A kaleidoscopic blossoming and blending of the senses

The sensorial domain of experience is drastically transfigured in the psychedelic DMT state, but this category is concerned with the predominantly visionary experiential components.

Open eye

Open-eye visuals, noted by 11 participants (31%), were either prior to their immersion into a separate space (see Michael et al., 2021), or when fleetingly opening their eyes. A further "reality breakdown" (3) was witnessed—sometimes a "pixilation", as in TM's (trip 2) case where the researchers "were very pixelated, with big pixels…you were like a very old video game from [sic]70s. *Worse* than that!" MS both saw her fairy-lights "morphing into…loads of skulls" and gasped that

> "Oh my god, there was like a flow! Freya [MS' dog] was moving, she was like the energy flow between me and [DMT partner]!... vividly moving…energy between us all. Because everything breaks down- you all break down into something or another".

Another particularly eye-opening impression communicated by GR was very "clairvoyant-like" (2), in the sense of wielding an experiential prowess uninhibited by the regular senses:

> "each individual atom of that particular information which I'd received from the outside world, was just like – you could go into it as much as you want, or go out of it as much as you want… every pixel of everything was more like a tunnel…and I could choose to go through it, and just choose where to go. It was like a complete[sic] freedom in that way…
>
> So this [chest of drawers] was actually…transported into a huge field of minute atoms or something. But I could go in it or outside it… this [carpet] was more like I could see through it, so like instead of it being a thin layer fabric it was more like something huge and I could go and see each detail of it".

Visual

Changes in the *visual* domain (eyes closed) were offered by 27 interviewees (75%). This was the fifth most commonly reported super-ordinate theme, largely in the colorful kinetic geometric-fractal dimension (virtually quintessential in the literature), with several of our DMT visionaries invoking a "kaleidoscope." The "geometry" (16) often defied description whatsoever, DS matter-of-factly retorting after being asked if he could describe them, "Not a chance." Similarly, BB blithely comments on "their intricacy and the fact they're infinite and all that", and MS stresses that "it's a busy other world and shapes and fractals and just absolutely mind-boggling!" More than the enrapturing aesthetics of these forms, their being of a sentient quality and united nature with oneself (see Michael et al., 2021) is succinctly accentuated by RV:

> "I was transported into precisely the place that ayahuasca took me on the previous journey. A place of unbelievable hyperintelligent geometry and shifting forms… it's so, so difficult to describe. But it's colourful, it's everywhere, it's moving, it's very, very precise, it's very form-full – and it's *you*, you know! You kind of realise that, whatever it is, *you* are too".

This remarkable initial display is often the membrane penetration through which affords the experient their "other-dimensional" venture, as in JA's case:

> "It's almost like you're being pushed through this tiny gap in the geometry that you have to sort of go through to come through to the other side. Then I was sort of twisting and going into it and coming through it, and then I knew – OK, I'm here now".

The geometrics were prominent in the "fractal" design (11). AZ, again highlighting their sensible or interactive properties, informs that he "could somehow manipulate

them and feel them…all I could see was these strange patterns of sacred geometrical figures which were infinitely drawing more geometrical patterns out of themselves". RH (trip 1) sketches the potentially overwhelming saturation of this multiplicative effect:

> "everything was going back that way, down up. And not just that, every single part of it was fractalizing, there was nothing to hold onto, nothing I could grip, or do anything. Everything was just expanding from every point, no end to it".

The significant kinetic energy of both the geometric-fractals and the other world at large, i.e., a state of "flux" (13), may also often preface a suddenly more stable or static other world. This is pithily gestured to by BB, expressing, "it was just crazy crazy crazy visuals – BANG, this thing, and just this thing." Notwithstanding, many others' entire scenes continued to be charged with this dynamic nature where "there were a million things happening, switching from one to another" (GR), such as JM's flowing tapestry of ever-gyrating cog-like structures, FF's teleportation into a wildly bustling biomechanism, and the dynamism of EM's fluid machine-like construction—all resonant with the mechanoid *and* organic imagery (see Michael et al., 2021). One explication of this effect was given a poignant spin by MS around her vibrant, fractal skeletal motifs:

> "That's what it taught me, the impermanence of everything. And everything's moving, nothing stays still. Nothing. That's what it really, really tells me a lot…and the sooner we realise it in this reality, the better the place we'll be
> Interviewer: …you've also got all this mortality imagery as well, so is it like our lives are transitory?
> It's exactly that, exactly what it is. We're only here for a blip, and death isn't a bad thing".

Again, implicit in the ineffability of some of the patterns seen (and often in the more iconic visions) is their occasional "hyperdimensionality" (8). RS riddles us that his "very intricate…dancing lattices" were "at least 4-5 spatial dimensions… sheets blowing in the wind – but hyperdimensional bedsheets!" GR describes a mind-bending folding of his awareness through impossible angles, and RH (trip 1) witnesses a garden that was "so much more than anything 3D", where such emphatically peculiar spreading of space is valiantly rendered in words by both SH and JM:

> "one bit where it kind of turned like *Voowwp*, and went kind of angular, a bit ketaminey when you kind of go, *Zzzz* and you shift into weird dimensions, or things change size or you become a different format…it was almost like I had become small and underneath a piece of furniture or something? This is *not* what it was like but the best I can try to describe it" (SH).
> "All this spinning, all this disorganised space that you can't quantify in 3D space… It's not necessarily linear… things spinning[sic] in multiple layers of things. It's very hard to describe in space terms… everything made sense wherever it was, even though it wouldn't make sense in a normal situation" (JM).

Cross-modal and other

Further to the purely visual, *cross-modal and other* sensory features were conveyed by 14 experiments (39%). "Sounds" appearing during the experience vs. at the onset did not seem very common (4). MS describes something of a more continuous sound, "*Rauuuughh* – there's this sound!... a sort of sound that came with it, like *Rrrrrrnngg*? Weird… A frequency vibration sound… every DMT trip I've ever done it comes with it". ST adds to his "Borg cube imagery" that it also possessed "accompanying synaesthetic glitchy sounds":

> "The hypercube was like a placeholder for the many such images I've…seen projected by [Video-Jockeys] to accompany tracks. The same quality of glitching that…populates psytrance DJ sets… there would be this coupling of the sound to the image and then my brain, my mind would kind of follow it and be like 'yes yes yes!'"

ST here introduces "synaesthesia" (10), appearing to be experienced by a significant number. Here, it is of a visual-auditory type, while next, he seems to describe a somatic-visual complex with cognitive-affective components, a hypercube vision corresponding to his experience of difficulty breathing and, indeed, to his self:

> "It's almost like I'm seeing what I'm feeling… it was that same process of teaching me to associate the feeling of…this 'autobots cyborg' thing, that I could visualise as my experience of Me… it's almost like watching yourself being sliced into a billion different pieces…
> Seems to be more like a multidimensional movement going on, different type[sic] of components that all appear to still be connected doing this kind of movement… it seemed to be a process where it's saying, 'Imagine this represents you', and then that realm, that imagination immediately makes it represent me, such that whatever is happening to *it* I am feeling, or rather is transmitted to whatever part of my experience".

Of note, ZD in addition to disclosing some dynamic relationship of her breath feeding into the geometric visions—in turn also associated with her sense of self:

> "I became really conscious of my breath…I can almost see it… very aware of the breath as all this geometric stuff starts happening and it's like the breath is *visualised* as a pillar in the centre of it all, and it might be like…a white thin line in the centre of it all, and it's expanding and contracting as I'm breathing, and then it sort of blips into nothing – and then that's where *I* disappear".

Psychological: In inarticulable loosening of the psyche

Memory and language

As per the cognitive repercussions of the breakthrough, faculties of *memory and language* were impacted dramatically, as exclaimed by a full 31 participants (86%). As strewn through all the above, very many found their journeys so out of this world as to be "*really* hard to put it into words", where they usually mandate some "recourse to metaphor" (19), and as evident throughout similes are also heavily relied upon by subjects. Though, even this is not without caveats, as ZD exemplifies that "it's just so subtle, that if I use a certain word it will be really misleading", DS fails to express "this thing here in the middle, whatever the fuck it was, I wanna say it was a serpent but it wasn't a serpent in any way". SH's words about her "beautiful patterns" let her down as they were "all, *Vvrrr*, coming around these rooms- they *weren't rooms*, but rooms". When asked to attempt the medium of drawing instead, RH (trip 2) admits, "I will, but I'm concerned that this human mind would distort [the entity]" which he witnessed as being "a bit octopusy[sic], but that would just make it very- you can almost forget that", as well as JB's retort that his trips are "more a feeling, sort of sensations. I just feel if I try to draw, I'd be rationalising it and the wrong side of my brain's gonna be trying…" JM sympathizes too, where ephemerality of the memory of the experience impedes its capturing: "It's really hard to memorise, isn't it? It's just so abstract, you're clutching at things that you thought you saw!"

> "Temporary memory loss" (15), that is *within* (vs. after) the experience, pertains, for instance, to subjects' suspension of their short-term memory, like the knowledge of being in a psychedelic experiment, especially at the trip peak (minutes 1–2). EM, for one, attempted to "'keep the question in mind and remember that you're a research subject' – but I kind of didn't after a split second". Many others resonate with this, but importantly too, alluding to a profound interruption of their selfhood, a diminishment in one's longer-term autobiographic memory (similar to an "ego-death"

effect, yet without an explicit *loss* of the individual perspective, and also without concomitant mystical features), such as SP poetically painting the picture of becoming a blank canvas, where he "just came to…with the feeling of, it sort of becoming from nothing. There wasn't much in between. Nothing. Like waking up – without any dreams". FF also thought provokingly recounts that "I wasn't really aware that I *didn't* know who I was… kind of like 'Wow, here we are, let's just observe and swim and just take it!"'

This occluding of one's prior conceptions of personhood and world is reinforced by RH (trip 3), convincing himself even in his trip that "there's no way I'm gonna even remember this, I'm completely in another world, with only a tiny remembrance there's a human world going on as well". Therefore, GR evocatively explains that

"I didn't even know if you were real or not, or is this real life or not, or reality or not… There was no reference point, no nothing… what would have brought me to have seen more to it would've been…if I were to keep my eyes closed – but I didn't have a conception of eyes, so it's very hard…

So I remember thinking, 'Where am I!? Is this going to end? When is it going to end?'… Because I lost my memory, or what I did, or the fact I took DMT – that did *not* exist, that information was not there anymore... As if I'm just like teleported without anything from the past…into a place, *Peeww*, just like, 'What the fuck!?' – I mean, I still had my language capacity!"

Accounts of "looping" were given on a few occasions (4), such as BW's complex replaying mix of mental imagery (which was also highly synaesthetic):

"it was so weird that it was…like an OCD-type intrusive thought that kept popping into my head… almost as if I was still talking to you like I was sober… the intrusive thought was a recent memory of a recent episodic thing…

The loop kept bouncing in. It was like 'what the fuck was that', and 'did you all see that!?' And then it's like…did I actually say that? Then it went, then it popped back in and then… 'Did you all see it as well?' Then it's like, but what *is* that!?... Then it's like, I've actually lost my mind, I've lost the power to know the difference between talking and thinking…

that really weird feeling of transparency, almost like a schizophrenia-type, am I saying it or thinking it…? …And then this sort of realisation that actually, I'm probably not talking at all, and this is all in my head… 'They're gonna think I'm crazy"'.

Awareness and sense of self

The most salient alterations within *awareness and sense of self*, noted in 18 cases (50%), involved more infrequent retention of "lucidity" (5)—the sense of "preservation of ego" or sense of self (as contrasted to the above, more common, loss of self-related autobiographical memory). AB emphasizes that "I was always aware that I was me and that I was having a DMT experience…but reality had completely been replaced". LG, although he was "dead in an icicle" and his "[etheric self] went into another plane… I was still me – my thought processes still felt the same… slowly I was like 'I *am* dead', but my ego was still here, so death is like…not that big a deal!" This staying within selfhood is sharply juxtaposed to the dissolution of the ego, the latter explicitly verbalized to a greater extent (see Michael et al., 2023, SSRN, regarding the mystical experience). An ambiguity, however, or even fluctuation between these states is suggested by JB:

"I was quite kind of lucidly half there, half here at points… Didn't have any sort of- feel like I met any external entities – other than a Oneness, an Everything entity, a Universal entity…God, or whatever… I was kind of *in* it...

Interviewer: But did you have a sense of you[sic] own identity still?

That's what I kept on laughing at myself that I did – in a way… I felt totally [unitive]… there was a certain self-awareness still. I don't think I completely lost myself".

Emotional: A soaring angelic, and fathoming hell, of the soul

Positive

DMT incites a profoundly emotionally pervasive experience. As viewed by 34 cases (94%), that is, almost *all* the experients—and despite the somewhat frightful experience onset—it becomes an overwhelmingly *positive* one. The trip was most often noted to be simply "very pleasant, very calm" (16), "really safe…so secure" and "so harmonious", for instance for EM it was "such a smooth trip, so nice, so lovely" to be amongst her "community of harlequins". TM (trip 3), admitting that though he "was coming from that torment in the beginning" suddenly "it was very peaceful… I was almost expecting to hear birds singing!" This "bumpy ride" at the onset was replaced by a more tranquil, "friendly kind of visit" is shared by numerous participants, such as JM:

> "if you're not getting a bit anxious when your head's falling about, there's something wrong with you – but beyond that rush at the start, it was friendly… very comfortable, [sic]little bit warm and fluffy… I was smiling".

The welling of "loving" feelings from the participants and experience of "connection" with others (10) was oftentimes deeply engendered. This may be associated with the mutual love generated between experient and entity, such as RH's (trip 3) uttering, still communing with his entities, "Oh I love you so much, it's like we are one thing. Oh, I love it here so much!". In BB's vision, he encountered representations of his wife and son, which struck in him an epiphany of the essence of the agape love form:

> "the feeling…of intimate connectedness with other people which I crave – desperately… It's the kind of feeling that encompasses one type of love which is in all the participants equally. So it's not as if, he's a kid who feels one way about me, and I feel a different way. No, it's just one shared form of love…crystallised into this kid figure".

The following two evoke an engagement with greater consciousness, from whom they could not wholly unembed themselves (echoing the dynamics of selfhood above)—their reflecting on which caused tears to stream from their eyes:

> "Wow. Just love. I don't know what to bring back from that. Woah… it was not so visual…not so cerebral, just this utter sort of all-bodied sort of connection… and just reminding myself, that 'I asked for this', and that I love you all, and that I love everything, and fucking- How much trust and love- [begins to cry, and laugh]…
>
> I…shed some tears, but tears of beautiful- very happy tears, laughy tears. I kept laughing at myself for thinking about myself as 'I'. My mind would say something like, 'I love it, I love everyone'. I was like 'I'm still there, I'm still saying "*I"* love everything, I'm still stuck on this *I*'!" (JB).

Though there is less levity, RV's pathos-filled account was also hued with striving to embrace letting go of the self amongst his similarly heart-opening encounter, here referring to the loving life to which he aspires:

> "It would be something much more fluid, about a much more spontaneous expression of love on a day-to-day basis. It would be about hugs, and about blessings, and giving, about never hoarding, never requiring[sic] [begins to cry]… I have actually thought about being a priest…someone whose job is blessing and love and giving and modesty and gentleness and slowness [crying, hugging interviewer]… That is why we're *here* isn't it?...
>
> Yeah, and there's this feeling that if I release my heart-centre, then my life has to change… to be…some kind of vehicle for love. I feel like I can be, but I've just resisted it my whole life, you know…
>
> Interviewer: …You've got a big heart [RV]!
>
> Yeah, but it's what we do though to shut it down".

The term “beautiful” is one of the commonest positive descriptors thus far volunteered, sometimes in connection to the aesthetics—but more deeply evoked by the encounter or mystical-type experiences, where the co-resonant “profundity” (14) captured many experiences. FF, despite going in with the intention of “sorting my bloody head out” and ending up as “just a spectator of this alien phenomenal environment”, resolves that it was one he:

> “felt privileged to be seeing… I'm blissed. I feel *blessed* that I've had this opportunity to go there… what's lovely with these things, is the profoundness of it is in itself an insight, and then that…leads to maybe helping with the intention…if you work on yourself”.

JB resonates with such otherworldly beauty and profundity being fundamental in its own right despite not necessarily receiving immediate, practical answers:

> “I was in another world… Yeah, it was full on, beautiful. Just totally blissful… But it leaves me wondering like, ‘What else?’ Or kind of, ‘What do we do with that?!’ Yeah, but in itself, it's just a powerful experience. To remind me of the abstract nature of reality, made me kind of feel this different universal plane. Which[sic] just feels really profound, and really beautiful to remember”.

Basking in such supreme profoundness on occasion elicited feelings of great “humility” (3). RV, here, manifestly wrestles with the ultimate truth of the accessed realms in stark contrast to the egoic self, which in turn is sometimes not strong enough to incorporate such truths upon returning:

> “And it was so astonishing and so humbling! And it feels so ridiculous in a way because there you are [makes squirming noises] just a tiny struggling ego… anything that's truthful for me has to connect to the truth…of this reality of what's presented [in the trip], and you know, these dimensions beyond waking consciousness…and all their manifest healing… And really anything less than that - the fact is my life *is less* than that… as yet I've not made my life about bringing that truth to humanity. I resist *that*, and that's what the last ayahuasca journey was about as well, was to stop resisting *that;* this *is* of ultimate importance. This is of ultimate importance – but it's *so* disorientating”.

Eloquently further parsing out his “cosmic giggle” (see *Cosmic game*, Michael et al., 2021) and mirroring FF/BB's sentiments of welcome unexpectedness, BB frames it by a particular way the ego can be put in its place by DMT:

> “Another reason for the giggles was…I said to you I go in usually with a question and it never gives you the answer to that question, it gives you the answer to a question you *should* have been asking. It's just, a kind of deflation, of what's left of your ego, just to say – ‘yeah, you really didn't have a fucking clue, did you!’ Kind of this feeling of ‘ok, alright like, I give up, whatever, cool, great – what else do we have, oh awesome, clouds!’... the greedy thing you go in with – it says, ‘you didn't need that, SMACK, dickhead, you needed this! So go on and enjoy’… So that laughing at yourself[sic]”.

An experience of “healing” (5) within and by the DMT state in itself was demonstrated by BB again, as part of this ego challenge here, and surprise revelation of love and lack therein (as at the start of this section):

> “there's a particular type…of emotional closeness, of love, basically, which I'm constantly searching for…in particular for my son – fully opening up to that, which I feel like I do. But I just realized, I probably *don't* completely. But…the intensity of that feeling, that's the medicine that I need. Just this feeling that there's like *another* layer, another type of love…
> there's this other thing, always in the background of my mind – ‘Why do I feel I'm not loved enough?’ And there was something, some little lock somewhere inside me, that I haven't accessed… Just this sense of, you know: take 5% fucked up your whole life, and if it was because of this thing, and all of a sudden – ‘that's what it is you idiot!’ And it's really acute and obvious!”

JA also required a suspension of ego to facilitate deep spiritual healing, coupled with shamanic-like ritual purgation:

> "So if I can connect to whether it's a sense of fear, or sense of an element of lack of self-love, and then if I can make the right sound, the right frequency, that will help to purge that energy which is sort of stuck within me…
> I realise when I'm in that state of consciousness how much I carry on a daily basis [in terms] of difficult energy, blocked emotions I'm not able to pass by or release. And…it just feels like we're in this pure divine state where we can remember how to process the energies that are difficult to release in everyday life".

This purgative energy is very akin to the intense emotional "release" or "relief" (4) experienced by some, such as SH and AF's highly resonant encounters imparting insight into the *Cosmic game* (see Michael et al., 2021). In AF's case (as with RV), this power was reminiscent of ayahuasca:

> "the second part when I laid down…and the crying, it felt like the ayahuasca… I'm just comparing the two things, because it was very liberating, and just like… Yeah, just *be*! I had that sensation of just existing. And I want it to last as long as possible… I just opened myself… Wow, this is powerful what you study [laughing]. My goodness… even the crying was like 'Yeahhh', crying, just 'Ahh, let it go"'.

SH shares this impression of simple "isness" accompanied by such liberation:

> "I was like This is The Game, you just go, step into experiences, and see where it leads you, without meaning to have an expectation or lesson or story or reason. Just what is just is. Quite profound… Amongst the silliness – it's so liberating. Often when I get these downloads from trips it feels quite heavy like 'Arggh', this just felt like *Pffwahh*. Amazing, like a big release".

While these feelings of profundity, humility, and healing can be of serious substance, these are time and again intimately wed with experiences of "humour" or even "hilarity" (7). This is well-embodied by this above gamification of the cosmos, received by SH as she juxtaposes the profundity and silliness, which catalyzed eruptions of laughter—as well as BB's celebratory giggling earlier, being granted the medicine he did not even know he needed. Not dissimilarly for JB, the humor hailed from trying to reconcile identifying with greater consciousness:

> "also a bit of chatter about ego, and '*not being special'*. Because part of it is, there is a sort of, 'Jesus' sort of feel, an enlightened ego thing. You feel like, 'Wow, I'm so special!'… Then this kind of laughing realisation about what you're saying and thinking, and how absurd it sounds to yourself!"

Understandably, this volume of emotions of such depth and positive valence incited in many subjects a "gratitude" (8)—from MP or RH (trip 3) repeatedly uttering "thank you" *in situ* as they tripped to MP explaining that it was "Just the opportunity, and the healing, and just being alive to witness it". AF responded, in regard to her above freedom from her mind, that she's "bloody grateful" to be able to "enjoy all the things that we forget we are"—but also her humbled appreciation for being gifted the experience, either of the DMT or her own life, asking herself, "Is actually all this time dedicated to me? Like I always had this feeling, it seems all for *me*. This is where the crying comes from [begins crying]."

The thankfulness of OR (trip 1), who belongs to an Afro-Brazilian syncretic ayahuasca-using church, was less for soaring angelic, but for averting a fathoming of hell, explaining that, upon having just witnessed the struggle endured by his non-religious DMT partner:

> “in my heart, as I may say this, I was very thankful for having a doctrine or a religion in which I go. Because I was literally hearing like, 'You know what happens when you're not prepared for some stuff'. And the spirit guide was like, ‘You're cool! You have this [doctrine], it's OK!”’

Several experients expressed their appreciation for their entities, for the teaching and healing they bestow, such as RV, who

> “felt them trying to work, even in that short space. As the entoptics faded slightly, I got the impression, the sense of…several entities starting to try to work on the tension in my jaw… they saw that some of the trauma is locked… And I was grateful for that”.

An impression of “familiarity” was oftentimes felt around the beings visited, but frequently a familiarity of a certain scent, a “déjà vu”, pervaded the experiential core (11), as gestured at by JB's framing his “different universal plane” as like a return; “to remember” after having “gone back somewhere”. Resounding this anamnestic process, RS shares, “I always feel very comfortable there, often I feel like ‘Oh yeah this is where I was before, and this is where I'll go after, I forgot about that!’ sort of – ‘Cool!’ [laughs] Like this lifting of this amnesia”. The conviction can be carved deeply in participants' minds, as conveyed by AF, “I know I was there, it's again like all the time, I know this place, its familiar. I've been there before, I know, I know, I've been there before!” Yet again, this feeling breeding ideas of origins is motioned by AN:

> “It felt like I came from it, I'd come from that submersion, that energy field that I was in, it felt like that was where I come from, so it felt natural to reassemble myself from that space. It felt familiar…doing that reassembling[sic] myself, felt natural. Something I'd done before”.

As tacit in these accounts (and reverberating with descriptions of the familiar beings, Michael et al., 2021), this unassailable recognition is one which runs beyond partaking in DMT on prior occasions, as clearly substantiated by FF, referring to an immersion into some natural, yet beguiling mechanism:

> “the intensity and the place you are, it's so phenomenally alien, but familiar as well, but shocking… That second I went in and that sense of fear, like ‘OK I've been here before’…
> Interviewer: And do you think it's familiar over and above the fact you've been in this place before when you've literally done DMT?
> Oh yes, oh definitely! No, I remember thinking this the very first time I did DMT, it's somewhere deep down…that it's a friend, you know… it's really interesting how it is such a familiar world”.

Neither or both

Many other parts of the experiences were not patently positive nor expressly challenging, but *Neither or Both*, as described by 21 (61%). This predominantly comprised statements as per the “intensity” of the DMT state (21), largely felt to such degrees as becoming “overwhelming”. In reference to requesting an intensity rating out of 10 for the whole trip, it was more often than not heard that “it was 10. Yeah, there was nowhere else to go”. Often in the experience's initial stages, interviewees were adamant “it had gone right off the scale” (RH 2); “It was 11 – it was fucking mind-blowing” (RH 1), “it just seemed hilarious, because it was so fucking intense that I could only *just* understand the question” (ZD), or in MS's case, “it was so, so powerful all I wanted to do was make sure I was breathing”, left only to “hang on for dear life!”. This echoes the psychical deluge, the “submersion” discussed at trip onset, where finally, for several, the overwhelm transpired amidst the throes of the collapse of their personal world, such as RH's second experience within the study, which “felt like death” and “was so intense…that the ego fractured”—or like during GR's efforts to ground himself:

> “It was very overwhelming... And I remember I was just going, my sense of self dissipated, I just did not exist anymore… I opened my eyes at some point, and that was my baseline reality, which was quite comforting in a way because I was looking for an anchor… there was just so much going on, like what the *hell* is going on!?”

The ability to “let go” or enact a “detachment” (3) despite the initial buffeting received was manifest in OR's (trip 2) adept approach, learned from his religious practice:

> “It's like a sense, a feeling I shouldn't just trip, I should understand this is a tool; I can just go with the flow, or I can- it's a different perspective from the neurotic position like I *have* to control this – it's like ‘Eh, I can be in the sea in the waves and let them throw me on the rocks, or I can learn how to surf’! It's the same space and place, but my perspective on that space is different. I can just be [makes drowning noise], or [makes flying noise]”.

Challenging

Experiences which were admittedly more *Challenging* than this occurred, but to a substantially lesser degree, divulged by seven subjects (17%)—and of these, perhaps only three journeys were marked by this on the whole. This maybe particularly so for RV, whose ego's “fear of letting go” (1), juxtaposed to OR above, has already been touched on in his awe-struck encounter and desire to embrace selfless love, which he here develops in even more profound depth around “re-experiencing past trauma” (1), also emotively catapulting him back to prior ayahuasca work:

> “so my ego is not sufficiently developed to let me go into that, sort of to allow the self to disappear, to allow the swallowing of the self into that ‘Super-place’… so it uses trauma or at least a kind of foundational fear that…I know…exists in childhood- fear as a way of keeping a tendril, preventing the swallowing… so what I see in that space is that this fear I have which stems from this trauma is, well, like a way of keeping me separate…it's a way of preventing that ecstatic self-losing…
>
> letting go and moving through this experience requires this very special, precious loving non-attachment… Which[sic] means a certain letting go of your nearest and dearest as well… in the last ayahuasca journey that was a big challenge for me; 'In order to experience this, you have to let go of [your wife and daughter]'. That's what they were telling me- Are you telling me I have to literally leave them!? It wasn't that, it was in order for you to excise this, you have to excise what is essentially a fear, a fear of loss isn't it? It's fucking hard”.

Not unlike this experience of RV refusing to accept saying goodbye to his beloved—a stunningly reminiscent type of “grief” (1), yet one from being forced to leave loved ones behind after having “died” *oneself* , as well as the resultant “guilt”, was characteristic of LG's uniquely chthonic journey:

> “I was like, so I'm dead, I *am* dead now. Then I was looking around in this plane… I was…viewing my face, like the[sic] shellshock, the magnitude of what's just happened. There was almost like a feeling of, I guess it was grief that set in-[sic] grief, but not for me, but for *her* [LG's romantic partner]…
>
> I was like *vrroohhmm* into this ethereal aura of whatever icicle thing. Then it was just trying to cope, and acceptance of the fact that this thing, this love is ended, and…she's gonna have to deal with the grief and pain…
>
> I was just there like ‘What the fuck is this!?’, I couldn't even pay attention to the surroundings that much because I was so distressed by the fact that I was dead [laughter]!”

A further and final category, “Meta-narratives: Co-creative Insight into Heart and Cosmos,” acts as an addendum to the above analysis, where an unabridged description is provided in the Supplementary material 1. This is owing to the content of answers not deriving directly from questions within the SSI but independently volunteered. Mainly, they are not explicitly pertaining to the experiential content in

itself, but rather more interpretative comments upon the experience, and as such, not easily comparable with Michael et al. (2023, SSRN) comparison with the near-death experience content. The reader is encouraged to refer to this in Supplementary material 1, given the nature of responses surrounding emotional breakthrough (Roseman et al., 2019; Davis et al., 2021; Timmermann et al., 2022) and ontological belief (e.g., Davis et al., 2020a; Watts and Luoma, 2020; Timmermann et al., 2021, 2022; Nayak and Griffiths, 2022), relevant to many recent reports.

Discussion

Overall, the present thorough thematic and content analysis has illuminated the DMT state as encompassing the *onset*, though often difficult labor, to then giving birth to a profound DMT breakthrough, which presented an all-pervasive spectrum of experiences. These experiences spread across all of the *bodily* domain, marked mostly by *dis*embodiment, the *sensorial*, being predominantly extravagantly visual; the *psychological*, transforming the core of the sense of self; and the *emotional* domain, which was almost universally desirable. This, therefore, is demonstrative of the drug's capacity to take one out of themselves and to engage with another, normally welcome, reconfiguration of all areas of one's own consciousness.

Comparison with other DMT studies

Representing the one other published thematic analysis on the DMT experience, Cott and Rock (2008) coded 19 reports from an online survey, resulting in nine general themes. These entailed—distortion in time, space, and self; hallucinations (visual, auditory, or bodily); veridical hallucinations (i.e., considered to be true or real, including sentient beings, see Michael et al., 2021); affective distortion: involving intense euphoria and anxiety, typically during the “DMT rush”—relating to *emotions, pleasurable or challenging*, in the above analysis, including at *onset*; spirituality: including *beauty* or *love*, relating to the same themes in the above analysis (also see Michael et al., 2023, SSRN, regarding the near-death experience). Finally, directly linking with themes herein, there is familiarity; lucidity: describing an ability to “fully appreciate the experience as if in an ordinary waking state”; ineffability: denoting difficulty capturing a non-linear, nondual experience; extreme intensity: where participants became “besieged by DMT-induced cognitions”, often leading to anxiety.

Timmermann (2017) delivered a preliminary overview of the prominent effects of 7–20 mg of injected DMT among 13 healthy subjects. These encompassed themes pertinent to Michael, Luke and Robinson (2021) analysis, namely complex imagery (e.g., which was familiar to 62% of participants)*; a* sense of presence (e.g., showing intent by 69% of participants); a sense of receiving information (46% of participants), and sense of being transported (e.g., to otherworldly space, 69% of participants, reminiscent of the current study's *Space-time shifts*). Themes correspondent to the present analysis included *bodily* effects (100% vs., in the present study, 28% *pleasurable*, 22% *neither*, 25% *uncomfortable*) such as an onset including a rush (vibration and warmth), distortion or dissolution (see “disembodiment”, 53%, in Michael et al., 2023, SSRN), and pleasure; simple visual imagery (100%) which were *geometric* (100 vs. 44–17%), *colorful* (77 vs. 36%), *kinetic* (62 vs. 36%), including “vortex…forms”, which may be “cartoonish” or “exquisite…resolution”; and

finally emotions (92%), which were predominantly positive like humility, love, gratitude, or peace—where spiritual feelings and inspiration may correlate to this study's “profundity/beauty”, and acceptance and openness, may correlate to “loving/connected”. Anxiety/fear (31%) was also coded, corresponding to this report's range from “terror” (at onset, 17%) to “anxiety” (during the experience, 8%).

Comparison with other exceptional human experiences

When comparing this study's themes characterizing the DMT space with exceptional human experiences (EHEs) of other kinds, as stressed in Michael et al. (2021) study, “alien abduction” or other alien-encounter experiences (Mack, 1994, 2000; Hancock, 2005) may be particularly evocative of the DMT trip. Some subjects' feelings of being “trapped” are similar to the sleep paralysis experience, compared to the alien abduction experience (mainly its first phases; Blackmore and Cox, 2000). The often deeply *pleasurable* states, under bodily experiences, are resonant with the sometimes ecstatic episodes reported by abductees, one asserting that she would “gladly sacrifice her child” for that feeling (Mack, 2011)—and the “vibratory” states here are also classically reported by them (Mack, 2000; as well as in OBEs, Montenegro, 2015). The *visual* experience, under the sensorial category, of the “organic-mechanic” quality links also to Luna (2022) and Kripal's (2022) attestations that, in the former, the witness leading to the coinage of “flying saucer” described the structures as living beings, and in the latter, the serpentine mother-being of ayahuasca is sometimes experienced in the form of a UFO. The emotions of a *positive* nature, such as “connection, humour, and healing”, are finally congruent, respectively, with abductees' frequent reports of feelings of oneness, including with the ET beings experienced (Mack, 2000), these entities' trickster-like characters (Keel, 1970), and their spontaneous healings, emotional and *physical* (Strieber and Kripal, 2016), with this latter particularly akin to *RV*'s healing (the beings also described by him were “mantis-like”).

Resonances between the shamanic journey and DMT are also obvious, where such DMT-containing “entheogens” like ayahuasca, or the snuff *yopo*, are employed by shamanistic cultures for divinatory and healing purposes. The descriptions of this study's participants of “submergence” at onset are arguably gesturing toward, especially with its watery dimension, the descent into the underworld (Hillman, 1979), but also the evident struggle of the self, and “competing currents”, suggestive of the shamanic experience of disintegration (Narby, 2022). Not dissimilarly, the *emotional/body*-related feelings at the beginning of fearing for the integrity of one's life echo this shamanistic rebirth motif, especially in light of propositions that historical near-death experiences acted as the basis for the development of shamanic societies' ritualistic technologies to replicate this experience of dying (Shushan, 2009, 2018). DMT's “organic-*mechanic”* aesthetic highlights the particularly entheogen-utilizing shamans' entering into (UFO-resembling) shining, metallic structures (Hancock, 2005).

The near-death experience, finally, has evidential overtones of the DMT themes herein. However, the precision of equivalence between the states may have been thus far over-estimated in the literature (see Michael et al., 2021), and this question is the dedicated purpose of a subsequent report (Michael et al., 2023, SSRN). An abridged version of the similarities (vs. differences) between the analyses herein and the NDE would include sounds at onset, sensations of dying, sentient light forms, preservation (most NDEs) or a diminishing (minority of NDEs) of the sense of ego,

and feelings of peace and love. One example of a lesser discussed NDE feature echoing DMT is the present themes of “hyperdimensionality” (also reported in Strassman, 2001) and “clairvoyant-like perception”, which are reminiscent of the so-called “omnidirectionality” of the visual experience of some near-death experiences, such as in the initial OBE (Ring and Cooper, 2008).

Putative neural mechanisms

Dream-like activity

Closed-eye DMT administration has been found to reverse cortical traveling waves from backward flowing (carrying top-down predictions) to forward (carrying bottom-up errors/sensory data). This is consistent with a reduction in the precision weighting of “priors”, i.e., predictions made about experiential causes and together constituting an internal generative world model, which suggests the brain's action as if it were receiving novel visual input (Alamia et al., 2020). The key other natural endogenous state sharing much with the DMT trip as delineated in the present study, including such complex visionary states, as well as intense, broad emotionality and perturbations in self—especially interactions with others in intrinsic sensorial worlds—is that of dreams. Dreams are the prototype for “disconnected consciousness” in which internal awareness is present despite apparent unresponsiveness—where the major neural correlates of the dream-state appear to be shared with the psychedelic and dissociative DMT state, that is, suppressed alpha cortical oscillations and elevated theta and delta (slow wave; Carhart-Harris, 2007). Both were correlated with the intensity of visual imagery under DMT (Timmermann et al., 2019)—with the theta–delta being shown in provisional analyses to be over the temporal association cortices, as in dreams (Timmermann, 2019). The theta–delta enhancement is also inversely correlated with the (more non-dual) mystical experience (Pallavicini et al., 2020), substantiating its association with the dualistic interactive style of the DMT breakthrough. As such, the DMT condition is akin to a lucid dream, albeit very unique in that the brain-state may be REM sleep-like, yet the individual is technically wakeful and typically experiences the state as real. The TPJ, possessing a key component of the DMN (the iPL), is also pivotally involved in the dream state (Scarpelli et al., 2019), where the release of the DMN's inhibitive effects on temporal lobe structures (Carhart-Harris et al., 2014) could also stimulate this region—and elevated global connectivity within the TPJ and insula has been reported at least under LSD (Tagliazucchi et al., 2016).

Relevantly, such DMT and dream theta and delta activity (also increased in other, for instance, regressed near-death states) is linked to the temporal organization of episodic, i.e., sensorially rich memories (Buzsáki and Moser, 2013; Martial et al., 2019). However, such episodic memories are typically autobiographic—which may be re-organized and reimagined in REM sleep, but the personally recollective nature of the DMT content is not self-evident. Indeed, much DMT phenomenology can be considered to bear little resemblance to that of dreams, suggesting important neural divergences also in their origins.

The entity encounter

Many participants in the present analysis articulated experiences in reference to entities, such as the sense of unity and familiarity with them, love felt for and from them, or healing received. As discussed by Michael et al. (2021), top-down cognitive mechanisms conferred onto basic sensory data may construct social imagery, where

computer modeling of this effect has generated examples of anthropomorphic visual forms (Aqil, 2022). Dissociative identity disorder (DID; formerly multiple personality disorder) may also be instructive, a condition in which “alters”, secondary personalities may be considered projected “hallucinations” of the fragmented self (van Heugten-van der Kloet and Lynn, 2020). DID has similarly been compared to the dream state, with in-dream relationships being a prototype for DID, but which also may be precursive to the disorder suggesting shared neurophysiological mechanisms (Barrett, 1995). Interestingly also, 57% of patients were identified as having their alters presenting as dream characters in their dreams, and 26% as having at least two sub-personalities dreaming at the same time and experiencing each other as characters (Barrett, 1994), which not only gestures at the characters as a derivative of the person's integrated self but also echoes the several DMT participants herein who expressed a continuity between themselves and the encountered entities (Michael et al., 2021).

Experiences at “onset”

The following attempts to frame specific themes of the present analysis, including some subjective *content*, in terms of their possible neural substrates. For instance, one's perception of flowing through time has been indicated to be a constructed phenomenon within the generative model (Seth, 2021), where participants' sense of time dilation may derive from elevated prediction error signal and thus updating, as unpredicted stimuli have been shown to appear longer lasting (Pink-Hashkes et al., 2017). Medium microdoses of LSD also dilate time, even in the absence of subjective effects (Yanakieva et al., 2019). Descriptions of (open-eye) deconstructions or pixelations of the visual scene, prior to breakthrough elsewhere, is a vivid phenomenological expression of the attenuation of the precision of priors rendering the world-model fluid before the reversion of backward (top-down) to forward (bottom-up) traveling waves implying visual stimulation (Alamia et al., 2020), and alpha decrease and theta–delta increase underwriting sensorial memory (Timmermann et al., 2019).

“Bodily” experiences

The analgesic effect reported, including ecstasy, links to Timmermann et al. (2019) identification that the main phenomenological component of “bodily” changes during DMT correlated with reductions in the oscillatory beta band, and Timmermann (2019) fMRI results suggesting that the posterior operator network, implicated in pain regulation, shows disintegration. Two trials are underway to investigate psilocybin's effects on fibromyalgia (Gilligan, 2021; Hendricks, 2021)—and one case study of a psilocybin NDE-like experience also included near-complete fibromyalgia remission (Michael, 2022a). One participant reported perceiving themselves where they lay, where such OBE-like imagery is more expectable with ketamine (Luke, 2012). This may be owing to disinhibition or integration of the TPJ (as abovementioned, involved in the world-model construction of dreaming), neuropathology or stimulation of which has been shown to incite OBEs (Blanke et al., 2004, 2015) due to high-level predictive modeling of bodily/vestibular and visual experience becoming disconnected. The one experient, while sitting under a tree, demonstrating the herein-coined “phytanthropy” is reminiscent of altered states generated by *salvia divinorum*, in which the individual may feel themselves as transformed into nearby objects, or, indeed plant life (Luke, 2013). The disintegration of the DMN connector hub is not only present under the influence of DMT (Timmermann, 2019) but also salvia (Doss et al., 2020).

“Sensorial” experiences

The fluxing fractal geometry was stressed as being sentient in its own right by several, even equated with the experient themselves, that “it is *you*”, is discussed in Michael et al. (2021) and harkens back to similar evocations from Strassman (2001). This impression could be undergirded by the reversal of the anticorrelation between the DMN, mediating *internal* self-referential processes, and the task-positive network (TPN), active when engaging *external* attentional demands (Carhart-Harris et al., 2013; Palhano-Fontes et al., 2015). One novel proposition, too, of the reputed “hyperintelligence” (superior to the experient) of these visual forms and entities may be linked to the diminishment of confidence in predictive priors. This may then lead to a loss of experiential context for the raw sensory or intrinsic incoming data, where such a lack of prior standards as a reference point may result in the subjective sense of information associated with the imagery as unfamiliar and advanced—which may also help account for the reported noetic “insights” or “revelatory” states (possibly appearing mundane or unintelligible upon return), as well as the sense of “humility” in the context of ego diminishment.

While synaesthesia of some description was shared by many subjects (common to tryptamine psychedelics, especially LSD, and typically sound color, Luke et al., 2022), one individual, *ST*, depicted an elaborate multisensory-cognitive manifestation. Psychedelic synaesthesia may be prompted by the global hyperconnectivity of non-local networks, which is concomitant with the disintegration of the DMN, which facilitates ego consciousness. A very apt qualitative expression of both these processes was *ST*'s synaesthetic visualization of his body/physical internal state and a sense of self as a rotating hypercube and his utterance of being “sliced up into a million pieces”. Regarding the binding of the body and very selfhood in this image, the generation of the sense of self is itself likely to be another phenomenon constructed by high-level predictions, but fundamentally of interoceptive inputs from the body and viscera (Solms and Friston, 2018; Damasio, 2021; Seth, 2021). Whereas the TPJ, integrating audio-visual and body schema data, has been a “hot zone” for consciousness generation (Koch, 2019), *self*-consciousness may not arrive if not for its integration with the insula's interoceptive information processing (Damasio, 2021).

“Psychological” experiences

The very graphic instance in this study of “looping” is a classic example of this well-known part of psychedelic phenomenology. Such loops are a constant reactivation of the same intrinsically generated (autobiographic or imagined) percept or repeat stimulation of one's short-term eidetic or echoic memory of environmental stimuli. Balaet (2022) discussed the cognitive effects of psychedelics and reviewed psychedelic studies on memory. For instance, Williams et al. (2002) highlighted that 5-HT2A receptors have a key physiological role in working memory (such as in PFC) and that LSD alters neuronal networks implicated in memory (Kaelen et al., 2016). Not elaborated is that (in the context of music listening) this involved increased functional connectivity and information flow between the parahippocampus and the visual cortex, positively correlating with visual, including autobiographic imagery. Also discussed are impairments in spatial working memory (Wittmann et al., 2007), in lexical/numerical working memory, and decreased free recall (Family et al., 2020) under psychedelics.

The preservation of personal ego in several subjects ostensibly throughout their trips is interesting. This is in spite of DMT's resulting in DMN disintegration (Timmermann, 2019), as well as other psychedelics' effects of increasing global functional connectivity (Tagliazucchi et al., 2016), reducing parahippocampal-executive network and interhemispheric medial temporal lobe (mTL) connectivity (Lebedev et al., 2015); and reversal of anticorrelation between the salience network and DMN, or DMN and dorsal attention network (Stoliker et al., 2021)—all proposed as undergirding ego dissolution. However, it appears that the temporal dynamics of the DMT experience dictates a continuum with a sense of losing self at the peak (maximal disruption of neural substrates of selfhood) and a greater self-sense prior to and soon after this (concurrent with dualistic interactivity including entities).

“Emotional” experiences

Timmermann et al. (2019) have evidenced a correlation between the intensity of emotionality and neural entropy during the DMT experience, where such diversification of the neural repertoire is considered to index wealth of conscious content. This is consistent with the disintegration of neurally constraining high-level networks concomitant with the spontaneous release of subservient nodes such as the mTL (Carhart-Harris et al., 2014), housing the amygdala and hippocampal zones, limbic regions pivotal to memory and emotional regulation, and freeing of neural, psychodynamic, and energy (Carhart-Harris and Friston, 2010). This is phenomenologically reflective of the intense emotional “release” reported. The compelling feeling of “familiarity” also articulated (in ironic opposition to the humor evoked by surprise, maybe linked to undermined priors) likely pertains to neurobiological overlap with “déjà vu”. Those with temporal lobe epilepsy more prevalently report the sensation, where it is inducible *via* temporal cortical stimulation—and may also be owing to past dreaming of comparable material (Moulin, 2017). These findings are supported, respectively, by the disinhibition of the hippocampal structures (Carhart-Harris et al., 2014) implicated in memory encoding-consolidation-retrieval mechanisms and shared temporal slow-wave oscillations between the dream state and that of psychedelics and DMT (Carhart-Harris, 2007; Timmermann, 2019).

Finally, of the few severer challenging experiences, that of intense “fear of letting go”, and of accepting the death of one's own self as well as one's personal universe and all that it contains can be framed again in terms of DMT's disruption of the uncertainty minimization minimization by the cortical predictive processing mechanisms. This means the introduction of disconcerting chaos into the system. However, more specifically, the dissolution of the internal world model generated by the priors would be, as far as the individual experient is concerned, tantamount to the dissolution of the world itself, and thus subjectively felt as categorically apocalyptic. In addition, the “sense of dying” (at onset) reported to be associated with terror and breathlessness, including the “rush” effect betraying a sympathetic activation, may well be, in turn, associated with the speculated release of endogenous DMT at the moment of human biological death (and evidenced production during rodent cardiac arrest, Dean et al., 2019). Thus, exogenous use of the compound may trigger similar physiological cascades as that which any evolved endogenous release may cause in response to a threat to organismal preservation—or similarly, such use leads to the body's false interpretation of the DMT, including predictive attempts to explain its interoceptive effects, to be a signal of such a threat to life owing to its release as being physically

correlated with the dying process (this is bolstered, e.g., in *EM*'s belief of her dying sensation is due to a feeling of “intoxication” by DMT, Michael et al., 2023, SSRN).

Therapeutic potential

Experiences at “onset”

The powerful subjective features of the experience, in particular the emotional dimension, may prove important mediators of any clinical effectivity of DMT (e.g., Watts et al., 2017; Dos Santos et al., 2018). Even within the *onset* of the breakthrough, participants' experiences of abject “terror”, including “dying”, may serve as a powerful confrontation with one's mortality—a key tenet of existential therapy—where fear of death itself is suggested to be found many psychopathological conditions (Moreton et al., 2020). Continuing from such convictions of dying, “expansion” of the body and transcendence beyond its limiting boundaries, to find oneself in an ostensibly changed dimension, may also alleviate existential distress and thus improve wellbeing (Gandy, 2017).

“Bodily” experiences

Regarding *bodily* changes, such as some individuals noting distinct “vibratory” states, this is echoing of so-called “shaking therapy” or tension and trauma release exercises (TRE), inspired by instinctive neurogenic tremoring after traumatic events (Beattie and Berceli, 2021)—where at least one subject volunteered a feeling of trauma release during the vibrations.

“Sensorial” experiences

The account of *MS* found in the *sensorial* category, in which her skeletal imagery in rapid “flux” signified her existential impermanence, which, if understood, would result in humanity's betterment, points poetically to deep insights which can be garnered from the aesthetic content of the trip itself. Extrapolating meaning from symbolism and metaphor, such as that within the dream state but equally as legitimately in the psychedelic sphere, has been a cornerstone, especially of Jungian depth psychology and therapy (Hill, 2019). Though the hypercube was detailed by a number of other participants, the highly baroque “synaesthetic” episode of *ST* and the cube's inconceivable configurations seemed to emulate his very states of feelings and simultaneously served a progressive teaching function for him. Again, such unique displays within the experiential content itself may be considered a profound therapeutic technology. The experient's inner state, even selfhood, is vividly visualized and from which lessons may be extracted. This is not different from the gestalt therapeutic approach to dream states, wherein characters and objects are considered manifestations of fragments of the psyche (Alban and Groman, 1975).

“Psychological” experiences

The transient “memory loss” of one's prior condition and diminutions of sense of self, in the *psychological* domain, clearly rings of the egoless dimension of the mystical experience, well-documented to predict psychedelic therapeutic outcome (e.g., Haijen et al., 2018; Roseman et al., 2018). The flagrant descriptions by some experients of this cognitively disrupted, yet the productive state of mind, such as “coming from nothingness” and suddenly finding themselves in a given experience and flowing with it (e.g., *FF, SP*), is strongly suggestive of the meditative state—especially of mindfulness betraying a radical presence and acceptance of the

moment. These are widely accepted to be crucial for mental wellness, their mirroring of central principles of acceptance-commitment therapy (ACT, Hayes and Wilson, 2017)—and its beneficial elevation also being identified after psychedelic experiences (Uthaug et al., 2019; Murphy-Beiner and Soar, 2020). In regard to the alternative, lesser reported preservation of the ego, one participant, *LG*, articulated an intense death-like scenario, but one in which his retained selfhood led him to conclude that "death isn't such a big deal". This, akin to the discussion of DMT's existential implications above, points to how this feature, perhaps ironically opposite to the ego death, which prefaces therapeutic relief, also has the potential to relieve death angst and thus other related anxieties.

"Emotional" experiences—Positive

With respect to the *emotional* effects of DMT, the poignant experiences recounted by most participants, not least *BB, RV*, and *AF*, and others, maybe a testament to the psychotherapeutic potential of this unique psychedelic state. Indeed, an emotional breakthrough has been substantiated as a distinct component of psychedelic phenomenology (this paper, see Supplementary material 1), where its presence has also significantly predicted improved wellbeing, as did the mystical experience, which is well-known to do so (Roseman et al., 2019). To begin with the *positive* reactions, by far the most dominant feeling, the commonly felt "loving connectedness" was manifested in some experients' relating to the entities themselves, whereas for *BB*, it emanated between himself and his son's presence, which he effusively framed as a healing experience of his own inadequacies in love. *RV*, too, was movingly heart-opened, expressing an acute reversal of his hitherto "shutting-down" of his deeply felt aspirations to be a loving person, which he realized to be, in fact, a universal purpose—though also revealed, was the challenge of the inherent need to "let go" with such unification. This type of overwhelming reconnection with oneself and others is yet another pivotal subjective mediator of psychotherapeutic healing from the psychedelic experience (Watts et al., 2017; Carhart-Harris et al., 2018; Kettner et al., 2021; Roseman et al., 2021).

The feelings of immense "beauty" and "profundity" volunteered by very many, encapsulating the aesthetic sublimity and conceptual depth of a seemingly more-than-real alternative world, could be argued to have an ameliorating influence on the crisis of meaning that the contemporary world is presently facing (Cormier, 2018), which in turn addresses the same "givens of life" as those intrinsic to existential therapy (i.e., meaning, death, isolation, freedom, Yalom, 1980). The "humility" when confronted with the enormity of the DMT sphere that several participants disclosed and its mental health relevance is congruent with psychedelics' acute undermining of the ego. For *RV*, again, this crystalized into nothing short of a revelation of the hero's journey, a mission, though one of selfless service, in which he wished to "bring to humanity" the gnosis he received from the DMT. As such, the therapeutic reach of the experience can be seen not to be limited to the individual, but how their healing aspires to heal others. *BB*'s humbling encounter involved his insight into having asked "the wrong question", replaced with the "correct" one—a psychological paradigm shift for him. Both experiences link to such a quality of insight in the psychedelic space being instrumental in the positive repercussions (Erritzoe et al., 2018; Davis et al., 2021), with this process being mediated by greater psychological flexibility (Davis et al., 2020b) like that during a reconfiguration to a less egoistic perspective.

In the subtheme pointing to DMT's “healing” properties, *BB* outrightly stated his unbidden revelation of the “cause of his suffering”, and *JA*, during his ritualistic sound-making, shared that he felt a reconnection to the divine replacing his everyday sicknesses. This latter is very evocative of the goals of transpersonal psychotherapy (TP), in which the dimensions greater than one's ego are worked with to enact healing of the person as a whole (Grof, 1973). The profuse feelings of “release” were alternately articulated as the compelling insight to “just *be*” (*AF*) or that “what is just is” (*SH*)—both redolent of the detachment and acceptance, and ayahuasca and 5MeO-DMT's mindfulness enhancements, discussed above in reference to *psychological* effects. These two participants (also *BB*) were, in addition, those whose experiences most characterized the so-called “Cosmic Game” (an entity communication identified in Michael et al., 2021)—expounded on with the following theme of “humour”. One technical theory of laughter is its derivation from a surprising or unpredicted stimulus, which is why it may be a classic reaction under psychedelics given their relaxing of “priors”, i.e., beliefs learned from experience enabling the prediction of our world—which, when relaxed, undermines the rigidity of psychological constructs contributing to psychopathology (Carhart-Harris, 2019; Carhart-Harris and Friston, 2019). Such deep-felt hilarity of the DMT trip is inherent to the idea of the “Cosmic Game”, a theme reflecting a realization of existence as being a “divine comedy” and the absurdist nature of the human condition, tantamount to the Hindu concept of *Lila* which denotes the fundamental playful purpose of the cosmos (Watts, 1989). The psychospiritually therapeutic potential of this dimension to DMT or psychedelic phenomenology, in its profound re-envisioning of the universe, may be hard to overestimate—in light of the *pronoia* essential to the experience, diametrically opposed to the paranoid stance to the world.

Several participants expressed their “gratitude” for the DMT experience itself and the profundity and healing it brought, self-evidencing the conduciveness of DMT to wellbeing. Such deep gratitude possesses a great capacity to generate a central perspectival shift from one of a sense of deprivation and emptiness to a sense of abundance and fullness. Indigenous societies, typically less psychopathological than contemporary ones, ritually give thanks for their provisions by their natural environment—where the modern world has turned to such techniques as “gratitude journaling”, empirically confirmed to bolster indices of mental health (Jans-Beken et al., 2020). Several participants also related the “familiarity” of the otherwise alien DMT world, including the entity characters therein. They couched this as making even the bizarreness or transpersonal events such as egoless unitivity as a comfortable or even perfectly natural process (e.g., *AN, FF*)—which would have important implications for any naïve and/or patient populations to be administered DMT, if medicalised, given the possible softening of its ontologically or otherwise shocking nature.

In considering all these desirable reports, it should be acknowledged that the specific participant population used here (self-selected, DMT experienced, psychedelic culturally engaged, as expounded in the Limitations section later), not least their lacking any clinical symptoms of psychiatric conditions including or often co-morbid with anxiety (Stein, 2001), such predominantly positive, and only scarcely frightening, DMT reports would have been predicted. Some challenges were evident still; for instance, the sheer “intensity” reported near-universally at the onset did entail a deeply felt threat to life and sometimes overwhelming feeling of instability of there being no experiential reference point—W. B. Yeats' resounding line that “the center

cannot hold”—as part of the ego-quashing peak of the trip, could present a real psychological danger to any naïve/patient groups. That this same onsetting deluge was framed with watery symbolism is also reminiscent of the Joseph Campbell quote that “The psychotic drowns in the same waters in which the mystic swims with delight,” which may also imply a cautioning of those with any predispositions to psychotic experience. The other *neutral* theme was the demonstration of “letting go” during the experience, mentioned expressly by a few, but particularly *OR*. His deftness in navigating the sometimes chaotic scene, he claims, is a testament to the value of his religious framework, which he brought to the experience, and thus the usefulness in possessing training of some nature in conceptualizing and exposing oneself to the space (conversely to his atheistic DMT partner). This, importantly, is contrary to the present view reflected in psychedelic clinical trials, which are not hesitant to give, potentially ontologically shattering experiences with traditionally entheogenic substances, which classically give rise to mystical communion otherwise reserved for the mystic; the *mysterium tremendum* being one description to encode the awe simultaneous with the terror it may engender for the uninitiated.

“Emotional” experiences—Challenging

As per the *Challenging* experiences, though they were few and far between (amongst a DMT-experienced group), these still had harrowing qualities to them. *RV*, for instance, albeit the only one doing so, spoke painfully about his “fear of letting go”—starkly contrasted to *OR* above—wherein past traumas were reignited, which themselves then thwarted an ability of “ecstatic self-losing”. He accentuated that even if such self-loss were accomplished, it must unthinkably bring with it the dissolution of his personal universe, populated by his beloved family. This being one case, alongside others such as *RH*'s fractured void, *BW*'s psychotiform confusion, or *ZD*'s existential dread—these instances demonstrate the limit to which the human spirit can be stretched. Though none officially reported any clinically sustained distress, a couple still shared lingering difficulties that should be recognized by any DMT studies going forward. Finally, the death-like scenario painted by *LG*, interestingly not ego death, is a reminder of the capacity of DMT to elicit NDE-like episodes (DMT being the main ingredient of ayahuasca, “vine of the dead”), which are sometimes of negative valence and even lead to trauma-like reactions (Cassol et al., 2019)—albeit in *LG's* case, the traumatic reaction did not occur, he was in fact moved by the experience to appreciate life in its transience. Mirroring *RV*'s suffering at the prospect of his own annihilation concurring with losing loved ones, *LG's* experience of nightmarish “grief” comprised of a refusal, but acknowledged need, to accept his death and thus the “death” of his relationship with his girlfriend and her own inevitable grief.

For these challenging episodes, it is important to note that these never characterized the entirety of the trip. Positive components were also shared within these same reports (e.g., *RV, RH, LG*). Significantly, the vast majority of the experiences herein were benign and beneficial, despite the illicit and uncontrolled nature of the usage, which is claimed to elevate the probability of “bad trips” (Barrett et al., 2016), though perhaps less so among such seasoned users, Indeed, having specific recreational intentions has been shown to predict *less* challenging experiences (Haijen et al., 2018). Moreover, in spite of such unpredictability of the experience, especially with less experienced users, there are guidelines helping to moderate such experiences in controlled research that are applicable to future clinical practice (Johnson et al., 2008), including screening for contraindications, sufficient preparing and aftercare of

participants, and curation of the setting, such as being in a safe space alongside trusted people.

Similarly, challenging experiences can be partially predicted and thus limited, where for instance, they are positively associated with neuroticism (Barrett et al., 2017). The degree of difficulty and harm has been predicted by the co-use of mood stabilizers and several variables related to set and setting (Simonsson et al., 2023). Whereas setting clear intentions predicted having a mystical experience, having a positive "set" reduced the chances of challenges (Haijen et al., 2018), and surrender also predicted mystical experiences (Russ et al., 2019).

In any case, distressing episodes may predict positive outcomes after the event. Their occurrence has been evidenced as being related to meaning, spiritual significance, and improvements in wellbeing (Barrett et al., 2016). Centrally, some psychedelic users choose to deny the term "bad trip", emphasizing instead that for them, such experiences have mostly provided insights of a profound existential and transformative nature, where the authors conclude that this term can be thought of as a coping mechanism in the form of narrative sense-making to facilitate life-story integration, explaining why users continue to use even after such trips (Gashi et al., 2021).

This being so, it is vital that any employment of this potent substance is attentive to the reality of such challenges, whether sensorial, psychological, or perhaps especially (e.g., see *RV*) metaphysical or ontological DMT, indeed all classical psychedelics, are not only experiential but are considered by shamanic societies as *entheogens* ("generating a sense of the divine within"), and as such are unprecedented as potential medicines in the psychiatric pharmacopeia. It has been suggested that the new medical interest in these molecules represents the maneuvering of spirituality through the back door of science, an institution possibly not wholly equipped to resolve the psychedelic mystical experience, and which may be appropriating this practice of indigenous groups who have developed an acute understanding of the putative metaphysical implications and how to navigate any formidable consequences (Corbin, 2010). For instance, 18% of DMT users were found to have undergone "conversion" experiences, constituting a drop of almost two-thirds of those subscribing as "atheist" before encountering otherworldly entities on DMT to "non-atheist" afterward (Davis et al., 2020a), where such ontological shifts may have therapeutic potential [psychedelic mystical experience: Roseman et al., 2018; entity encounter: Lutkajtis, 2020; near-death experience (NDE): Van Lommel et al., 2001], and belief shifts post-psilocybin toward panpsychism correlated with improved mental health outcomes (Timmermann et al., 2021). Nevertheless, such metaphysically intense experiences may simultaneously be the driver of subsequent challenges, which often include ontological shock (mystical: Michael, 2022b; entity: Davis et al., 2020a; NDE: Pratte, 2021). For example, though small, one percent (26 respondents) of Davis et al.'s (2020a) DMT users endorsed that the experience provoked an "undesirable alteration in their conception of reality", and some arguments suggest that materialism is a coping mechanism to defend against disturbing aspects of one's self and world (Kastrup, 2016), which if undermined may actually be deleterious.

The present study neither investigated the long-term effects of DMT nor explicitly seek to explore therapeutic applicability, though many participants did volunteer post-acute effects. These ranged from the simple and positive "I feel [relaxed] for several

days afterwards" to much more ambivalently complex and perplexing experiences, which evoke the magnitude of the ontological shifts possible and yet emphasize the extreme cautionary stance one may have to take toward them:

> "There's part of me that, a bit like in *the Matrix*…I almost feel not entirely right about taking people out of the Matrix unless they're absolutely called to it… should I give my wife the opportunity to see this? I don't know, not unless she's absolutely called to it, because it's *so* disorientating. Perhaps its[sic] better just to live in the Matrix, and try to find love and be love, find humility and be humility[sic], and try and live, try and be everything you can, without this extraordinary shamanic experience, which is *so* real… Every religious[sic]- *every* attempt at being spiritual or religious…is some attempt to connect with this. However misguided the religion…there's an attempt to try and wake us up to this extraordinary thing, and *truth*" (*RV*).

In relation to the therapeutic potential of DMT to treat depression, it is pertinent that initial findings of phase I and phase IIa clinical trials are promising (Baker-Jones and Campbell, 2022; Small Pharma, 2023).

Limitations

The initial report on the DMT field study (Michael et al., 2021) elaborates in depth on the remaining limitations of the study, despite its addressing constraints of past research and the reader is again invited to refer to this. A summary here would include over-representation of Caucasian men (mostly White British, see Table 1), self-selection bias possibly predetermining the quality of the trip, stringent screening including past DMT experiences meaning non-naiveté and exposure to psychedelic culture, thus influencing experiential content (Hartogsohn, 2016), an untested plant-extracted physical substance used, and an uncontrolled naturalistic vs. lab environment. All such shortcomings being so, certain justifications can be made where, respectively, this demographic constitutes typical DMT users (Palamar and Le, 2018), ethical reasons contributed to using experienced users, experiences after use of the untested DMT are patently congruent with past research (see *Comparison with other DMT studies*), and lab contexts problematically introducing primes (Luke, 2017).

To elaborate on the self-selection of those with a positive attitude to DMT use and recruitment of, often very, experienced users (see Table 1) engaged with the psychedelic subculture, this would have certainly introduced a bias in terms of the resultant content of the DMT experiences, as psychological history ("set") is a central driver of experiential content (Hartogsohn, 2016). Brief examples of this include Davis et al.'s (2020a) noting that respondents' most memorable entity encounter was during their first DMT experience and Strassman's (2001) finding that, of the high-dose participants, most of whom were initially naïve to DMT, around half reported such encounters, as compared to the present study's 94% prevalence of encounters. Other than this, it is not straightforward to discern how this specific population's DMT experiences would differ from a naïve or non-self-selected one, and it is beyond the scope of this one qualitative study to correlate the content of experience with the number of prior DMT experiences, which itself may be associated with influence by the psychedelic community. Future research could fruitfully address this relationship. However, peak intensity ratings for all participants (apart from one 7/10) were at least 8/10, indicating that the experience will be uniformly intense despite past experience. Also, while set and setting are well-known conditioners of the psychedelic state, such priming has not been empirically shown with DMT, and the use of such subjects was

advantageous in terms of mitigating overwhelming reactions and optimizing phenomenological recall.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by University of Greenwich Research Ethics Committee (Ref. 17.3.5.15). The patients/participants provided their written informed consent to participate in this study.

Author contributions

PM and DL: conceptualization, data curation, and funding acquisition. PM, DL, and OR: methodology. PM: formal analysis and writing the original draft. PM and OR: review and editing. DL and OR: supervision. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1083356/full#supplementary-material

References

Alamia, A., Timmermann, C., VanRullen, R., and Carhart-Harris, R. L. (2020). DMT alters cortical travelling waves. *bioRxiv* 2020, 1–18. doi: 10.7554/eLife.59784

PubMed Abstract | CrossRef Full Text | Google Scholar

Alban, L., and Groman, W. (1975). Dreamwork in a gestalt therapy context. *Bull. Am. Psychoanal. Assoc.* 35, 147–156. doi: 10.1007/BF01358186

PubMed Abstract | CrossRef Full Text | Google Scholar

Aqil, M. (2022). "Visual hallucinations: at the edge of nature and culture," in *Interdisciplinary Conference on Psychedelic Research, Sep 22nd-24th* (Haarlem).

Google Scholar

Baker-Jones, M., and Campbell, G (2022). *Psychedelic Assisted Therapy with DMT: Michelle Baker-Jones and Dr Graham Campbell Discuss the Experience of a Phase I Trial [Public Presentation]*. London: The Psychedelic Society.

Google Scholar

Balaet, M. (2022). Psychedelic cognition—The unreached frontier of psychedelic science. *Front. Neurosci.* 16, 832375. doi: 10.3389/fnins.2022.832375

PubMed Abstract | CrossRef Full Text | Google Scholar

Barker, S. A., McIlhenny, E. H., and Strassman, R. (2012). A critical review of reports of endogenous psychedelic N, N-dimethyltryptamines in humans: 1955-2010. *Drug Test. Anal.* 4, 617–635. doi: 10.1002/dta.422

PubMed Abstract | CrossRef Full Text | Google Scholar

Barrett, D. (1994). Dreams in dissociative disorders. *Dreaming* 4, 165. doi: 10.1037/h0094410

CrossRef Full Text | Google Scholar

Barrett, D. (1995). The dream character as prototype for the multiple personality alter. *Dissociation* VIII, 61–68.

Google Scholar

Barrett, F. S., Bradstreet, M. P., Leoutsakos, J. M. S., Johnson, M. W., and Griffiths, R. R. (2016). The challenging experience questionnaire: characterization of challenging experiences with psilocybin mushrooms. *J. Psychopharmacol.* 30, 1279–1295. doi: 10.1177/0269881116678781

PubMed Abstract | CrossRef Full Text | Google Scholar

Barrett, F. S., Johnson, M. W., and Griffiths, R. R. (2017). Neuroticism is associated with challenging experiences with psilocybin mushrooms. *Person. Ind. Differ.* 117, 155–160. doi: 10.1016/j.paid.2017.06.004

PubMed Abstract | CrossRef Full Text | Google Scholar

Beattie, J., and Berceli, D. (2021). *Global Case study: The Effects of TRE on Perceived Stress, Flourishing and Chronic Pain Self-Efficacy Evaluation of TRE Training Using Standard TRE Protocol*. Available online at: https://traumaprevention.com/research/ (accessed April 4, 2022).

Google Scholar

Blackmore, S., and Cox, M. (2000). Alien abductions, sleep paralysis and the temporal lobe. *Eur. J. UFO Abduct. Stud.* 1, 113–118.

Google Scholar

Blanke, O., Faivre, N., and Dieguez, S. (2015). "Leaving body and life behind: out-of-body and near-death experience. out-of-body and near-death experience," in *The Neurology of Consciousness: Cognitive Neuroscience and Neuropathology*, eds S. Lauries, O. Gosseries, and G. Tononi (Academic Press), 323–347.

Google Scholar

Blanke, O., Landis, T., Spinelli, L., and Seeck, M. (2004). Out-of-body experience and autoscopy of neurological origin. *Brain* 127, 243–258. doi: 10.1093/brain/awh040

PubMed Abstract | CrossRef Full Text | Google Scholar

Boszormenyi, Z., and Szara, S. (1958). Dimethyltryptamine experiments wth psychotics. *Central State Inst. Nerv. Menial Dis.* 104, 445–453. doi: 10.1192/bjp.104.435.445

CrossRef Full Text | Google Scholar

Braun, V., and Clarke, V. (2006). Using thematic analysis in psychology. *Qual. Res. Psychol.* 3, 77–101. doi: 10.1191/1478088706qp063oa

CrossRef Full Text | Google Scholar

Buzsáki, G., and Moser, E. I. (2013). Memory, navigation and theta rhythm in the hippocampal-entorhinal system. *Nat. Neurosci.* 16, 130–138. doi: 10.1038/nn.3304

PubMed Abstract | CrossRef Full Text | Google Scholar

Carbonaro, T. M., and Gatch, M. B. (2016). Neuropharmacology of N,N-dimethyltryptamine. *Brain Res. Bull.* 126, 74–88. doi: 10.1016/j.brainresbull.2016.04.016

PubMed Abstract | CrossRef Full Text | Google Scholar

Carhart-Harris, R. (2007). Waves of the unconscious: the neurophysiology of dreamlike phenomena and its implications for the psychodynamic model of the mind. *Neuropsychoanalysis* 9, 183–211. doi: 10.1080/15294145.2007.10773557

CrossRef Full Text | Google Scholar

Carhart-Harris, R. L. (2019). How do psychedelics work? *Curr. Opin. Psychiatry* 32, 16–21. doi: 10.1097/YCO.0000000000000467

PubMed Abstract | CrossRef Full Text | Google Scholar

Carhart-Harris, R. L., Erritzoe, D., Haijen, E., Kaelen, M., and Watts, R. (2018). Psychedelics and connectedness. *Psychopharmacology* 235, 547–550. doi: 10.1007/s00213-017-4701-y

PubMed Abstract | CrossRef Full Text | Google Scholar

Carhart-Harris, R. L., and Friston, K. J. (2010). The default-mode, ego-functions and free-energy: a neurobiological account of Freudian ideas. *Brain* 133, 1265–1283. doi: 10.1093/brain/awq010

PubMed Abstract | CrossRef Full Text | Google Scholar

Carhart-Harris, R. L., and Friston, K. J. (2019). REBUS and the anarchic brain: toward a unified model of the brain action of psychedelics. *Pharmacol. Rev.* 71, 316–344. doi: 10.1124/pr.118.017160

PubMed Abstract | CrossRef Full Text | Google Scholar

Carhart-Harris, R. L., Leech, R., Erritzoe, D., Williams, T. M., Stone, J. M., Evans, J., et al. (2013). Functional connectivity measures after psilocybin inform a novel hypothesis of early psychosis. *Schizophr. Bull.* 39, 1343–1351. doi: 10.1093/schbul/sbs117

PubMed Abstract | CrossRef Full Text | Google Scholar

Carhart-Harris, R. L., Leech, R., Hellyer, P. J., Shanahan, M., Feilding, A., Tagliazucchi, E., et al. (2014). The entropic brain: a theory of conscious states informed by neuroimaging research with psychedelic drugs. *Front. Hum. Neurosci.* 8, 1–22. doi: 10.3389/fnhum.2014.00020

PubMed Abstract | CrossRef Full Text | Google Scholar

Cassol, H., Martial, C., Annen, J., Martens, G., Charland-Verville, V., Majerus, S., et al. (2019). A systematic analysis of distressing near-death experience accounts. *Memory* 27, 1122–1129. doi: 10.1080/09658211.2019.1626438

PubMed Abstract | CrossRef Full Text | Google Scholar

Corbin (2010). *Spirituality in the Laboratory: Neotiating the Politics of Knowledge in the Psychedelic Sciences* (Doctoral thesis). University of Maryland. Available online at: https://drum.lib.umd.edu/bitstream/handle/1903/10853/Corbin_umd_0117E_11507.pdf?sequence=1andisAllowed=y (accessed January 25, 2023).

Google Scholar

Cormier, Z. (2018). *DMT Is the Drug for Our Collective Crisis of Meaning – Zoe Cormier [online]. zoecormier.com*. Available online

at: http://zoecormier.com/2018/10/30/dmt-is-the-drug-for-our-collective-crisis-of-meaning/ (accessed April 5, 2022).

Google Scholar

Cott, C., and Rock, A. (2008). Phenomenology of N,N-dimethyltryptamine use : a thematic analysis. *J. Sci. Explorat.* 22, 359–370.

Google Scholar

Damasio, A. (2021). *Feeling and Knowing: Making Minds Conscious*. New York City, NY: Pantheon.

PubMed Abstract | Google Scholar

Davis, A. K., Barrett, F. S., and Griffiths, R. R. (2020b). Psychological flexibility mediates the relations between acute psychedelic effects and subjective decreases in depression and anxiety. *J. Context. Behav. Sci.* 15, 39–45. doi: 10.1016/j.jcbs.2019.11.004

PubMed Abstract | CrossRef Full Text | Google Scholar

Davis, A. K., Barrett, F. S., So, S., Gukasyan, N., Swift, T. C., and Griffiths, R. R. (2021). Development of the psychological insight questionnaire among a sample of people who have consumed psilocybin or LSD. *J. Psychopharmacol*. 35, 437–446. doi: 10.1177/0269881120967878

PubMed Abstract | CrossRef Full Text | Google Scholar

Davis, A. K., Clifton, J. M., Weaver, E. G., Hurwitz, E. S., Johnson, M. W., and Griffiths, R. R. (2020a). Survey of entity encounter experiences occasioned by inhaled N,N-dimethyltryptamine: phenomenology, interpretation, and enduring effects. *J. Psychopharmacol.* 34, 1008–1020. doi: 10.1177/0269881120916143

PubMed Abstract | CrossRef Full Text | Google Scholar

Dean, J. G. (2018). Indolethylamine-N-methyltransferase polymorphisms: genetic and biochemical approaches for study of endogenous N, N,-dimethyltryptamine. *Front. Neurosci.* 12, 232. doi: 10.3389/fnins.2018.00232

PubMed Abstract | CrossRef Full Text | Google Scholar

Dean, J. G., Liu, T., Huff, S., Sheler, B., Barker, S. A., Strassman, R. J., et al. (2019). Biosynthesis and extracellular concentrations of N,N-dimethyltryptamine (DMT) in mammalian brain. *Sci. Rep.* 9, 1–11. doi: 10.1038/s41598-019-45812-w

PubMed Abstract | CrossRef Full Text | Google Scholar

Dos Santos, R. G., Sanches, R. F., Osório, F. D. L., and Hallak, J. E. C. (2018). Long-term effects of ayahuasca in patients with recurrent depression: a 5-year qualitative follow-up. *Rev. Psiquiatr. Clin.* 45, 22–24. doi: 10.1590/0101-60830000000149

CrossRef Full Text | Google Scholar

Doss, M. K., May, D. G., Johnson, M. W., Clifton, J. M., Hedrick, S. L., Prisinzano, T. E., et al. (2020). The acute effects of the atypical dissociative hallucinogen salvinorin A on functional connectivity in the human brain. *Sci. Rep.* 10, 1–12. doi: 10.1038/s41598-020-73216-8

PubMed Abstract | CrossRef Full Text | Google Scholar

D'Souza, D. (2021). *Fixed Order, Open-Label, Dose-Escalation Study of DMT in Humans (NCT04711915). ClinicalTrials.gov*. Available online at: https://clinicaltrials.gov/ct2/show/NCT04711915?term=d%27souza+dmtanddraw=2andrank=1 (accessed February 12, 2021).

Google Scholar

Erritzoe, D., Roseman, L., Nour, M. M., MacLean, K., Kaelen, M., Nutt, D. J., et al. (2018). Effects of psilocybin therapy on personality structure. *Acta Psychiatr. Scand.* 138, 368–378. doi: 10.1111/acps.12904

PubMed Abstract | CrossRef Full Text | Google Scholar

Family, N., Maillet, E. L., Williams, L. T. J., Krediet, E., Carhart-Harris, R. L., Williams, T. M., et al. (2020). Safety, tolerability, pharmacokinetics, and pharmacodynamics of low dose lysergic acid diethylamide (LSD) in healthy older volunteers. *Psychopharmacology* 237, 841–853. doi: 10.1007/s00213-019-05417-7

PubMed Abstract | CrossRef Full Text | Google Scholar

First, M., Williams, J., Spitzer, R., and Gibbon, M. (2007). *Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Clinical Trials Version (SCID-CT)*. New York, NY: Biometrics Research, New York State Psychiatric Institute.

Google Scholar

Gallimore, A. R., and Strassman, R. J. (2016). A model for the application of target-controlled intravenous infusion for a prolonged immersive DMT psychedelic experie. *Front. Pharmacol.* 7, 1–11. doi: 10.3389/fphar.2016.00211

PubMed Abstract | CrossRef Full Text | Google Scholar

Gandy, S. (2017). Dying to live: the power of transcendence in the treatment of existential anxiety. *J. Interdiscipl. Conscious. Stud.* 1, 25–36.

Google Scholar

Gashi, L., Sandberg, S., and Pedersen, W. (2021). Making “bad trips” good: how users of psychedelics narratively transform challenging trips into valuable experiences. *Int. J. Drug Policy* 87, 102997. doi: 10.1016/j.drugpo.2020.102997

PubMed Abstract | CrossRef Full Text | Google Scholar

Gilligan, J. (2021). *Open-label Study to Assess the Safety and Efficacy of TRP-8802 With Psychotherapy in Adult Participants With Fibromyalgia (NCT05128162)*. ClinicalTrials.gov. Available online at: https://www.clinicaltrials.gov/ct2/show/NCT05128162?term=psychedelicandcond=Fibromyalgiaanddraw=2andrank=1 (accessed April 8, 2022).

Google Scholar

Grof, S. (1973). Theoretical and empirical basis of transpersonal psychology and psychotherapy: observations from LSD research - ProQuest. *J. Transpers. Psychol.* 5, 15–53.

Google Scholar

Haijen, E. C. H. M., Kaelen, M., Roseman, L., Timmermann, C., Kettner, H., Russ, S., et al. (2018). Predicting responses to psychedelics: a prospective study. *Front. Pharmacol.* 9, 897. doi: 10.3389/fphar.2018.00897

PubMed Abstract | CrossRef Full Text | Google Scholar

Halberstadt, A. L., Nichols, D. E., and Vollenweider, F. X. (2017). *Behavioral Neurobiology of Psychedelic Drugs*. Available online at: http://www.springer.com/series/7854 (accessed September 1, 2022).

Google Scholar

Hancock, G. (2005). *Supernatural: Meetings With the Ancient Teachers of Mankind*. London: Century.

Google Scholar

Hartogsohn, I. (2016). Set and setting, psychedelics and the placebo response: an extra-pharmacological perspective on psychopharmacology. *J. Psychopharmacol.* 30, 1259–1267. doi: 10.1177/0269881116677852

PubMed Abstract | CrossRef Full Text | Google Scholar

Hayes, S. C., and Wilson, K. G. (2017). Acceptance and commitment therapy: altering the verbal support for experiential avoidance. *Behav. Anal.* 17, 289–303. doi: 10.1007/BF03392677

PubMed Abstract | CrossRef Full Text | Google Scholar

Hendricks, P. (2021). *Psilocybin-facilitated Treatment for Chronic Pain (NCT05068791). ClinicalTrials.gov*. Available online at: https://www.clinicaltrials.gov/ct2/show/NCT05068791?term=psychedelicandcond=Fibromyalgiaanddraw=2andrank=4 (accessed April 8, 2022).

Google Scholar

Hill, S. (2019). *Confrontation With the Unconscious: Jungian Depth Psychology and Psychedelic Experience*. London: Aeon Books.

Google Scholar

Hillman, J. (1979). *The Dream and the Underworld.* New York, NY: Harper and Row, New York.

Google Scholar

Jans-Beken, L., Jacobs, N., Janssens, M., Peeters, S., Reijnders, J., Lechner, L., et al. (2020). Gratitude and health: an updated review. *J. Posit. Psychol.* 15, 743–782. doi: 10.1080/17439760.2019.1651888

CrossRef Full Text | Google Scholar

Johnson, M. W., Richards, W. A., and Hopkins, J. (2008). Human hallucinogen research: guidelines for safety. *J. Psychopharmacol.* 22, 603–620. doi: 10.1177/0269881108093587

PubMed Abstract | CrossRef Full Text | Google Scholar

Kaelen, M., Roseman, L., Kahan, J., Santos-Ribeiro, A., Orban, C., Lorenz, R., et al. (2016). LSD modulates music-induced imagery via changes in parahippocampal connectivity. *Eur. Neuropsychopharmacol.* 26, 1099–1109. doi: 10.1016/j.euroneuro.2016.03.018

PubMed Abstract | CrossRef Full Text | Google Scholar

Kastrup, B. (2016). The physicalist worldview as neurotic ego-defense mechanism. *SAGE Open* 6, 2158244016674515. doi: 10.1177/2158244016674515

CrossRef Full Text | Google Scholar

Keel, J. A. (1970). *UFO's: Operation Trojan Horse*. New York, NY: Putnam.

Google Scholar

Kettner, H., Rosas, F. E., Timmermann, C., and Kärtner, L. (2021). Psychedelic communitas : intersubjective experience during psychedelic group sessions predicts enduring changes in psychological wellbeing and social connectedness. *Front. Pharmacol.* 12, 1–20. doi: 10.3389/fphar.2021.623985

PubMed Abstract | CrossRef Full Text | Google Scholar

Koch, C. (2019). *The Feeling of Life Itself: Why Consciousness is Widespread But Can't Be Computed*. Cambridge, MA: Mit Press.

Google Scholar

Kripal, J. (2022). “Biological gods: science (fiction) and some emergent mythologies,” in *DMT Entity Encounters: Dialogues on the Spirit Molecule*, eds D. Luke, and R. Spowers (Rochester, VT: Park Street Press).

Google Scholar

Kuypers, K. P. C., Riba, J., de la Fuente Revenga, M., Barker, S., Theunissen, E. L., and Ramaekers, J. G. (2016). Ayahuasca enhances creative divergent thinking while decreasing conventional convergent thinking. *Psychopharmacology* 233, 3395–3403. doi: 10.1007/s00213-016-4377-8

PubMed Abstract | CrossRef Full Text | Google Scholar

Lebedev, A. V., Lövdén, M., Rosenthal, G., Feilding, A., Nutt, D. J., and Carhart-Harris, R. L. (2015). Finding the self by losing the self: Neural correlates of ego-dissolution under psilocybin. *Hum. Brain Map.* 36, 3137–3153. doi: 10.1002/hbm.22833

PubMed Abstract | CrossRef Full Text | Google Scholar

Liechti, M., and Ley, L. (2020). *Effects of Dimethyltryptamine in Healthy Subjects (NCT04353024)*. ClinicalTrials.gov. Available online at: https://clinicaltrials.gov/ct2/show/NCT04353024?term=liechti+dmtanddraw=2andrank=1 (accessed February 12, 2021).

Google Scholar

Luke, D. (2012). Psychoactive substances and paranormal phenomena: a comprehensive review anomalistic psychology view project breaking convention view project. *Int. J. Transpers. Stud.* 1. doi: 10.24972/ijts.2012.31.1.97

CrossRef Full Text | Google Scholar

Luke, D. (2013). Ecopsychology and the psychedelic experience. *Eur. J. Ecopsychol.* 4, 1–8.

Google Scholar

Luke, D. (2017). *Otherworlds: Psychedelics and Exceptional Human Experience*. London: Muswell Hill Press.

Google Scholar

Luke, D. (2020). Anomalous psychedelic experiences: at the neurochemical juncture of the humanistic and parapsychological. *J. Human. Psychol.* 62, 257–297. doi: 10.1177/0022167820917767

CrossRef Full Text | Google Scholar

Luke, D., and Spowers, R. (2018). *DMT Dialogues: Encounters with the Spirit Molecule*. Rochester, VT: Park Street Press.

Google Scholar

Luke, D., and Spowers, R. (2022). *DMT Entity Encounters: Dialogues on the Spirit Molecule*. Rochester, VT: Park Street Press.

Google Scholar

Luke, D. P., Lungu, L., Friday, R., and Terhune, D. B. (2022). The chemical induction of synaesthesia. *Human Psychopharmacol. Clin. Exp.* 37, e2832. doi: 10.31234/osf.io/s6eh3

CrossRef Full Text | Google Scholar

Luna, L. E. (2022). “On encounters with entities in the ayahuasca realm. A phenomenological view” in *DMT Entity Encounters: Dialogues on the Spirit Molecule*, eds D. Luke and R. Spowers (Rochester, VT: Park Street Press).

Google Scholar

Lutkajtis, A. (2020). Entity encounters and the therapeutic effect of the psychedelic mystical experience. *J. Psyched. Stud.* 4, 171–178. doi: 10.1556/2054.2020.00143

PubMed Abstract | CrossRef Full Text | Google Scholar

Lyke, J. (2019). *DMT and Entities: Not Everyone Gets Machine Elves | Jennifer A. Lyke - YouTube*. Available online at: https://www.youtube.com/watch?v=bWTT4778IIQ

Google Scholar

Mack, J. E. (1994). *Abduction: Human Encounters With Aliens*. New York, NY: Scribner's.

Google Scholar

Mack, J. E. (2000). *Passport to the Cosmos: Human Transformation and Alien Encounters*. CA: Three Rivers Press.

Google Scholar

Mack, J. E. (2011). *The Alien Abduction Experience - Budd Hopkins and John Mack, MD*. UFOTV On Demand. Available online at: https://www.youtube.com/watch?v=L9SJUowifik (accessed July 14, 2020).

Google Scholar

Martial, C., Cassol, H., Laureys, S., and Gosseries, O. (2020). Near-death experience as a probe to explore (disconnected) consciousness. *Trends Cogn. Sci.* 24, 173–183. doi: 10.1016/j.tics.2019.12.010

PubMed Abstract | CrossRef Full Text | Google Scholar

Martial, C., Mensen, A., Charland-Verville, V., Vanhaudenhuyse, A., Rentmeister, D., Bahri, M. A., et al. (2019). Neurophenomenology of near-death experience memory in hypnotic recall: a within-subject EEG study. *Sci. Rep.* 9, 1–11. doi: 10.1038/s41598-019-50601-6

PubMed Abstract | CrossRef Full Text | Google Scholar

Meyer, P. (1992). “Apparent communication with discarnate entities induced by dimethyltryptamine (DMT),” in *Psychedelic Monographs and Essays, Volume 6*, ed L.

Thomas. Available online at: https://www.serendipity.li/dmt/dmtart06.html (accessed February 12, 2021).

Google Scholar

Michael (2022b, August 31-September 4). *A Marriage of Heaven and Hell: Oneness in Psychedelic and Near-Death Experiences*. Salt Lake City, UT: IANDS Conference: Timeless Oneness.

Google Scholar

Michael, P. (2022a). “The death-trip: a case study of psilocybin's simulation of the phenomenology and long-term changes of the near-death experience,” in *Breaking Convention: A Seismic Shift in Psychedelia*, eds A. Tollen, N. Wyrd, and H. Wells, et al. (Strange Attractor Press).

Google Scholar

Michael, P., Luke, D., and Robinson, O. (2021). An encounter with the other: a thematic and content analysis of DMT experiences from a naturalistic field study. *Front. Psychol.* 12, 720717. doi: 10.3389/fpsyg.2021.720717

PubMed Abstract | CrossRef Full Text | Google Scholar

Michael, P., Luke, D., and Robinson, O. (2023). *An Encounter With Death: A Content Analysis of the DMT Experience From a Naturalistic Study and Comparison With the Near-death Experience*. Available online at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4362174 (accessed February 22, 2023).

Google Scholar

Montenegro, R. (2015). The out-of-body experience - an experiential anthology. *J. Except. Exp. Psychol.* 62.

Google Scholar

Moreton, S. G., Szalla, L., Menzies, R. E., and Arena, A. F. (2020). Embedding existential psychology within psychedelic science: reduced death anxiety as a mediator of the therapeutic effects of psychedelics. *Psychopharmacology* 237, 21–32. doi: 10.1007/s00213-019-05391-0

PubMed Abstract | CrossRef Full Text | Google Scholar

Moulin, C. (2017). The cognitive neuropsychology of déjà vu. *Cogn. Neuropsychol.* 1–200. doi: 10.4324/9781315524931

CrossRef Full Text | Google Scholar

Murphy-Beiner, A., and Soar, K. (2020). Ayahuasca's ‘afterglow’: improved mindfulness and cognitive flexibility in ayahuasca drinkers. *Psychopharmacology* 237, 1161–1169. doi: 10.1007/s00213-019-05445-3

PubMed Abstract | CrossRef Full Text | Google Scholar

Narby, J. (2022). “Amazonian perspectives on invisible entities,” in *DMT Entity Encounters: Dialogues on the Spirit Molecule*, eds D. Luke and R. Spowers (Rochester, VT: Park Street Press).

Google Scholar

Nayak, S. M., and Griffiths, R. R. (2022). A single belief-changing psychedelic experience is associated with increased attribution of consciousness to living and non-living entities. *Front. Psychol.* 13, 1035. doi: 10.3389/fpsyg.2022.852248

PubMed Abstract | CrossRef Full Text | Google Scholar

Palamar, J. J., and Le, A. (2018). Trends in DMT and other tryptamine use among young adults in the United States. *Am. J. Addict.* 27, 578–585. doi: 10.1111/ajad.12803

PubMed Abstract | CrossRef Full Text | Google Scholar

Palhano-Fontes, F., Andrade, K. C., Tofoli, L. F., Jose, A. C. S., Crippa, A. S., Hallak, J. E. C., et al. (2015). The psychedelic state induced by ayahuasca modulates the activity and connectivity of the default mode network. *PLoS ONE* 10, e0118143. doi: 10.1371/journal.pone.0118143

PubMed Abstract | CrossRef Full Text | Google Scholar

Pallavicini, C., Cavanna, F., Zamberlan, F., de la Fuente, L. A., Perl, Y. S., Arias, M., et al. (2020). Neural and subjective effects of inhaled DMT in natural settings. *bioRxiv* 1–39. doi: 10.1101/2020.08.19.258145

PubMed Abstract | CrossRef Full Text | Google Scholar

Petitmengin, C. (2006). Describing one's subjective experience in the second person: an interview method for the science of consciousness. *Phenomenol. Cogn. Sci.* 5, 229–269. doi: 10.1007/s11097-006-9022-2

CrossRef Full Text | Google Scholar

Pink-Hashkes, S., van Rooij, I., and Kwisthout, J. (2017). Perception is in the details: a predictive coding account of the psychedelic phenomenon. *CogSci* 26–29.

Google Scholar

Pratte (2021). *Wellbeing Impacts and Clinical Implications of Near-Death Experiences* (doctoral thesis). University of Northampton. Available online at: https://www.researchgate.net/publication/359176426_Wellbeing_Impacts_and_Clinical_Implications_of_Near-Death_Experiences (accessed January 25, 2023).

Google Scholar

Ring, K., and Cooper, S. (2008). *Mindsight: Near-Death and Out-of-Body Experiences in the Blind.* Bloomington, IND: iUniverse.

Google Scholar

Rodrigues, A. V. S. L., Almeida, F. J., and Vieira-Coelho, M. A. (2019). Dimethyltryptamine: endogenous role and therapeutic potential. *J. Psychoact. Drugs* 51, 299–310. doi: 10.1080/02791072.2019.1602291

PubMed Abstract | CrossRef Full Text | Google Scholar

Roseman, L., Haijen, E., Idialu-Ikato, K., Kaelen, M., Watts, R., and Carhart-Harris, R. (2019). Emotional breakthrough and psychedelics: validation of the emotional breakthrough inventory. *J. Psychopharmacol*. 33, 1076–1087. doi: 10.1177/0269881119855974

PubMed Abstract | CrossRef Full Text | Google Scholar

Roseman, L., Nutt, D. J., and Carhart-Harris, R. L. (2018). Quality of acute psychedelic experience predicts therapeutic efficacy of psilocybin for treatment-resistant depression. *Front. Pharmacol.* 8, 974. doi: 10.3389/fphar.2017.00974

PubMed Abstract | CrossRef Full Text | Google Scholar

Roseman, L., Ron, Y., Saca, A., Ginsberg, N., Luan, L., and Marcus, O. (2021). Relational processes in ayahuasca groups of Palestinians and Israelis. *Front. Pharmacol.* 12, 1–18. doi: 10.3389/fphar.2021.607529

PubMed Abstract | CrossRef Full Text | Google Scholar

Russ, S. L., Carhart-Harris, R. L., Maruyama, G., and Elliott, M. S. (2019). States and traits related to the quality and consequences of psychedelic experiences. *Psychol. Conscious. Theory Res. Pract.* 6, 1–21. doi: 10.1037/cns0000169

CrossRef Full Text | Google Scholar

Sai-Halasz, A., Brunecker, G., and Szara, S. (1958). Dimethyltryptamine, a new psychotogenic agent. *Psychiatr. Neurol.* 135, 258–301. doi: 10.1159/000131921

CrossRef Full Text | Google Scholar

Scarpelli, S., Bartolacci, C., D'Atri, A., Gorgoni, M., and De Gennaro, L. (2019). The functional role of dreaming in emotional processes. *Front. Psychol.* 10, 459. doi: 10.3389/fpsyg.2019.00459

PubMed Abstract | CrossRef Full Text | Google Scholar

Scheidegger, M. (2021). *Neurodynamics of Prosocial Emotional Processing Following Serotonergic Stimulation With N,N-Dimethyltryptamine (DMT) and Harmine in Healthy Subjects* (NCT04716335). ClinicalTrials.gov. Available online at: https://clinicaltrials.gov/ct2/show/NCT04716335?term=scheidegger+dmtanddraw=2andrank=1 (accessed February 12, 2021).

Google Scholar

Seth, A. (2021). *Being You: A New Science of Consciousness*. London: Penguin.

Google Scholar

Shushan, G. (2009). *Conceptions of the Afterlife in Early Civilizations: Universalism, Constructivism and Near-Death Experience*. London: AandC Black.

Google Scholar

Shushan, G. (2018). *Near-Death Experience in Indigenous Religions*. Oxford: Oxford University Press.

Google Scholar

Simonsson, O., Hendricks, P. S., Chambers, R., Osika, W., and Goldberg, S. B. (2023). Prevalence and associations of challenging, difficult or distressing experiences using classic psychedelics. *J. Affect. Disord*. 326, 105–110. doi: 10.1016/j.jad.2023.01.073

PubMed Abstract | CrossRef Full Text | Google Scholar

Small Pharma (2023). *Small Pharma Reports Positive Top-Line Results From Phase IIa trial of SPL026 in Major Depressive Disorder*. Available online at: https://smallpharma.com/press-releases/positive-topline-results-from-phase-iia-trial-of-spl026-in-major-depressive-disorder/ (accessed January 25, 2023).

Google Scholar

Smith, C. (2021). *The Cutting Edge of Psychedelic Science (06/05/21) - Oxford Psychedelic Society*. Available online at: https://www.youtube.com/watch?v=AdvDYXzh-qc (accessed April 13, 2022).

Google Scholar

Solms, M., and Friston, K. (2018). How and why consciousness arises: some considerations from physics and physiology. *J. Conscious. Stud.* 25, 202–238.

Google Scholar

Stein, D. J. (2001). Comorbidity in generalized anxiety disorder: impact and implications. *J. Clin. Psychiatry* 62, 29–36.

PubMed Abstract | Google Scholar

Steiner, J., Erritzoe, D., and Boyce, M. (2020). *SPL026 (DMT Fumarate) in Healthy Subjects and MDD Patients (NCT04673383)*. ClinicalTrials.gov. Available online at: https://clinicaltrials.gov/ct2/show/NCT04673383?term=steiner%2C+dmtanddraw=2andrank=1 (accessed February 12, 2021).

Google Scholar

Stoliker, D., Novelli, L., Vollenweider, F. X., Egan, G. F., Preller, K. H., and Razi, A. (2021). Effective connectivity of LSD-induced ego dissolution. *medRxiv*, 2021-12.

Google Scholar

Strassman, R. (2001). *DMT: The Spirit Molecule: A Doctor's Revolutionary Research Into the Biology of Near-Death and Mystical Experiences*. Rochester, VT: Park Street Press.

Google Scholar

Strassman, R., Wojtowicz, S., Luna, L., and Frecska, E. (2008). *Inner Paths to Outer Space: Journeys to Alien Worlds Through Psychedelics and Other Spiritual Technologies*. New York, NY: Simon and Schuster.

Google Scholar

Strassman, R. J., Qualls, C. R., Uhlenhuth, E. H., and Kellner, R. (1994). Dose-response study of N,N-dimethyltryptamine in humans: II. subjective effects and preliminary results of a new rating scale. *Arch. Gen. Psychiatry* 51, 98–108. doi: 10.1001/archpsyc.1994.03950020022002

PubMed Abstract | CrossRef Full Text | Google Scholar

Strieber, W., and Kripal, J. J. (2016). *The Super Natural: A New Vision of the Unexplained*. New York City, NY: Jeremy P. Tarcher-Penguin.

Google Scholar

Tagliazucchi, E., Roseman, L., Kaelen, M., Orban, C., Muthukumaraswamy, S. D., Murphy, K., et al. (2016). increased global functional connectivity correlates with LSD-induced ego dissolution. *Curr. Biol.* 26, 1043–1050. doi: 10.1016/j.cub.2016.02.010

PubMed Abstract | CrossRef Full Text | Google Scholar

Timmermann, C. (2017). *Brain Activity and Extraordinary Experiences Induced by DMT*. London: UCL Society for the Application of Psychedelics.

Google Scholar

Timmermann, C. (2019). *The Neuroscience of DMT: Imperial College Research*. London: The Experimental Thought Co.

Google Scholar

Timmermann, C., Kettner, H., Letheby, C., Roseman, L., Rosas, F. E., and Carhart-Harris, R. L. (2021). Psychedelics alter metaphysical beliefs. *Sci. Rep.* 11, 1–13. doi: 10.1038/s41598-021-01209-2

PubMed Abstract | CrossRef Full Text | Google Scholar

Timmermann, C., Roseman, L., Schartner, M., Milliere, R., Williams, L. T. J., Erritzoe, D., et al. (2019). Neural correlates of the DMT experience assessed with multivariate EEG. *Sci. Rep.* 9, 1–13. doi: 10.1038/s41598-019-51974-4

PubMed Abstract | CrossRef Full Text | Google Scholar

Timmermann, C., Roseman, L., Williams, L., Erritzoe, D., Martial, C., Cassol, H., et al. (2018). DMT models the near-death experience. *Front. Psychol.* 9, 1–12. doi: 10.3389/fpsyg.2018.01424

PubMed Abstract | CrossRef Full Text | Google Scholar

Timmermann, C., Watts, R., and Dupuis, D. (2022). Towards psychedelic apprenticeship: developing a gentle touch for the mediation and validation of psychedelic-induced insights and revelations. *Transcult. Psychiatry* 59, 691–704. doi: 10.31234/osf.io/j5768

PubMed Abstract | CrossRef Full Text | Google Scholar

Turner, W., and Merlis, S. (1959). Effect of Some Indolealkylamines on Man. *Arch. Neurol. Psychiatry* 81, 121–129. doi: 10.1001/archneurpsyc.1959.02340130141020

PubMed Abstract | CrossRef Full Text | Google Scholar

Uthaug, M. V., Lancelotta, R., van Oorsouw, K., Kuypers, K. P. C., Mason, N., Rak, J., et al. (2019). A single inhalation of vapor from dried toad secretion containing 5-methoxy-N,N-dimethyltryptamine (5-MeO-DMT) in a naturalistic setting is related to sustained enhancement of satisfaction with life, mindfulness-related capacities, and a decrement of psyc. *Psychopharmacology* 236, 2653–2666. doi: 10.1007/s00213-019-05236-w

PubMed Abstract | CrossRef Full Text | Google Scholar

van Heugten-van der Kloet, D., and Lynn, S. J. (2020). Dreams and dissociation—commonalities as a basis for future research and clinical innovations. *Front. Psychol.* 11, 745. doi: 10.3389/fpsyg.2020.00745

PubMed Abstract | CrossRef Full Text | Google Scholar

Van Lommel, P., Van Wees, R., Meyers, V., and Elfferich, I. (2001). Near-death experience in survivors of cardiac arrest: a prospective study in the Netherlands. *Lancet.* 358, 2039–2045. doi: 10.1016/S0140-6736(01)07100-8

PubMed Abstract | CrossRef Full Text | Google Scholar

Varela, F. J., and Shear, J. (1999). First-person methodologies: what, why, how? *J. Conscious. Stud.* 6, 1–14.

Google Scholar

Watts, A. (1989). *The Book: On the Taboo Against Knowing Who You Are*. New York City, NY: Randomhouse.

Google Scholar

Watts, R., Day, C., Krzanowski, J., Nutt, D., and Carhart-Harris, R. (2017). Patients' accounts of increased “connectedness” and “acceptance” after psilocybin for treatment-resistant depression. *J. Human. Psychol.* 57, 520–564. doi: 10.1177/0022167817709585

CrossRef Full Text | Google Scholar

Watts, R., and Luoma, J. B. (2020). The use of the psychological flexibility model to support psychedelic assisted therapy. *J. Context. Behav. Sci.* 15, 92–102. doi: 10.1016/j.jcbs.2019.12.004

CrossRef Full Text | Google Scholar

Whitfield, H. J. (2021). A spectrum of selves reinforced in multilevel coherence: a contextual behavioural response to the challenges of psychedelic-assisted therapy development. *Front. Psychiatry* 12, 1–19. doi: 10.3389/fpsyt.2021.727572

PubMed Abstract | CrossRef Full Text | Google Scholar

Williams, G. V., Rao, S. G., and Goldman-Rakic, P. S. (2002). The physiological role of 5-HT2A receptors in working memory. *J. Neurosci.* 22, 2843–2854. doi: 10.1523/JNEUROSCI.22-07-02843.2002

PubMed Abstract | CrossRef Full Text | Google Scholar

Winstock, A. R., Kaar, S., and Borschmann, R. (2014). Dimethyltryptamine (DMT): prevalence, user characteristics and abuse liability in a large global sample. *J. Psychopharmacol.* 28, 49–54. doi: 10.1177/0269881113513852

PubMed Abstract | CrossRef Full Text | Google Scholar

Wittmann, M., Carter, O., Hasler, F., Cahn, B. R., Grimberg, U., Spring, P., et al. (2007). Effects of psilocybin on time perception and temporal control of behaviour in humans. *J. Psychopharmacol.* 21, 50–64.

PubMed Abstract | Google Scholar

Yalom, I. D. (1980). *Existential Psychotherapy*. New York, NYNY: Basic Books.

Google Scholar

Yanakieva, S., Polychroni, N., Family, N., Williams, L. T. J., Luke, D. P., and Terhune, D. B. (2019). The effects of microdose LSD on time perception: a randomised, double-blind, placebo-controlled trial. *Psychopharmacology* 236, 1159–1170. doi: 10.1007/s00213-018-5119-x

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Personality traits and pattern of beliefs of near-death(-like) experiencers


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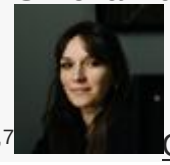
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Introduction: Little is known about the potential personality and psychological predictors of near-death experiences (NDEs), and fewer yet those of near-death-like experiences (NDEs-like; similar phenomenology reported after a non-life-threatening context). This study investigated whether personality traits (Openness, Extraversion, Pleasantness, Conscientiousness, and Neuroticism), dissociative experiences, Fantasy proneness, disposition toward auditory hallucinations, absorption trait, and endorsement of paranormal and spiritual beliefs could be associated with the recall of NDEs(-like).

Methods: To this aim, we invited four groups of people to retrospectively fill in questionnaires assessing the following factors: NDE experiencers (*n* = 63), NDE(-like) experiencers (*n* = 31), controls with a life-threatening situation but no NDE(-like) (*n* = 43), and controls without a life-threatening situation or an NDE(-like) (*n* = 44). We carried out univariate analyses for each factor and then performed a multiple regression analysis and a discriminant analysis.

Results: The multivariate logistic regression analysis revealed that the endorsement of spiritual beliefs was associated with the recall of NDEs-like while Openness and Fantasy proneness were associated with the recall of NDEs. The discriminant analysis showed that these variables produce 35% of correct classification.

Discussion: Albeit retrospective, these results pave the way for future research on psychological predictors of NDEs(-like) by highlighting the influence of Spirituality, Openness, and Fantasy proneness on these phenomena.

1. Introduction

When people experience a near-death incident, disconnected consciousness can sometimes emerge in the form of dream-like experiences (Martial et al., 2020a). We call them *near-death experiences* (NDEs) if certain prototypical mystical features are present, such as out-of-body experiences, entering a gateway (e.g., a tunnel), and meeting entities (Martial et al., 2020b). **In parallel, numerous subjective experiences closely resembling NDEs have been reported by people in various non-life-threatening situations, such as syncope (Lempert et al., 1994), consumption of recreational drugs (Martial et al., 2019), meditation (Van Gordon et al., 2018), and intense grief (Kelly, 2001). They have been termed "*near-death-like experiences*" (NDEs-like). Up to now, there is no empirical**

study indicating that the phenomenology of NDEs and NDEs-like differs (Charland-Verville et al., 2014).

In theory, every human could experience them, but empirical studies indicate an incidence of 10–23% in cardiac arrest survivors (van Lommel et al., 2001; Schwaninger et al., 2002; Greyson, 2003) and 4–8% in the general population (Knoblauch et al., 2001; Perera et al., 2005). **Previous research on personality and cognitive profile showed that most individuals reporting an NDE do not present deficits in global cognitive functioning (Greyson, 2003) or specific pathological disorder (Gabbard and Twemlow, 1984; Greyson, 1997; Facco and Agrillo, 2012). Moreover, the occurrence of NDEs does not appear to be influenced by factors, such as educational level, social class, marital status (Wilson and Barber, 1982; Roberts and Owen, 1988; Zhi-ying and Jian-xun, 1992; van Lommel et al., 2001; Schwaninger et al., 2002; Greyson, 2003), state anxiety, neuroticism, or extroversion (Locke and Shontz, 1983). Nevertheless, the existing literature interviewing NDE(-like) experiencers (NDErs[-like]) suggests that some particular cognitive and personality factors may play a role in the generation (or, at least, the recall) of an NDE(-like). Notably, several types of research led by Greyson identified some variables, such as a higher proportion of purportedly psychic experiences (i.e., extrasensory perceptions, paranormal experiences such as *déjà vu*) (Greyson, 2003) and a tendency for (non-pathological) dissociative experiences (Greyson, 2000), in NDE experiencers (NDErs) compared with controls. More recently, Martial et al. (2018a) found a higher engagement in fantasy (i.e., Fantasy proneness) in NDErs-like as compared with control volunteers (without a life-threatening situation) but not in classical NDErs as compared with a control group of people who experienced a life-threatening situation without the recall of an NDE. In the same vein,*** Greyson and Liester (2004) found that in a sample of 73 interviewed NDErs, 80% reported auditory hallucinations (i.e., voices) after their NDE and 20% reported auditory hallucinations both before and after their NDE. They also noted that respondents reporting subsequent hallucinations are individuals who describe more elaborate NDEs [i.e., scoring very high on the Greyson NDE Scale (Greyson, 1983)]. In parallel, Twemlow and Gabbard (1985) found that NDErs scored higher on a measure of absorption [i.e., the propensity to focus attention on imaginative and selected sensory experiences to the exclusion of stimuli in the external environment (Tellegen and Atkinson, 1974)] than a group of people reporting "only" an out-of-body experience (Twemlow and Gabbard, 1985). More recently, a trend toward absorption predicting N,N-Dimethyltryptamine (DMT)-induced NDEs-like was demonstrated, however, the relationship did not reach significance (Timmermann et al., 2018).***nu**

A few authors have also been interested in religious beliefs in the NDE population, but the results do not show a clear link between religious orientation and NDEs' occurrence or intensity (Ring, 1980; Sabom, 1982). Indeed, when assessing whether religious orientation would influence the intensity of the NDE, Ring (1980) and Sabom (1982) could not find any convincing results. One study examined intrinsic religious beliefs in NDErs; nevertheless, no significant link between intrinsic religious beliefs and the intensity of the NDE (based on the narrative recall) was found (McLaughlin and Malony, 1984). Indirectly related to NDE, one study also found a positive correlation between endorsing paranormal beliefs, assessed by the Revised

Paranormal Belief Scale (Tobacyk, 2004), and having lived an out-of-body experience (Tobacyk and Mitchell, 1987) or premonition (Tobacyk, 1991).

Only one study examined a varied range of personality traits (introversion–extraversion, sensing–intuition, thinking–feeling, judging–perceiving, and Fantasy proneness) and beliefs (paranormal and spiritual) in NDErs by comparing them with people who believed that NDE (who never experienced one) is proof of afterlife and controls (i.e., no NDE and no belief of an afterlife as NDE) (Gow et al., 2003). The results showed that NDErs scored significantly higher on scales assessing disposition toward fantasy, paranormal beliefs, and spiritual beliefs (e.g., "During altered states, such as sleep or trances, the spirit can leave the body") as compared with controls but not people who believed that an NDE is proof of an afterlife (Gow et al., 2003). Nevertheless, this study has some limitations marked by a limited number of NDErs (n = 30), classification of participants into the different groups according to the subjective belief of participants (not Greyson NDE Scale's standardized cutoff), no inclusion of NDErs-like, and a correlational study design (Gow et al., 2003).

Altogether, previous research on personality and NDE(-like) has so far included only small sample sizes and no proper control groups (e.g., individuals who have experienced a life-threatening situation without an NDE). In addition, few studies assessed a single personality or cognitive trait in samples of NDErs, and only one study assessed various traits together. In the present study, we first looked at the different facets of the personality and beliefs of NDE(-like) experiencers by administering several standardized questionnaires, in comparison to two control groups. We aimed to explore whether any personality factors are consistently related to reporting NDE(-like). To this goal, we retrospectively compared personality traits in four groups: NDErs, NDErs-like, controls with a life-threatening situation but no NDE (controls w/LTS), and controls without a life-threatening situation (controls w/o LTS). Second, we determined whether personality differences or cognitive traits could predict membership in one of the four groups.

2. Materials and methods

2.1. Participants

NDErs(-like) were recruited from the NDErs database of the Coma Science Group (GIGA-Consciousness, University of Liège, Belgium) which includes 352 French-speaking people who claim to have experienced an NDE(-like), who gave their approval to be contacted again by providing their valid emails and/or postal addresses. All 352 people were invited to take part in the study. The presence of an NDE(-like) was identified and quantified using the Greyson NDE Scale [i.e., a cutoff score of ≥7/32; Greyson (1983)]. Participants from the control groups were recruited *via* announcements in local media. Recruitment and testing were in conformity with the local Ethics Committee of the Faculty of Medicine of the University of Liège. All participants signed informed consent in accordance with the Declaration of Helsinki and its later amendments.

2.2. Procedure

Participants were invited to take part in a study on personality *via* mailed questionnaires. It started with an introduction letter which contained all the

information of the study, followed by informed consent. Participants were then invited to respond to sociodemographic items (i.e., sex, education, and age at the interview). For NDErs(-like), we asked information concerning the context of their experience as follows: age at NDE(-like), time since NDE(-like), presence of life-threatening situation and/or of coma (i.e., loss of consciousness >1h), as well as etiology (i.e., cardiac arrest, drowning, electrocution, brain trauma, vascular accident, anesthesia/surgery, sleep, other with a medical cause [e.g., sepsis], or other without a medical cause [e.g., syncope, orgasm]). The latest information allowed us to distinguish NDEs-like from classical NDEs. Participants in the control groups were asked whether they had ever experienced a life-threatening situation and/or a coma. To evaluate the occurrence of a life-threatening situation, we asked them to refer to which type of event they had gone through (see etiology categories) if they had a period of coma and the (approximate) date of the incident. This latter information allowed us to differentiate the two control groups. Subsequently, they had to answer a battery of seven questionnaires as follows: the Big Five Inventory Questionnaire (John and Srivastava, 1999); the Dissociative Experience Scale (Bernstein and Putnam, 1986); the Creative Experiences Questionnaire (Merckelbach et al., 2001); the Launay–Slade Hallucination Scale (Larøi et al., 2004); the Tellegen Absorption Scale (Tellegen and Atkinson, 1974); the Intrinsic Religious Motivation Scale (Hoge, 1972); and the Revised Paranormal Belief Scale (Tobacyk, 2004). For NDErs(-like), the Greyson NDE Scale (Greyson, 1983) was also administered before these seven questionnaires.

The participants in this study were classified into four groups, according to whether or not they had had an NDE based on the total score of the Greyson NDE Scale (Greyson, 1983) which was due to a life-threatening situation or not. The “NDErs” group includes people who experienced an NDE (i.e., reaching the cutoff score of ≥7/32 on the Greyson NDE Scale; Greyson, 1983) in a life-threatening situation. The “NDErs-like” group includes people who experienced an NDE-like (i.e., reaching the cutoff score of ≥7/32 on the Greyson NDE Scale; Greyson, 1983) out of a life-threatening situation. The “controls w/LTS” group includes people who lived a life-threatening situation but did not recall an NDE(-like). “Controls w/o LTS” includes people who had neither a life-threatening situation nor an NDE(-like).

2.3. Materials

The *Greyson NDE Scale* (Greyson, 1983) is composed of 16 questions that assess whether a person has had a subjective experience that can be considered an NDE. This scale is divided into four subscales (cognitive, e.g., “Did time seem to speed up?”; affective, e.g., “Did you have a feeling of peace or pleasantness?”; paranormal, e.g., “Were your senses more vivid than usual?”; and transcendental, e.g., “Did you seem to enter some other, unearthly world?”) and provides a maximum score of 32, with a score ranging from 0 to 2 (0 = not present, 1 = moderately or ambiguously present, and 2 = definitely present) for each question. A minimum score of 7 is the cutoff for a “true” NDE. It has good test–retest reliability and internal consistency and evaluates the richness of an NDE using a total score.

The *Big Five Inventory Questionnaire* (John and Srivastava, 1999) is a personality test that identifies five fundamental dimensions (Extraversion, e.g., “Is talkative”; Pleasantness, e.g., “Tends to find fault with others”; Conscience, e.g., “Does a thorough job”; Neuroticism, e.g., “Is depressed, blue”; and Openness, e.g., “Is original, comes up with new ideas”) for the description and evaluation of personality.

It is composed of 45 items to which participants must respond using a five-point Likert scale (1 = strongly disagree, 2 = disagree a little, 3 = neither agree nor disagree, 4 = agree a little, and 5 = strongly agree) divided into five sections. Each section has a different score range (from a minimum of 8 to a maximum of 50). It is an economic, understandable, sufficiently exhaustive tool to describe the personality and can constitute a common and generalizable matrix in the evaluation process (Benjamin, 2002).

The *Dissociative Experience Scale* (Bernstein and Putnam, 1986) is a self-reported questionnaire used to evaluate the presence, quantity, and type of dissociative experiences one might live in daily life. It consists of 28 items (e.g., “Some people are so deep in thought that they don't hear the doorbell”) arranged on an analog scale (from 0 to 100% measuring the frequency of dissociative experiences), and the total score ranges from 0 to 100. There is a cutoff of 45 as a mean score to suggest a dissociative disorder. This questionnaire is not a diagnostic instrument; it is designed only for screening, but it can suggest that a specific clinical assessment is needed. The Dissociative Experience Scale is a valid and reliable tool for measuring dissociative experiences both in clinical samples and in control populations (Bernstein and Putnam, 1986; Steinberg et al., 1991; Carlson et al., 1993), revealing a similar factorial structure in groups of psychiatric patients and healthy subjects (Sanders and Green, 1994).

The *Creative Experiences Questionnaire* (Merckelbach et al., 2001) is a self-reported questionnaire that is composed of 25 true/false items (e.g., “As a child, I thought that the dolls, teddy bears, and stuffed animals that I played with were living creatures”) that measure Fantasy proneness. The items are referred to as the developmental antecedents, involvement, and consequences in fantasy and daydreaming. The total score range is 0–25. The higher the score, the higher the level of Fantasy proneness. This questionnaire has good internal consistency and optimal test–retest stability (Merckelbach et al., 2001).

The *Launey–Slade Hallucination Scale* validated the French version (Larøi et al., 2004) and aims to measure participants' hallucinations in terms of frequency, intensity level of control, and affective responses. It consists of 16 items (e.g., “I have had the feeling of touching something or being touched and then found that nothing or no one was there”) to which participants respond using a five-point Likert scale (0 = certainly does not apply to me, 1= possibly does not apply to me, 2 = unsure, 3 = possibly applies to me, and 4 = certainly applies to me). The total score range is between 0 and 64. A high score indicates a higher tendency to hallucinate. This scale has high reliability.

The *Tellegen Absorption Scale* (Tellegen and Atkinson, 1974) consists of 34 true/false items (e.g., “My thoughts often do not occur as words but as visual experiences”), aiming to measure the absorption of a person, meaning the disposition for having episodes of a deep involvement that engage all the subject's resources (perceptual, imaginative, and cognitive). The total score range is from 0 to 34. The higher the score, the more one has a high propensity for absorption.

The *Intrinsic Religious Motivation Scale* (Hoge, 1972) is a self-reported questionnaire that measures internal religious motivation. Internal religious motivation is considered intrinsic because it does not rely on external behavior but rather on the concept of religiosity itself. It consists of 10 items with a four-point Likert scale (1 = strongly

disagree, 2 = disagree, 3 = agree, and 4 = strongly agree), with a total score range between 10 and 40. A high score indicates a high internal religious motivation. Some examples of the questions are as follows: "*My faith involves my whole life*", "*One should seek God's guidance in making any important decision*", and "*In my life, I experience the presence of the Divine"*.

The *Revised Paranormal Belief Scale* (Tobacyk, 2004) is a self-reported scale that gives a measure of belief in paranormal phenomena through seven dimensions as follows: Traditional Religious Belief (e.g., "The soul continues to exist though the body may die"), Psi [e.g., "Some individuals are able to levitate (lift) objects through mental forces"], Witchcraft (e.g., "Black magic really exists"), Superstition (e.g., "Black cats can bring bad luck"), Spiritualism [e.g., "Your mind or soul can leave your body and travel (astral projection)"], Extraordinary Life Forms (e.g., "The abominable snowman of Tibet exists"), and Precognition (e.g., "Astrology is a way to accurately predict the future"). It consists of 26 items to which participants respond using a seven-point Likert scale (1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = uncertain, 5 = slightly agree, 6 = moderately agree, and 7 = strongly agree), with a total score ranging from 1 to 7. This scale has great internal reliability and good cross-cultural validity (Drinkwater et al., 2017). A high score indicates a high endorsement of paranormal beliefs.

2.4. Statistical analyses

First, descriptive statistics were conducted. Qualitative variables were expressed with counts and percentages. The normality of quantitative variables was examined graphically with histograms and quantile–quantile plots, and statistically by realizing a Shapiro–Wilk normality test. If normality was assumed for the distribution of the quantitative variable, mean and standard deviation (SD) were reported. Conversely, median and interquartile range were presented. Second, univariate analyses were performed to compare scores between the four groups (i.e., controls w/o LTS, controls w/ LTS, NDErs-like, and NDErs). The χ^2 test was used in the case of categorical variables, and the one-way analysis of variance (ANOVA) or its non-parametric equivalent the Kruskal–Wallis test was used for the dimensions of the Big Five Questionnaire, the Dissociative Experience Scale, the Creative Experience Questionnaire, the Launey–Slade Hallucination Scale, the Tellegen Absorption Scale, the Intrinsic Religious Motivation Scale, and the Revised Paranormal Belief Scale. *Post-hoc* analyses were carried out with Tukey's test or its non-parametric equivalent the Dwass-Steel-Critchlow-Fligner pairwise comparison test. Cramer's V, eta square, and ε^2 were used as a measure of effect size. Significant variables in the univariate case were included in a multivariate logistic regression to determine predictive variables associated with the occurrence of the recall of an NDE(-like) within a single statistical model. The dependent variables were the NDErs-like, NDErs, and controls w/LTS factors; the controls w/o LTS were taken as the referential category. Two-tailed *p*-values of < 0.05 were considered to be statistically significant. Then, we performed a discriminant analysis including only the variables identified in the multinomial logistic regression to test the classification function. Discriminant analysis is a multivariate technique used to separate two or more groups based on one or more linear combinations of selected variables, exploring the contribution of each variable in separating the groups defined before the study. Two-tailed *p*-values of < 0.05 were considered to be statistically significant. We also carried out a sensitivity power analysis (alpha = 0.01, a power of 0.80, total sample

size = 181, and four groups). The acquired data were processed using statistical data processing software Jamovi 2.2.5[1] and SAS 9.4 (© SAS Institute Inc.).

3. Results

3.1. Univariate analyses for participant characteristics

A total of 63 participants (35% out of the whole sample included in this study, i.e., total *N* = 181) reached the cutoff score for an NDE lived during a life-threatening situation, they formed the first group ("NDErs"). The second group was composed of 31 participants (17%) who had an NDE but were not related to a life-threatening situation ("NDErs-like"). The last two groups included control participants as follows: 43 participants (24%) lived a life-threatening situation but did not recall an NDE ("controls w/LTS") and 44 participants (24%) had neither a life-threatening situation nor an NDE ("controls w/o LTS"). Considering sociodemographic data, there was no statistical difference in age at the NDE(-like) event, time since the NDE(-like) event, sex, education, and all subscales of the Greyson NDE Scale (Greyson, 1983) ($p > 0.05$) (Table 1). Significant differences were found for age at the interview ($p < 0.001$) with NDErs and NDErs-like being older than controls w/LTS and w/o LTS.

	NDErs ($n = 63$)	NDErs-like ($n = 31$)	Controls w/LTS ($n = 43$)	Controls w/o LTS ($n = 44$)	p-value	Effect size
Age at interview, years, median (interquartile)	62 (15.0)	63 (18.5)	42 (23.5)	47.5 (27.3)	<0.001	$\varepsilon^2 = 0.22$
Age at NDE(-like),¥ years, median (interquartile)	26 (24.0)	34 (25)	-	-	0.22	$\varepsilon^2 = 0.02$
Time since NDE(-like),¥ years, median (interquartile)	28 (22.5)	27 (29.5)	-	-	0.33	$\varepsilon^2 = 0.01$
Gender, *n* (%)						
Female	32 (49)	21 (68)	22 (51)	29 (66)	0.22	Cramer's V = 0.16
Male	31 (51)	10 (32)	21 (48)	15 (34)		
Education, *n* (%)						
Elementary	1 (2)	0 (0)	0 (0)	0 (0)	0.85	Cramer's V = 0.11
High school	10 (16)	3 (10)	7 (16)	3 (7)		
Bachelor	19 (30)	9 (29)	16 (37)	15 (34)		
University	28 (44)	16 (51)	19 (45)	23 (52)		
PhD	5 (8)	3 (10)	1 (2)	3 (7)		
Coma, *n* (%)						
Yes	37 (59)	0 (0)	17 (39)	0 (0)	<0.001	Cramer's V = 0.57
No	26 (41)	31 (100)	26 (61)	44 (100)		
Etiologies*, *n* (%)						
Cardiac arrest	9 (15)	0 (0)	2 (5)	-	<0.001	Cramer's V = 0.70
Drowning	2 (3)	0 (0)	3 (8)			
Electrocution	2 (3)	0 (0)	0 (0)			
Brain Trauma	19 (30)	0 (0)	18 (46)			
Vascular accident	1 (2)	0 (0)	1 (2)			
Anesthesia/surgery	6 (9)	0 (0)	5 (13)			
Sleep	0 (0)	1 (3)	0 (0)			
Other w/medical cause	24 (38)	2 (7)	10 (26)			
Other w/o medical cause	0 (0)	28 (90)	0 (0)			
Greyson NDE Scale¥						
Cognitive (0–32), median (interquartile)	3 (3)	3 (2)	-	-	0.26	$\varepsilon^2 = 0.01$
Affective (0–32), median (interquartile)	5 (3.8)	6 (3.0)			0.59	$\varepsilon^2 = 0.00$
Paranormal (0–32), median (interquartile)	4 (3.0)	4 (2)			0.5	$\varepsilon^2 = 0.00$
Transcendental (0–32), median (interquartile)	3 (3)	4 (4)			0.47	$\varepsilon^2 = 0.01$
Total, mean ± SD	15.7 (5.6)	16.2 (5.2)			0.69	$\eta^2 = 0.00$

*Comparison was carried out between NDErs, NDErs-like, and Control w/ LTS. ¥Comparisons were carried out between NDErs and NDErs-like. NDErs, Near-Death Experiencers; NDErs-like, Near-Death-Like Experiencers; Controls w/LTS, Controls with a life-threatening situation; Controls w/o LTS, Controls without a life-threatening situation; SD, standard deviation; n, sample size.

Table 1. Participant characteristics of NDErs, NDErs-like, control w/LTS, and control w/o LTS groups (total *n* = 181).

3.2. Univariate analyses for personality and belief questionnaires

No statistical difference was found across groups for the Extraversion, Pleasantness, and Neuroticism subscales of the Big Five Inventory Questionnaire (John and Srivastava, 1999), the Dissociative Experience Scale (Bernstein and Putnam, 1986), the Launey–Slade Hallucination Scale (Larøi et al., 2004), and Superstition and Extraordinary life form subscales of the Revised Paranormal Belief Scale (Tobacyk,

2004) (Table 2). Significant differences were shown for the Openness and Conscientiousness subscales of the Big Five Inventory Questionnaire (John and Srivastava, 1999). Concerning the Openness subscale, controls w/o LTS were less open to experience than the NDErs-like, the NDErs, and the controls w/LTS (p = 0.01). While the Conscientiousness subscale was globally significant (p = 0.03), *post-hoc* analyses did not yield any significant differences between the groups. About the Creative Experience Questionnaire (Merckelbach et al., 2001), controls w/o LTS had significantly ($p < 0.001$) lower engagement in fantasy than NDErs, NDErs-like, and controls w/LTS. Concerning the Tellegen Absorption Scale (Tellegen and Atkinson, 1974), NDErs had a significantly (p = 0.004) higher disposition toward absorption than NDErs-like, controls w/LTS, and controls w/o LTS. Controls w/o LTS had significantly (p = 0.02) less intrinsic religious motivations than controls w/LTS, NDErs, and NDErs-like, assessed with the Intrinsic Religious Motivational Scale (Hoge, 1972). Finally, the groups significantly differed on various subscales of the Revised Paranormal Belief Scale (Tobacyk, 2004). NDErs had significantly more Traditional Religious Beliefs than NDErs-like, controls w/ LTS, and controls w/o LTS (p = 0.001). While the Psi subscale was globally significant (p = 0.02), *post-hoc* analyses did not yield any significant differences between the groups. The same pattern of results was found for the Witchcraft subscale (p = 0.2). For the Spiritualism subscale, NDErs-like scored significantly higher than NDErs, controls w/LTS, and controls w/o LTS ($p < 0.001$). Concerning the Precognition subscale, NDErs score significantly higher than NDErs-like, controls w/LTS, and controls w/o LTS ($p < 0.001$).

Questionnaire (min-max)	NDErs ($n = 63$)	NDErs-like ($n = 31$)	Controls w/LTS ($n = 43$)	Controls w/o LTS ($n = 44$)	p-value	Effect size
Big five questionnaire (8–50)						
Extraversion	29 (8.5)	28 (8.0)	27 (8.5)	30 (10.0)	0.72	$\varepsilon^2 = 0.01$
Pleasantness	42 (7.5)	43 (5.5)	42 (8.5)	42 (5.0)	0.47	$\varepsilon^2 = 0.01$
Conscientiousness	37 (7.0)	38 (7.5)	35 (9.0)	35 (6.5)	0.03	$\varepsilon^2 = 0.05$
Neuroticism	18 (8.5)	17 (13.5)	22 (10.5)	21 (12.3)	0.29	$\varepsilon^2 = 0.02$
Openness	41 (6.0)*	42 (8.5)	40 (9.0)	37 (11.8)*	0.01	$\varepsilon^2 = 0.07$
Dissociative experience scale (0–100)	12.1 (15.0)	10.7 (17.9)	10.0 (16.8)	10.7 (9.2)	0.3	$\varepsilon^2 = 0.02$
Creative experience questionnaire (0–25)	8 (6.5)*	7 (7.0)*	6 (5.5)	4 (4.0)*	<0.001	$\varepsilon^2 = 0.12$
Launey-Slade Hallucination Scale (0–64)	20 (18.0)	21 (25.0)	17 (12.5)	14 (19.3)	0.12	$\varepsilon^2 = 0.03$
Tellegen absorption scale (0–34)	19.0 (7.1)*	18.0 (7.2)	15.8 (1.0)	14.0 (6.8)*	0.004	$\eta^2 = 0.02$
Intrinsic religious motivation scale (10–40)	20 (8.0)*	21 (10.5)	18 (8.5)	16.5 (6.0)*	0.02	$\varepsilon^2 = 0.06$
Revised paranormal belief scale (1–7)						
Traditional religious belief	3.5 (2.3)*	3.3 (2.5)*	2.3 (2.3)	2.6 (2.0)*	0.001	$\varepsilon^2 = 0.09$
Psi	3.8 (2.3)	4 (2.5)	2.5 (1.9)	3.0 (2.4)	0.02	$\varepsilon^2 = 0.05$
Witchcraft	3.8 (2.8)	3.3 (3.3)	2 (2.8)	2.3 (2.8)	0.02	$\varepsilon^2 = 0.05$
Superstition	1 (0.7)	1 (0.2)	1 (0.0)	1 (0.0)	0.45	$\varepsilon^2 = 0.01$
Spiritualism	4.5 (2.6)*	5 (1.9)*	3 (3.9)	3 (2.1)*	<0.001	$\varepsilon^2 = 0.16$
Extraordinary life form	2.7 (1.3)	2.7 (2.0)	2 (1.0)	2 (1.1)	0.15	$\varepsilon^2 = 0.03$
Precognition	3.5 (2.6)*	3.3 (2.0)*	1.8 (2.1)	2 (2.1)*	<0.001	$\varepsilon^2 = 0.13$

NDErs, Near-Death Experiencers; NDErs-like, Near-Death-Like Experiencers; Controls w/ LTS, Controls with a life-threatening situation; Controls w/o LTS, Controls without a life-threatening situation; SD, standard deviation; n, sample size; *, *post-hoc* significant differences.

Table 2. Mean (SD) or median (interquartile ranges) for non-normal distribution of the 17 variables measured at the interview.

3.3. Multiple regression analysis

A 10-predictor logistic model was fitted to the data to test the research hypothesis regarding the likelihood of having factors that predict the likelihood of recalling an NDE (Table 3). Regarding the NDErs, two factors were significant predictors as follows: the Openness subscale of the Big Five Inventory Questionnaire (John and Srivastava, 1999) (p = 0.04) and Fantasy proneness [p = 0.02; assessed *via* the Creative Experience Questionnaire (Merckelbach et al., 2001)]. Concerning NDErs-like, only the Spiritualism subscale (p = 0.02) of the Revised Paranormal Belief Scale (Tobacyk, 2004) was a significant predictor, while the Fantasy proneness was a tendency (p = 0.05). No predictor was statistically significant for the controls w/LTS group.

Predictors	NDErs (n = 63)		NDErs–like (n = 31)		Controls w/LTS (n = 43)	
	Estimate (95%CI)	p-value	Estimate (95%CI)	p-value	Estimate (95%CI)	p-value
Tellegen absorption scale	0.007 (−0.07–0.09)	0.86	−0.03 (−0.13–0.06)	0.51	−0.007 (−0.09–0.07)	0.33
Big five questionnaire						
Conscience	0.07 (−0.02–0.15)	0.13	0.07 (−0.04–0.17)	0.2	−0.01 (−0.09–0.06)	0.72
Openness	0.07 (0.002–0.32)	0.04	0.05 (−0.03–0.13)	0.24	0.03 (−0.03–0.09)	0.34
Creative experience questionnaire/fantasy proneness	0.18 (0.03–0.32)	0.02	0.16 (−0.005–0.33)	0.05	0.13 (−0.02–0.29)	0.11
Intrinsic religious motivation scale	0.02 (−0.08–0.13)	0.64	0.07 (−0.04–0.19)	0.23	0.06 (−0.04–0.17)	0.27
Revised paranormal belief scale						
Traditional religious belief	0.14 (−0.33–0.62)	0.55	0.02 (−0.51–0.55)	0.93	−0.14 (−0.64–0.35)	0.56
Psi	−0.20 (−0.63–0.23)	0.36	−0.12 (−0.62–0.39)	0.65	0.18 (−0.25–0.60)	0.42
Witchcraft	−0.11 (−0.49–0.26)	0.55	−0.28 (−0.74–0.17)	0.21	0.05 (−0.37–0.47)	0.81
Spiritualism	0.20 (−0.24–0.64)	0.37	0.63 (0.09–1.16)	0.02	−0.04 (−0.49–0.41)	0.86
Precognition	0.32 (−0.14–0.79)	0.17	0.14 (−0.39–0.67)	0.61	−0.27 (−0.77–0.24)	0.3

NDErs, Near-Death Experiencers; NDErs-like, Near-Death-Like Experiencers; Controls w/ LTS, Controls with a life-threatening situation; CI, confidence interval; n, sample size.

Table 3. Results of multiple logistic regression analysis of potential predictors for NDErs: Tellegen Absorption Scale, Big Five Questionnaire (Conscientiousness and Openness subscales), Creative Experience Questionnaire, Intrinsic Religious Motivation Scale, and Revised Paranormal Belief Scale (Traditional Religious Belief, Psi, Witchcraft, Spiritualism, Precognition).

3.4. Discriminant analyses

Discriminant analysis including the 10 predictors identified earlier showed that the Openness subscale of the Big Five Inventory Questionnaire (John and Srivastava, 1999) and the Fantasy proneness (Merckelbach et al., 2001) and Spiritualism subscales of the Revised Paranormal Belief Scale (Tobacyk, 2004) can classify and predict the group membership of experiencers (Wilks'λ = 0.76, $F_{(9)}$ = 5.49, $p < 0.001$, R^2 = 0.24) but only for 35% of the sample. A low percentage of the controls w/o LTS (9%) and controls w/LTS (24%) groups was classified into the NDErs group. In contrast, a relatively higher percentage of NDErs-like (35%) was classified into the NDErs group (see Table 4).

Number of observations and percent classified into group					
From group	Controls w/LTS	Controls w/o LTS	NDErs	NDErs-Like	Total
Controls w/LTS	12	18	4	9	43
	27.91%	41.86%	9.30%	20.93%	100%
Controls w/o LTS	15	18	3	8	44
	34.09%	40.91%	6.82%	18.18%	100%
NDErs	15	6	20	22	63
	23.81%	9.52%	31.75%	34.92%	100%
NDErs-like	3	6	8	14	31
	9.68%	19.35%	25.81%	45.16%	100%
Total	45	48	35	53	181
	24.86%	26.52%	19.34%	29.28%	100%
Priors	0.25	0.25	0.25	0.25	
Error counts estimates for groups					
Rate	0.7209	0.5909	0.6825	0.5484	0.6357
Priors	0.25	0.25	0.25	0.25	

NDErs, Near-Death Experiencers; NDErs-like, Near-Death-Like Experiencers; Controls w/ LTS, Controls with a life-threatening situation; Controls w/o LTS, Controls without a life-threatening situation.

Table 4. Classification results and error rates between the four groups of participants.

4. Discussion

This study aimed to explore whether any personality factors are consistently related to reporting an NDE(-like) by retrospectively comparing personality traits and patterns of belief in four different groups (NDErs, NDErs-like, controls w/LTS, and controls w/o LTS) and carried out a multiple regression analysis to determine potential predictive factors. The results indicated that only the Spiritualism subscale of the Revised Paranormal Belief Scale (Tobacyk, 2004) was a significant predictor for NDErs-like, meaning that believing in astral journeys, reincarnation, and dissociation of mind and body, and that communicating with the dead are possible facts, may increase the likelihood of recalling an NDE outside of an LTS. It is worth mentioning that only three (out of 31) participants from the NDErs-like group experienced the NDE-like in the context of meditation or drug intake, while all the others reported their NDE-like in contexts where there was no willingness of inducing an altered state of consciousness permitting to experience an NDE-like. Spirituality, as a predictor, has been studied little in the context of NDEs. Only one study which used the same questionnaire as ours has indeed demonstrated a correlation between the presence of spiritual beliefs and NDEs, but this study was only correlational and did not include NDErs-like, preventing any comparison with our results (Gow et al., 2003). In parallel, it has been shown that the intensity of an NDE is strongly correlated with a change in spirituality after the experience (Greyson, 2006); people seem to change their perspective on life, endorse deep spiritual consciousness, and decrease their fear of death. One of the hypotheses for this change is related to the mystical aspect of the NDE (e.g., encounter with a mystical presence or being traveled to a mystical realm) (Greyson, 2006). The psychedelic literature shows that experiencing a mystical experience may provide an alternative perspective on the meaning of life that seems to account for the beneficial/therapeutic effects of psychedelic experience (Griffiths et al., 2006; Nicholas et al., 2018). Considering the fact that NDE and psychedelic experience can be highly similar in terms of phenomenology (Timmermann et al.,

2018; Martial et al., 2019), one can hypothesize that they could share some similar psychological processes of change (Greyson, 2006).

Regarding the NDErs, two factors were significant predictors, such as the Openness subscale (John and Srivastava, 1999) and Fantasy proneness (Merckelbach et al., 2001). This means that being creative, open to new experiences, and having a high engagement in fantasy (e.g., daydreaming and vivid mental imagery) may increase the likelihood of recalling an NDE when confronted with an LTS. With respect to Openness, we are not aware of any studies that have examined this personality trait in the context of NDEs. However, the literature on other non-ordinary states of consciousness has shown that expert meditators score high on this trait (mindfulness meditation, van den Hurk et al., 2011; Zazen and Tai Chi meditation, Pokorski and Suchorzynska, 2018) and that psychedelic experience might lead to an increase in openness (Erritzoe et al., 2018). Congruently, greater openness to experience was related to more intense 3,4-methylenedioxymethamphetamine-induced altered states (Studerus et al., 2021), which could suggest a bidirectional link between openness and the phenomenology of a particular experience. Moreover, Openness is known to be negatively correlated with age. In our sample, the NDErs(-like) were older than the control groups, thereby highlighting that Openness effectively seems to be a determinant factor for people who have experienced an NDE. To note the Dissociative Experience Scale (Carlson et al., 1993), the Superstition, Precognition, and Traditional Paranormal Belief subscales of the Revised Paranormal Belief Scale (Tobacyk, 2004) are also affected by age (Ross, 1990; Lange et al., 2000). Nevertheless, none of these (sub) scales turned out to have a significant influence on NDE(-like) recollection. A limitation of the retrospective design of this study is that we do not have information on the participants' prior personality traits. Typically, personality traits are supposed to be (more or less) stable personality constructs, but as mentioned earlier, certain life experiences such as intense spiritual practice or psychedelic drug use can alter personality traits such as Openness. It is known that having an NDE is transformative and that people who experience it might score higher on this trait after the NDE (Greyson, 2006). Notably, the control groups are typical in terms of their scoring (Plaisant et al., 2005, 2010) to the Big Five Inventory Questionnaire (John and Srivastava, 1999). Regarding Fantasy proneness, as mentioned in the introduction, Martial et al. (2018a) demonstrated a positive correlation between this personality trait and NDErs-like, whereas this link did not reach significance in NDErs. The results of the present study indicate that NDErs and NDErs-like do score higher on this scale than the two control groups, but only for NDErs, the Fantasy proneness might be a predictor while it is a tendency for NDErs-like. Furthermore, we have found that NDErs(-like) only scored significantly higher than the three other groups (i.e., NDErs, controls w/o LTS, and controls w/LTS) on the Spirituality subscale of the Revised Paranormal Belief Scale (Tobacyk, 2004), which also turned out to be the only significant predictor of NDErs(-like) recollection. A hypothesis might be that the NDErs(-like) who endorse spiritual beliefs and/or practices (e.g., meditation) might be more inclined to either experience a particular experience in a spiritually-oriented manner (i.e., to attribute a spiritual dimension to an experience) or undergo an experience labeled as NDErs(-like) within the context of spiritual practice (e.g., meditation). These are slightly different but complementary results highlight the need for further investigation.

Importantly, the retrospective design of our study does not permit concluding any causal pathway, namely, whether NDErs(-like) occur more frequently in individuals with (previously established) high engagement in Openness, Fantasy, and Spirituality

propensity or whether such experiences encourage Openness, Fantasy, and Spirituality propensities in individuals who were previously not prone to that. However, since the items of the questionnaires assess retrospective Openness, Fantasy proneness, and Spirituality, it is reasonable to hypothesize that high engagement in those factors, as a habitual tendency, makes people more likely to report subjective NDEs when exposed to certain physiological and/or psychological conditions. One can hypothesize that NDErs(-like) are particularly sensitive to episodes of disconnected consciousness and possess a special propensity to pick up subjective experiences that other people are blind to. Peinkhofer et al. (2021) recently raised an evolutionary hypothesis suggesting a specific biological benefit of the survival of NDE when facing a life-threatening situation. This would offer a less distressing "reality" when facing a potentially inescapable danger. However, it is worth noting that the fact to have experienced an NDE(-like) may have influenced the current personality of NDErs(-like) and potentially the way they answered the questionnaires administered in the present study.

In this study, we chose a series of questionnaires assessing some specific personality traits and some beliefs; however, it must be emphasized that personality traits and beliefs' patterns allowed us to correctly classify 35% of the sample. Notably, this highlights that personality-related variables might influence the occurrence and nature of NDEs. Indeed, cognitive factors such as memory characteristics can play a role. Recently, we demonstrated that NDErs seem more likely to have an illusory recollection of details associated with the generation of false memory (notably, this study did not assess the recall of NDE *per se*) (Martial et al., 2018b). Other factors such as those linked to the circumstances of the NDE(-like) itself might also play an important role.

The present study has several limitations. First, the study was retrospective, cross-sectional, and relied on self-report measures. Nevertheless, the sensitivity power analysis indicated 0.80 power to detect medium to high statistical effects ($\eta^2 = 0.08$). Second, volunteers who participated likely represent a self-selected sample and consequently might not be representative due to a possible selection bias. Third, it would have been relevant to include more information such as the religion of the participants at the time of the NDE, whether they had dissociative experiences by other means (e.g., meditation and drugs), the presence of spiritual practices before the NDE, and medical information regarding the presence of a life-threatening context. Fourth, the procedure for the control groups and the NDE(-like) groups was not the same. Future studies should consider administering the exact same list of questionnaires to all the groups that are part of the study. Fifth, the NDErs(-like) and the control groups (both w/ and w/o LTS) have been recruited at different periods (although they did fill in the present questionnaire at the same period), and the NDErs(-like), as compared with the controls, had repeated experience in completing various questionnaires due to the fact that they are part of the Coma Science Group's database. Thus, this might have influenced the scoring of participants. Furthermore, having the scores on the NDE scale for the control groups would have been interesting. Sixth, our participants were Western, thereby limiting our ability to extrapolate the present results to other parts of the world. Future research should include a more heterogeneous sampling population by recruiting people from different cultural and religious backgrounds. Finally, there might be potential overlaps between items of the different scales, assessing different but closely related constructs. To better understand this phenomenon, prospective studies aiming at identifying potential predisposing factors (not limited to personality) to NDEs should

be carried out. Nevertheless, those studies are very complex to conduct due to the spontaneous nature of an NDE(-like).

The results obtained do not allow us to draw any coherent conclusion on how to distinguish people who have experienced an NDE from those who have not. Nevertheless, this study is the first to explore a varied range of potential personality traits and beliefs that might predict, if not the occurrence, the likelihood to recall an NDE. Due to the transformative effect an NDE has on one's view of the world and self (Cassol et al., 2019), the rigorous study of potential predictors of an NDE is of great importance. Furthermore, Openness, Spirituality, and Fantasy proneness have been linked to NDE, and other non-ordinary states of consciousness such as mediation, psychedelics, and self-induced cognitive trance [i.e., a volitional (i.e., by will) non-ordinary state of consciousness, adapted from traditional Mongolian shamanic trance and abstracted from any ritual, spiritual, and cultural expression; (Flor-Henry et al., 2017; Gosseries et al., 2020; Grégoire et al., 2022)], paving the way for a knowledge base for future research. Indeed, new protocols assessing the personality characteristics and the phenomenological features of participants learning self-induced cognitive trance (a non-ordinary state of consciousness known to produce a phenomenology similar to that of NDEs) are currently being carried out. This will allow, among other things, a better understanding of the personality predisposition of NDE. Furthermore, prospective studies addressing the abovementioned limitations would provide a better understanding of the psychological mechanisms at play in this phenomenon.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the Faculty of Medicine of the University of Liège (2013/292). The patients/participants provided their written informed consent to participate in this study.

Author contributions

CM was the main investigator and designed the protocol. CM, HC, SA, and PF obtained the data. AB and JS analyzed the data. AB, JS, PF, and CM interpreted the data. AB and CM wrote the manuscript. All authors contributed to the revision of the manuscript. All authors were involved in editing the manuscript and approved the final version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Footnotes

1. ^Jamovi - Stats. Open. Now. (no date). Available online at: https://www.jamovi.org/ (accessed September 9, 2022).

References

Benjamin, L. S. (2002). *Interpersonal Diagnosis and Treatment of Personality Disorders*. New York, NY: Guilford Press.

Bernstein, E. M., and Putnam, F. W. (1986). Development, reliability, and validity of a dissociation scale. *J. Nerv. Mental Dis.* 174, 727–735. doi: 10.1097/00005053-198612000-00004

PubMed Abstract | CrossRef Full Text | Google Scholar

Carlson, E. B., Putnam, F. W., Ross, C. A., Torem, M., Coons, P., Dill, D. L., et al. (1993). Validity of the Dissociative Experiences Scale in screening for multiple

personality disorder: a multicenter study. *Am. J. Psychiat.* 150, 1030–1036. doi: 10.1176/ajp.150.7.1030

PubMed Abstract | CrossRef Full Text | Google Scholar

Cassol, H., D'Argembeau, A., Charland-Verville, V., Laureys, S., and Martial, C. (2019). Memories of near-death experiences: are they self-defining? *Neurosci. Conscious.* 2019, niz002. doi: 10.1093/nc/niz002

PubMed Abstract | CrossRef Full Text | Google Scholar

Charland-Verville, V., Jourdan, J.-. P, Thonnard, M., Ledoux, D., Donneau, A- F., et al. (2014). Near-death experiences in non-life-threatening events and coma of different etiologies. *Front. Human Neurosci.* 8, 203. doi: 10.3389/fnhum.2014.00203

PubMed Abstract | CrossRef Full Text | Google Scholar

Drinkwater, K., Denovan, A., Dagnall, N., and Parker, A. (2017). An assessment of the dimensionality and factorial structure of the revised paranormal belief scale. *Front. Psychol.* 8, 1693. doi: 10.3389/fpsyg.2017.01693

PubMed Abstract | CrossRef Full Text | Google Scholar

Erritzoe, D., Roseman, L., Nour, M. M., MacLean, K., Kaelen, M., Nutt, D. J., et al. (2018). Effects of psilocybin therapy on personality structure. *Acta Psychiatr. Scandin.* 138, 368–378. doi: 10.1111/acps.12904

PubMed Abstract | CrossRef Full Text | Google Scholar

Facco, E., and Agrillo, C. (2012). Near-Death-Like Experiences without Life-Threatening Conditions or Brain Disorders: A Hypothesis from a Case Report. *Front. Psychol.* 3, 490. doi: 10.3389/fpsyg.2012.00490

PubMed Abstract | CrossRef Full Text | Google Scholar

Flor-Henry, P., Shapiro, Y., and Sombrun, C. (2017). Brain changes during a shamanic trance: Altered modes of consciousness, hemispheric laterality, and systemic psychobiology. *Cogent Psychol.* 4, 1313522. doi: 10.1080/23311908.2017.1313522

CrossRef Full Text | Google Scholar

Gabbard, G. O., and Twemlow, S. W. (1984). *With the Eyes of the Mind: An Empirical Analysis of Out-Of-Body States*. New York: Praeger.

Gosseries, O., Fecchio, M., Wolff, A., Sanz, L. R. D., Sombrun, C., Vanhaudenhuyse, A., et al. (2020). Behavioural and brain responses in cognitive trance: A TMS-EEG case study. *Clin. Neurophysiol.* 131, 586–588. doi: 10.1016/j.clinph.2019.11.011

PubMed Abstract | CrossRef Full Text | Google Scholar

Gow, K., Lane, A., and Chant, D. (2003). Personality characteristics, beliefs, and the near-death experience. *Austr. J. Clin. Exper. Hypn.* 31, 128–152.

PubMed Abstract | Google Scholar

Grégoire, C., Marie, N., Sombrun, C., Faymonville, M.-. E, Kotsou, I., et al. (2022). Hypnosis, meditation, and self-induced cognitive trance to improve post-treatment oncological patients quality of life: study protocol. *Front. Psychol.* 13, 807741. doi: 10.3389/fpsyg.2022.807741

PubMed Abstract | CrossRef Full Text | Google Scholar

Greyson, B. (1983). The Near-Death Experience Scale: Construction, reliability, and validity. *J. Nerv. Mental Dis.* 171, 369–375. doi: 10.1097/00005053-198306000-00007

PubMed Abstract | CrossRef Full Text | Google Scholar

Greyson, B. (1997). The near-death experience as a focus of clinical attention. *J. Nerv. Mental Dis* 185, 327–334. doi: 10.1097/00005053-199705000-00007

PubMed Abstract | CrossRef Full Text | Google Scholar

Greyson, B. (2000). Dissociation in people who have near-death experiences: out of their bodies or out of their minds? *Lancet* 355, 460–463. doi: 10.1016/S0140-6736(99)07305-5

PubMed Abstract | CrossRef Full Text | Google Scholar

Greyson, B. (2003). Incidence and correlates of near-death experiences in a cardiac care unit. *General Hospital Psychiat.* 25, 269–276. doi: 10.1016/S0163-8343(03)00042-2

PubMed Abstract | CrossRef Full Text | Google Scholar

Greyson, B. (2006). Near-death experiences and spirituality. *Zygon*® 41, 393–414. doi: 10.1111/j.1467-9744.2005.00745.x

CrossRef Full Text | Google Scholar

Greyson, B., and Liester, M. B. (2004). Auditory hallucinations following near-death experiences. *J. Humanistic Psychol.* 44, 320–336. doi: 10.1177/0022167804266281

CrossRef Full Text | Google Scholar

Griffiths, R. R., Richards, W. A., McCann, U., and Jesse, R. (2006). Psilocybin can occasion mystical-type experiences having substantial and sustained personal meaning and spiritual significance. *Psychopharmacology.* 187, 268–283. doi: 10.1007/s00213-006-0457-5

PubMed Abstract | CrossRef Full Text | Google Scholar

Hoge, D. R. (1972). A validated intrinsic religious motivation scale. *J. Sci. Study Relig.* 11, 369–376. doi: 10.2307/1384677

CrossRef Full Text | Google Scholar

John, O., and Srivastava, S. (1999). *The Big Five Trait taxonomy: History, measurement, and theoretical perspectives*. Available online at: https://www.semanticscholar.org/paper/The-Big-Five-Trait-taxonomy%3A-History%2C-measurement%2C-John-Srivastava/a354854c71d60a4490c42ae47464fbb9807d02bf (accessed February 21, 2023).

Kelly, E. W. (2001). Near-death experiences with reports of meeting deceased people. *Death Stud.* 25, 229–249. doi: 10.1080/07481180125967

PubMed Abstract | CrossRef Full Text | Google Scholar

Knoblauch, H., Schmied, I., and Schnettler, B. (2001). Different kinds of near-death experience: a report on a survey of near-death experiences in Germany. *J. Near-Death Stud.* 20, 15–29. doi: 10.1023/A:1011112727078

CrossRef Full Text | Google Scholar

Lange, R., Irwin, H. J., and Houran, J. (2000). Top-down purification of tobacyks revised paranormal belief scale. *Person. Indiv. Differ.* 29, 131–156. doi: 10.1016/S0191-8869(99)00183-X

CrossRef Full Text | Google Scholar

Larøi, F., Marczewski, P., and Van der Linden, M. (2004). Further evidence of the multi-dimensionality of hallucinatory predisposition: Factor structure of a modified version of the Launay-Slade Hallucinations Scale in a normal sample. *Eur. Psychiat.* 19, 15–20. doi: 10.1016/S0924-9338(03)00028-2

PubMed Abstract | CrossRef Full Text | Google Scholar

Lempert, T., Bauer, M., and Schmidt, D. (1994). Syncope and near-death experience. *Lancet* 344, 829–830. doi: 10.1016/S0140-6736(94)92389-2

PubMed Abstract | CrossRef Full Text | Google Scholar

Locke, T. P., and Shontz, F. C. (1983). Personality correlates of the near-death experience: A preliminary study. *J. Am. Soc. Psych. Res.* 77, 311–318.

Martial, C., Cassol, H., Charland-Verville, V., Merckelbach, H., and Laureys, S. (2018a). Fantasy proneness correlates with the intensity of near-death experience. *Front. Psychiat.* 9, 190. doi: 10.3389/fpsyt.2018.00190

PubMed Abstract | CrossRef Full Text | Google Scholar

Martial, C., Cassol, H., Charland-Verville, V., Pallavicini, C., Sanz, C., Zamberlan, F., et al. (2019). Neurochemical models of near-death experiences: A large-scale study based on the semantic similarity of written reports. *Conscious. Cogn.* 69, 52–69. doi: 10.1016/j.concog.2019.01.011

PubMed Abstract | CrossRef Full Text | Google Scholar

Martial, C., Cassol, H., Laureys, S., and Gosseries, O. (2020a). Near-death experience as a probe to explore (disconnected) consciousness. *Trends Cogn. Sci.* 24, 173–183. doi: 10.1016/j.tics.2019.12.010

PubMed Abstract | CrossRef Full Text | Google Scholar

Martial, C., Charland-Verville, V., Dehon, H., and Laureys, S. (2018b). False memory susceptibility in coma survivors with and without a near-death experience. *Psychol. Res.* 82, 806–818. doi: 10.1007/s00426-017-0855-9

PubMed Abstract | CrossRef Full Text | Google Scholar

Martial, C., Simon, J., Puttaert, N., Gosseries, O., Charland-Verville, V., et al. (2020b). The Near-Death Experience Content (NDE-C) scale: Development and psychometric validation. *Conscious. Cogn.* 86, 103049. doi: 10.1016/j.concog.2020.103049

PubMed Abstract | CrossRef Full Text | Google Scholar

McLaughlin, S. A., and Malony, H. N. (1984). Near-death experiences and religion: A further investigation. *J. Relig. Health* 23, 149–159. doi: 10.1007/BF00996157

PubMed Abstract | CrossRef Full Text | Google Scholar

Merckelbach, H., Horselenberg, R., and Muris, P. (2001). The Creative Experiences Questionnaire (CEQ): A brief self-report measure of fantasy proneness. *Person. Indiv. Differ.* 31, 987–995. doi: 10.1016/S0191-8869(00)00201-4

CrossRef Full Text | Google Scholar

Nicholas, C. R., Henriquez, K. M., Gassman, M. C., Cooper, K. M., Muller, D., Hetzel, S., et al. (2018). High dose psilocybin is associated with positive subjective effects in healthy volunteers. *J. Psychopharmacol.* 32, 770–778. doi: 10.1177/0269881118780713

PubMed Abstract | CrossRef Full Text | Google Scholar

Peinkhofer, C., Martial, C., Cassol, H., Laureys, S., and Kondziella, D. (2021). The evolutionary origin of near-death experiences: a systematic investigation. *Brain Commun.* 3, fcab132. doi: 10.1093/braincomms/fcab132

PubMed Abstract | CrossRef Full Text | Google Scholar

Perera, M., Padmasekara, G., and Belanti, J. (2005). Prevalence of near-death experiences in Australia. *J. Near-Death Stud.* 24, 109–116. doi: 10.17514/JNDS-2005-24-2-p109-116

CrossRef Full Text | Google Scholar

Plaisant, O., Courtois, R., Réveillère, C., and Mendelsohn, G. A. (2010). Validation par analyse factorielle du Big Five Inventory Français (BFI-Fr). Analyse convergente avec le NEO-PI-R. [Factor structure and internal reliability of the French Big Five

Inventory (BFI-Fr). Convergent and discriminant validation with the NEO-PI-R]. *Annales Médico-Psychologiques* 168, 97–106. doi: 10.1016/j.amp.2009.09.003

CrossRef Full Text | Google Scholar

Plaisant, O., Srivastava, S., Mendelsohn, G. A., and Debray, Q. (2005). "Relations entre le Big Five Inventory français et le manuel diagnostique des troubles mentaux dans un échantillon clinique français," in *Annales Médico-psychologiques, revue psychiatrique* (Elsevier Masson) 161–167. doi: 10.1016/j.amp.2005.02.002

CrossRef Full Text | Google Scholar

Pokorski, M., and Suchorzynska, A. (2018). Psychobehavioral effects of meditation. *Adv. Exper. Med. Biol.* 1023, 85–91. doi: 10.1007/5584_2017_52

PubMed Abstract | CrossRef Full Text | Google Scholar

Ring, K. (1980). *Life at Death: A Scientific Investigation of the Near-Death Experience*. First Edition. New York: Coward Mc Cann.

Roberts, G., and Owen, J. (1988). The near-death experience. *Br. J. Psychiat.* 153, 607–617. doi: 10.1192/bjp.153.5.607

PubMed Abstract | CrossRef Full Text | Google Scholar

Ross, A. (1990). Dissociative experiences in the general population. *Am. J. Psychiat*. 147, 1547–1552. doi: 10.1176/ajp.147.11.1547

PubMed Abstract | CrossRef Full Text | Google Scholar

Sabom, M. B. (1982). *Recollections of Death: A Medical Investigation, eweb:40112*. Available online at: https://repository.library.georgetown.edu/handle/10822/792025 (accessed November 7, 2022).

Sanders, B., and Green, J. A. (1994). The factor structure of the Dissociative Experiences Scale in college students. *Dissociation* 7, 23–27.

Google Scholar

Schwaninger, J., Eisenberg, P. R., and Schechtman, K. B. (2002). A prospective analysis of near-death experiences in cardiac arrest patients. *J. Near-Death Stud.* 20, 215–232. doi: 10.1023/A:1015258818660

CrossRef Full Text | Google Scholar

Steinberg, M., Rounsaville, B., and Cicchetti, D. (1991). Detection of dissociative disorders in psychiatric patients by a screening instrument and a structured diagnostic interview. *Am. J. Psychiat.* 148, 1050–1054. doi: 10.1176/ajp.148.8.1050

PubMed Abstract | CrossRef Full Text | Google Scholar

Studerus, E., Vizeli, P., Harder, S., Ley, L., and Liechti, M. E. (2021). Prediction of MDMA response in healthy humans: a pooled analysis of placebo-controlled studies. *J. Psychopharmacol.* 35, 556–565. doi: 10.1177/0269881121998322

PubMed Abstract | CrossRef Full Text | Google Scholar

Tellegen, A., and Atkinson, G. (1974). *Tellegen absorption scale*. doi: 10.1037/t14465-000

CrossRef Full Text | Google Scholar

Timmermann, C., Roseman, L., Williams, L., Erritzoe, D., Martial, C., Cassol, H., et al. (2018). DMT models the near-death experience. *Front. Psychol.* 9, 1424. doi: 10.3389/fpsyg.2018.01424

PubMed Abstract | CrossRef Full Text | Google Scholar

Tobacyk, J. J. (1991). Superstition and beliefs about the prediction of future events. *Psychol. Rep.* 68, 511–512. doi: 10.2466/pr0.1991.68.2.511

PubMed Abstract | CrossRef Full Text | Google Scholar

Tobacyk, J. J. (2004). A revised paranormal belief scale. *Int. J. Transper. Stud.* 23, 94–98. doi: 10.24972/ijts.2004.23.1.94

CrossRef Full Text | Google Scholar

Tobacyk, J. J., and Mitchell, T. E. (1987). Out-of-body experience status as a moderator of effects of narcissism on paranormal beliefs. *Psychol. Rep.* 60, 440–442. doi: 10.2466/pr0.1987.60.2.440

CrossRef Full Text | Google Scholar

Twemlow, S. W., and Gabbard, G. O. (1985). The Influence of Demographic/Psychological Factors and Preexisting Conditions on the Near-Death Experience. *OMEGA - J. Death Dying* 15, 223–235. doi: 10.2190/8VHV-YYEP-DE5M-HL8N

CrossRef Full Text | Google Scholar

van den Hurk, P. A. M., Wingens, T., Giommi, F., Barendregt, H. P., Speckens, A. E. M., van Schie, H. T., et al. (2011). On the relationship between the practice of mindfulness meditation and personality—an exploratory analysis of the mediating role of mindfulness skills. *Mindfulness* 2, 194–200. doi: 10.1007/s12671-011-0060-7

PubMed Abstract | CrossRef Full Text | Google Scholar

Van Gordon, W., Shonin, E., Dunn, T. J., Sheffield, D., Garcia-Campayo, J., Griffiths, M. D., et al. (2018). Meditation-induced near-death experiences: a 3-year longitudinal study. *Mindfulness* 9, 1794–1806. doi: 10.1007/s12671-018-0922-3

PubMed Abstract | CrossRef Full Text | Google Scholar

van Lommel, P., van Wees, R., Meyers, V., and Elfferich, I. (2001). Near-death experience in survivors of cardiac arrest: a prospective study in the Netherlands. *Lancet (London, England)* 358, 2039–2045. doi: 10.1016/S0140-6736(01)07100-8

PubMed Abstract | CrossRef Full Text | Google Scholar

Wilson, S. C., and Barber, T. X. (1982). The fantasy-prone personality: Implications for understanding imagery, hypnosis, and parapsychological phenomena. *PSI Res.* 1, 94–116.

Google Scholar

Zhi-ying, F., and Jian-xun, L. (1992). Near-death experiences among survivors of the 1976 Tangshan earthquake. *J. Near-Death Stud.* 11, 39–48. doi: 10.1007/BF01082736

PubMed Abstract | CrossRef Full Text | Google Scholar
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Does N,N- Dimethyltryptamine (DMT) Adequately Explain Near- Death Experiences?

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ABSTRACT: Some NDE researchers have suggested that because some users of psychedelic drugs have experiences purportedly similar to near-d eath experiences (NDEs), the neural receptors and neurotransmitters affected by a particular drug may underlie out-o f- body experiences and NDEs. One of the most recent psychedelic candidates that allegedly causes NDE- like experiences is N,N- dimethyltryptamine (DMT), a natural substance that the body produces in small amounts. If DMT experiences are phenomenologically similar to NDEs, then it is possible that the human body *in extremis* may produce larger amounts of DMT that reach psychedelic experience-c ausing levels in the blood. In this paper, I explore the issue of whether DMT might play a causal role in the production of NDEs. The first section summarizes basic information about NDEs, focusing on their phenomenological aspects. The second section classifies theories of NDEs to place the DMT theory in the context of the history of the debate over the cause of NDEs. The following section discusses DMT's chemical composition, physical effects, and psychological effects. The final section explores whether NDE and DMT experiences have a sufficient degree of phenomenological similarity to justify a causal role for DMT in the production of NDEs and concludes that such similarity is lacking.

KEY WORDS: near-d eath experiences; out- of- body experiences; N,N- dimethyltryptamine; phenomenology of NDEs

Since the publication of Raymond Moody's *Life After Life* (1975), authors have produced a plethora of literature on the phenomena he termed "near- death experiences" (NDEs). An NDE is an experience in

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which a person encounters an actual or anticipated ("fear- death") close brush with death and has the subjective experience of profound peace and/or a sense of one's consciousness functioning apart from the physical body; this latter sense can include a material aspect— perceiving the material world, sometimes termed out- of- body experience (oBE), and/or a transmaterial phase—p erceiving and often interacting with environments and entities (deceased loved ones, spiritual/religious figures) not of the material world. Research indicates that approximately one in five people who survive an actual or anticipated close brush with death report an NDE (Zingrone & Alvarado, 2009). Phenomenologically indistinguishable experiences can occur apart from an actual or anticipated close brush with death, usually in other psychologically extreme states such as profound grief or other emotional arousal, deep relaxation, or intense physical exertion.

As one attempt to explain the origin of NDEs, some researchers have suggested that the activation or inhibition of particular receptor sites in the brain may be the cause of both OBEs and NDEs (Hill & Persinger, 2003; Jansen, 1989, 1996; Kärkkäinen, Forsström, Tornaeus, Wähälä,

Kiuru, Honkanen, Stenman . . . Hesso, 2005; Strassman, 1996, 2001; Strassman, Qualls, Uhlenhuth, & Kellner, 1994). One route these researchers have taken is to suggest that because some psychedelic drugs users' experiences mimic key phenomenological aspects of NDEs, the receptors and neurotransmitters that the drug affects may underlie and, therefore, be responsible for producing, OBEs and NDEs. The drugs they have implicated include LSD, psilocybin, and ketamine. One psychedelic candidate that allegedly causes NDE- like experiences is N,N-dimethyltryptamine (DMT), a natural substance produced by the body in small amounts (Strassman, 2001). If DMT experiences are phenomenologically similar to NDEs, then it is possible that the human body *in extremis* may produce larger amounts of DMT that reach psychedelic-causing levels in the blood.

In this article, I explore the issue of whether DMT plays a causal role in the production of NDEs. The first section will summarize basic information about NDEs, with a focus on their phenomenological aspects. The second section will classify theories of NDEs to place the DMT theory in the context of the history of the debate over the cause of NDEs. The following section will discuss DMT's chemical composition, physical effects, and psychological effects. The final section will explore whether NDE and DMT experiences have a sufficient degree of phenomenological similarity to substantiate a causal role for DMT in the production of NDEs.

Near- Death Experiences (NDEs)

Rense Lange, Bruce Greyson, and James Houran (2004) defined NDEs as "transcendental experiences precipitated by a confrontation with death and which do not seem to be accounted for by our current understanding of the dying process" (p. 161). Michael Sabom (1982) has proposed a useful distinction between "autoscopic" and "transcendental" NDEs. The autoscopic NDE involves a sense of separation from the body and may include seeing one's physical body as well as seeing and hearing one's resuscitation. The transcendental NDE involves visions of "another world," including experiences of religious figures, such as angels or God. Janice Miner Holden (2009) made a similar distinction, referring to the "material aspect" and "transmaterial aspect" (p. 185) of NDEs. Both involve the experience of one's consciousness functioning apart from the physical body. The material aspect involves an NDEr perceiving— seeing, hearing, etc.—m aterial phenomena, mainly but not exclusively in the area surrounding her body. These phenomena include the NDEr's body itself and/or the people, objects, and environments surrounding or distant from the body. The transmaterial aspect involves perceiving "phenomena in transcendent dimensions beyond the material world" (p. 185)–environments often of exceptional beauty and entities such as deceased loved ones and spiritual/religious figures.

The "gold standard" in assessing whether a person has experienced an NDE and the depth of the experience is the Near-D eath Experience Scale (Greyson, 1983). Greyson (1983) culled the Scale's 16 questions from a list of 80 features associated with NDEs. Among other experiences, the questions address temporal distortions, feelings of peace, a sense of separation from the body, and encountering dead relatives (Lange et al., 2004). For each question, the respondent subjectively rates the feature on a three- point scale: 0 indicating no experience of that feature, 1 indicating a mild experience, and 2 indicating the most intense experience. The Scale has been useful in distinguishing NDEs from other kinds of experiences. For a person to be considered as having an NDE, she must score seven or above, with higher scores indicating more features or more subjectively intense features.

The phenomena listed do not necessarily all take place in an NDE, and when they do, they do not occur in a set order. Most NDEs do not go beyond the feeling of peace or joy. However, full-fledged experiences that contain both material-w orld perceptions and transcendental elements can be impressive, especially if a patient details seeing her own body and what was being done to it during, for example, open- heart surgery (see Sabom, 1982; Holden, 2009). Such cases of veridical NDE perception raise the issue of whether some spiritual part of a person really does separate from the body during NDEs. If so, NDEs could be construed as evidence of at least a temporary survival of a conscious part of a person after clinical death (cardio- pulmonary arrest). This possibility would still not answer the question of whether survival continues after the point of no return to physical existence that marks irreversible biological death. However, if a conscious part of people survives clinical death, the probability increases of survival beyond biological death.

The DMT Theory in the Spectrum of Theories of the Causes of NDEs

Theories of NDEs are divided into three main classes: (1) psychological theories, (2) physiological theories, and (3) non- materialistic ("spiritual" or "transcendental" theories; Greyson, Kelly, and Kelly, 2009). Psychological and physiological theories tend to be reductionist and deny that NDEs are anything more than the result of a particular psychological or physiological mechanism. However, such theories need not be reductionist; for example, if NDEs were correlated with low blood oxygen levels (current evidence is ambiguous; in a study of NDEs in cardiac arrest patients, those people having a near- death experience had higher blood oxygen levels than the non-e xperiencers; Parnia, Waller, Yeates, and Fenwick, 2001— but Michael D. Gliksman and Allan Kellehear (1990) argue that blood gas levels in cardiac arrest patients are not reliable indicators of actual cerebral oxygen levels), it is still possible that NDEs could reveal some kind of extraordinary perception or transcendent realm. The physiological theorist would have to further argue from parsimony to make her case.

Psychological theories can be divided into the following categories:

1. Fantasy or depersonalization to protect a person from the fear of death (Noyes & Kletti, 1976, 1977; Siegel, 1980)
2. A reliving of the birth experience (Sagan, 1979) 3. The role of personality factors in generating NDEs:

A. Fantasy-p roneness (Wilson & Barber, 1983)
B. Absorption (Tellegen & Atkinson, 1974)
C. Dissociative tendencies (Irwin, 1993)

The weakest of the psychological theories is Carl Sagan's view that an NDE involves memories of the experience of birth, because the newborn baby's brain is not developed enough to have sufficient cognitive capacity to remember the birth experience (Becker, 1982). In Becker's critique of Sagan's hypothesis, he also noted the fatal flaw in reductionist psychological theories: that they commit the genetic fallacy. The ultimate nature of NDEs cannot be decided in terms of psychological correlations with NDEs; NDEs could be ontologically transcendental experiences and a way to find peace at death. Psychology is not metaphysics. The genetic fallacy is particularly seen in Ronald K. Siegel's (1980) article in which he went into detail on a history of human psychological motivations for belief in life after death, including explaining phenomena surrounding death such as dreaming of the deceased and phenomena such as rebirth in nature in springtime. In a sharp exchange, Ian Stevenson (1981) noted that the origin of human belief in life after death is irrelevant its truth or falsity. However, Siegel (1981) went on to argue that such psychological continuities have behind them common biological reactions to stimuli, common brain structures, and common patterns resulting from environmental stimuli that are exemplified by NDE and other phenomena surrounding death.

Reductionists have also tried to explain NDEs by physiological and pharmacological means. This is a broader category of potential explanations and includes:

1. Temporal lobe excitation (Britton & Bootzin, 2010; Neppe, 1983, 1989; Persinger, 1989; Saavedra- Aguilar & Gómez- Jeria, 1989;)
2. Anesthesia (awareness during anesthesia to explain continued sense awareness of surgical patients who have NDEs; Blackmore, 1993)
3. Hypercapnia (also called "hypercarbia"), an excess of carbon dioxide in the blood (Blackmore, 1993; Klemenc-K etis, Kersnik, & Grmec, 2010)
4. Hypoxia (a low blood oxygen level; Blackmore, 1993)
5. Natural endorphins and neurotransmitters (whose reception sites may be affected by psychedelic drugs such as LSD, ketamine, and DMT (see Morse, Venecia, & Milstein, 1989).

Greyson (2000, 2010), along with his colleagues (Kelly, Greyson, & Kelly 2007), have summarized objections to physiological reductionism, employing two major prongs: (1) patients while having NDEs are not in the physiological state demanded by a particular physiological theory, and (2) the phenomenology of NDEs differs in significant ways from experiences resulting from physiological causes that allegedly cause NDEs. Experiences of persons suffering from hypercapnia/ hypercarbia or hypoxia are often more emotionally distressing than the majority of NDEs are, and they are often disjointed, more like a dream than like the sense of reality that characterizes most NDEs. NDErs uniformly claim what William James (1997/1902) called (referring to mystical experiences) a "noetic quality" to their experiences: The experiences felt "realer than real." Temporal lobe epilepsy and temporal lobe lesions result in less unified experiences than characterize NDEs, and most people who have such experiences believe them to be imaginary, in contrast to most NDErs' view that their NDEs actually happened.

Contemporary physiological theories follow that of Susan Blackmore (1993) in developing a multi- causal model for NDEs. For example, DMT release might explain some NDEs or parts of

NDEs, and hypoxia or hypercapnia might explain others. Temporal lobe excitation may be involved. This approach may be vulnerable to the objection that multiple leaky buckets still leak; that is, multiple weak physiological theories do not explain NDEs any better than one weak physiological theory. In addition, as Emily Kelly and her colleagues (Kelly et al., 2007) pointed out, major elements of NDEs, including their noetic quality, the life review, and meeting deceased relatives are not accounted for in many physiological theories. No physiological theory, they suggest, can explain veridical perception of loved ones who have died when the NDEr does not know prior to the NDE that the person has died. Thus, even combinations of physiological theories fail to adequately explain NDEs.

The weaknesses in other physiological theories will be shown to haunt the position that NDEs are caused by naturally psychotropic hormones in the body released near actual or feared death. It is also alleged that psychedelic drugs that act on those receptors result in a subjective state that mimics key features of NDEs. one candidate often discussed is ketamine, an animal anesthetic that in the past was used on humans, that affects NMDA receptors, and that results in psychedelic affects in humans (Jansen, 1989, 1996). Although Karl Jansen's claims have been sharply criticized (Bianchi, 1997; Fenwick, 1997; Kungurtsev, 1997; Morse, 1997; Twemlow & Gabbard, 1997; see also Jansen, 1997, in which he replied to his critics), I will use ketamine as an example of how drugs can be used to make a reductionist argument regarding NDEs:

1. Ketamine results in subjects experiencing phenomenological features found in NDEs, often surpassing a score of seven on the NDE Scale.
2. Ketamine acts on neurotransmitter receptor site S that is sensitive for neurotransmitter Y.
3. It is probable that Ketamine mimics the effects of large doses of Y.
4. Thus higher than normal levels of Y in extremis can trigger NDEs.
5. From an evolutionary perspective such high levels may function to calm an organism that is facing death.

As previously stated, not everyone who believes that neurotransmitters play a key role in causing NDEs are reductionists. For example, Rick Strassman, who has performed extensive experiments with DMT, is not a reductionist; see his discussion of ketamine in Strassman (1997). It may be the case that certain events must happen in the brain to "trigger" the soul's release from the body, and these events will involve neurotransmitters. However, a skeptic concerning the existence of the soul, a transcendent realm, and/or survival of death could argue that if neurotransmitter release can explain the formation of NDEs, there is no need to posit a soul or support any survivalist interpretation of NDEs. Although I have argued elsewhere (Potts, 2011) that occam's Razor is not decisive in rejecting a particular scientific explanation, an analysis of the subjective states resulting from a particular psychedelic and those of NDEs could at least answer the question of whether NDEs are sufficiently similar to a drug- induced experience to suggest that they involve the same chemical facilitator.

The debate over this issue has been extensive, beginning with the discussion regarding whether drug-induced experience could induce a mystical or transcendental experience in general. William James (1997/1902) suggested a non- reductionist interpretation of his experiences with nitrous oxide. Later, Aldous Huxley (1954), Huston Smith (2000), and Stanislav Grof (2009) all suggested that psychedelic drugs such as mescaline (Huxley) and LSD (Smith, Grof) could open the door to a transcendent realm, with R. C. Zaehner (1957) strongly disagreeing. With the beginning of the modern study of NDEs, this debate extended to those experiences. The debate has ranged over the major psychedelics, although focusing mainly on LSD, ketamine, and DMT (Greyson, 2000, 2010; Greyson, Kelly, & Kelly, 2009; Grof, 1985, 2009; Jansen, 1989, 1996; Luke, 2008; Morse et al., 1989; Ring, 1988; Rogo, 1984; Siegel, 1980; Strassman, 1996, 2001; Strassman et al., 1994; Yensen, 1988). The main issue is whether there is any more to NDEs than a physical experience caused by a neurological reaction to psychedelic- like substances in the body. A secondary issue is whether psychedelics themselves are doorways to a transcendent realm. With this debate in mind, the next section will address DMT.

DMT

DMT and its close relative 5- methoxy-N ,N- dimethyltryptamine (5- Meo- DMT, also known as bufotenine due to its presence in the venom of frogs from the *Bufo* genus) were first used as psychedelic substances by the native tribes of South America, especially in the Amazon region of Brazil (Stafford & Bigwood, 1993). They were used in religious ceremonies, medicine, magic, and various rites of passage and are still used today by two Brazilian religious groups: the Santo Daime and the Uniao de Vegetal (Riba, Valle, Urbano, Yritia, Morte, & Barbancu, 2003). The natives and

the religious groups drink a beverage called ayahuasca that combines various parts of native plants. The active ingredients are DMT and monoamine oxidase inhibitors.

Since the synthesis of DMT in 1931, it has been researched, especially from the 1950s (Szara, 2007) until it was placed on Schedule I of the Controlled Substances Act in 1970, although there was already a trend toward making it illegal in individual state laws (Stafford & Bigwood, 1993). Since then, research has been more sporadic on DMT—a nd on psychedelics in general— but recent speculation about a possible causal role of DMT in schizophrenia has kept interest alive in DMT research (see, for example, Heller, Narasimhachari, Spaide, Haskovec, & Himwich, 1970; however, more recent research has yielded conflicting results; see Gable, 2007), and the pace of research articles published on DMT has increased.

In these publications, researchers have reported on their investigations of DMT's chemical properties, pharmacology, and psychedelic effects. DMT is synthesized from the amino acid tryptophan (Jacob & Presti, 2004). Its molecular structure is simpler than the other tryptamine psychedelics such as psilocybin and bufotenine (Gable, 2007; Strassman, 2001). Solomon Snyder and Elliot Richelson (1968) found that tryptamines and other classes of psychedelics "all approximate a unique conformation, simulating in part rings A, B, and C of LSD" (p. 206). DMT is chemically similar to serotonin, and like LSD and psilocybin, DMT is a serotonin agonist at the 5-hydroxytryptamine (5-H T_{2A}) and 5- HT_{2C} receptors (Riba, Valle, Urbano, Yritia, Morte, & Barbanoj, 2003; Yritia, Riba, ortuño, Ramirez, Castillo, Alfaro . . . Barbanoj, 2002). This similarity is important because

> 5- HT receptor sites exist in human central tissue in areas known to subserve emotional, perceptual, and somatosensory function. . . . 5- HT2 receptors were found in human cortical areas, mammillary bodies, claustrum, amygdala, caudate, putamen, nucleus accumbens, hippocampus. . . . cortex and striatum" (Strassman et al., 1994, p. 103).

The function of endogenous DMT is unknown. Endogenous DMT has been found in smaller amounts in urine and blood and in larger amounts in the stool, which has led to the suggestion that DMT may play some role in intestinal function (Kärkkäinen et al., 2005). However, Michael Jacob and David Presti (2005) pointed to recent research revealing the role of neurotransmitters outside the brain, including those in the gut, in helping to establish mood. They suggested that natural DMT has a calming rather than a psychedelic effect, which they believe has to do with DMT's affinity for the trace amine (TA) receptor. Strassman (2001) suggested that the pineal gland may produce DMT, referring to its secretion of the non-p sychedelic tryptamine N- acetyl-5-m ethoxytryptamine (melatonin).

Natural DMT is quickly broken down in the body, most likely through "first- pass enzymic degradation by monoamine oxidase (MAO)" (Yritia et al., 2002, p. 272). Without a monoamine oxidase inhibitor such as harmaline, which is found along with DMT and other MAOIs in the ayahuasca beverage, orally ingested DMT is dormant (Yritia et al., 2002). Besides oral ingestion, DMT can be smoked, snorted, or injected (Rodriguez, 2006). Early on, Stephen Szara (1969) discovered that DMT's effect on animals is similar to the effects of mescaline and of LSD, although with short- lasting action: 45 minutes to one hour. Animals given 5-M eO- DMT engage in "head shaking, forepaw treading, flat- body posture, straub tail, and hindlimb abduction" (Shen, Jiang, Winter, & Yu, 2010, p. 661), behaviors that are standard responses to many hallucinogens; the authors noted that it also leads to sham rage in cats. Szara (1956) also discovered the psychedelic properties of DMT in humans: "visual hallucinations and illusions, distorsion [sic] of the spatial perception and body image, disturbances of thought and speech, euphoria" (Szara, 1956, p. 441). Physical symptoms include an increase in heart rate and blood pressure and pupillary dilation (Strassman, 2001; Szara, 1956).

Strassman and his colleagues (Strassman et al., 1994) have done the most recent detailed studies of DMT's effects on humans. With 12 subjects who were experienced users of psychedelics, they administered DMT via IV; one subject dropped out of the experiment. At first, on different days subjects would receive a low dose (0.04 mg/kg) and a high dose (0.4 mg/kg) of DMT. Later, in a double- blind study with saline placebo, they received doses of 0.05, 0.1, 0.2, and 0.4 mg/kg. Doses of 0.2 and 0.4 mg/kg resulted in "the nearly instantaneous onset of visual hallucinatory phenomena, bodily dissociation, and extreme shifts in mood. . . . Auditory effects were noted in about half the subjects" (Strassman et al., 1994, p. 101). At the highest dose, subjects experienced a nearly immediate "rush" in which the normal perceptual field was replaced with a hallucinogenic one. The psychological effects peaked after two minutes and ended in most subjects by 30 minutes (Strassman, 1996). Subjective experiences that Strassman and his colleagues (1994) reported were almost all visual and included "concrete, well- formed, visual images" such as "a fantastic bird" or "human and 'alien' figures" (p. 100). Subjects also reported less specific visual images such as

unusually intense colors or "beautiful, colorful pink cobwebs" (p. 100). Auditory effects including "chattering" or "enhanced 'auditory acuity'" (p.101). Cognitive effects ranged from "ineffability" to a "sense of experiencing 'full intelligence' or 'full consciousness'— but an 'emotionally detached' entity" (p. 102). Some subjects also reported a sense of "an almost complete loss of control" (p. 102).

In another study, researchers compared the psychological effects of DMT and ketamine in nine (of an original fifteen) healthy subjects who completed the experiment by being given both drugs (Gouzoulis- Mayfrank, Heekeren, Neukirch, Stoll, Stock, Obradovic, & Dovar, 2005). Some types of experiences were common to both drugs, such as bodily misperceptions, including a sense of the body melting and a sense that even soft contact on the body made permanent indentations. Subjects experienced their body boundaries as vague. Also, high doses of both drugs resulted in paranoia and a sense of "altered meaning or significance" (p. 307). Visual hallucinations were more common with DMT, and subjects given DMT also reported auditory sensations of hearing whispering or a telephone ringing. Visual hallucinations associated with DMT administration included "complex geometrical patterns on the walls and body parts on the computer screen" (p. 307). Two subjects during DMT administration showed evidence of paranoia, believing that the scientists conducting the experiment were being directed by a higher being of some kind. Subjects' thinking became disorganized, and logical connections between propositions loosened. Mood changes occurred, but two subjects felt anxious because they did not believe the mood changes were real as much as caused by DMT.

Ketamine led to "dose- dependent hypomimia, psychomotor poverty, poverty of speech, apathy and withdrawal. Six subjects displayed catatonic- like behavior" (Gouzoulis- Mayfrank et al., 2005, pp. 207– 208), and all subjects displayed emotional blunting and detachment from other people. Visual hallucinations occurred in only one subject, which involved "cartoon- like figures moving on the computer screen" (p. 208). Some subjects reported a sense of the body moving through space. With only one exception, subjects found the experience unpleasant. The authors concluded that DMT, an LSD- like drug, causes symptoms similar to the positive effects of schizophrenia, and ketamine, which is similar to PCP, causes symptoms similar to the negative effects.

Strassman (2001) was impressed with the subjects in his experiments who had visions of races of beings that the patients interpreted as "transdimensional" or "extraterrestrial." Subjects reported hallucinations of intelligent insectoid and reptilian beings, and some hallucinations involved aliens experimenting and probing the subjects. A few subjects experienced NDE-l ike visions, including a vision of a tunnel that included seeing gremlin- like antagonistic beings as well as good beings who were aiding the subject. Strassman (2001), like Rodriguez (2006) after him, went as far as to suggest that the "realms" the subjects experienced might actually exist on some world in another dimension. But, in my view, this interpretation lends too much evidential value to the subjective certainly of some subjects that their experience was of an alternate dimension or world. Subjective certainty does not imply the truth of that about which one is certain. Person P could be certain that she sees a rabbit 20 yards from her– until she draws closer and sees that the animal is a squirrel. Her certainty that she saw a rabbit does not turn a squirrel into a rabbit. Such a "noetic quality," a sense of certainty that one is gaining knowledge through an experience, is also present in mystical experiences, as William James (1902/1997) noted. As James recognized, although such knowledge may have overwhelming epistemic value for the person who had the experience, it does not necessarily have such epistemic value for those who did not have it.

Does DMT Underlie NDEs?

D. R. Hill and Michael Persinger (2003) argued that mystical experiences of all types, in which category they included NDEs, might be caused by strong magnetic fields that trigger the release of DMT by the pineal gland. They conducted an experiment in which weak electromagnetic fields were released into both cerebral hemispheres; the most vivid experiences occurred when the magnetic fields sent to the right hemisphere were 10% more intense than those sent to the left. Subjects experienced a sense of separation from their bodies, a white light, a sense of bodily deformation, and entities such as deceased relatives or another kind of being. They also experienced hallucinations of "cartoon characters, specific animals, insects, and reptilian- like references" (p. 1049). In addition, some experienced "odd tastes and smells and intense fear" (p. 1049). Hill and Persinger (2003) hypothesized that higher DMT levels will correlate with magnetic field signals sent to the brain. A major problem with Persinger's studies, however, was noted by Pehr Granqvist and his associates (Granqvist, Fredrikson, Unge, Hagenfeldt, Valind, Larhammar, & Larsson, 2005) who used Persinger's equipment and found that suggestion from the

experimenter, rather than weak magnetic fields, was the cause of the reported sensory experiences. This result led to considerable discussion and controversy, and debate has continued (Larsson, Larhammer, Fredrikson, & Granqvist, 2005; Persinger & Koren, 2005; St.- Pierre & Persinger, 2006).

Van Lommel (2010) expressed the belief that DMT production is stimulated by epinephrine and norepinephrine. He indicated that two factors may increase the amount of DMT near death: (1) release of epinephrine and norepinephrine in response to the stress of terminal illness or injury, and/or (2) massive release of DMT by the pineal gland as the body begins the dying process. Van Lommel claimed that experiences similar to NDEs occur with the use of DMT. But I find problems with his position, specifically the absence of evidence for either mechanism and especially that either mechanism produces DMT in large enough amounts for psychedelic effects. These questions could be investigated. Researchers could measure the amount of DMT in the blood and/or tissues at the time of cardiac arrest and afterward to know that there is a correlation between cardiac arrest and sufficiently high levels of DMT. However, even if correlations could be shown, it would not count as causation without particularly strong evidence. I believe the value of van Lommel's theories is to provide models for designing future experiments to test them.

Strassman (2001) and Hill and Persinger (2003) have independently made a strong claim: that DMT plays the main causal role in producing *all* mystical experience and *all* NDEs. Even van Lommel has not gone that far. But as Peter Fenwick (1997), speaking of ketamine, has noted, a particular drug such as ketamine may be involved in some, but not necessarily all, NDEs. The same could be speculated regarding DMT. This assumption seems reasonable given the variety of situations in which NDEs occur. Although the claim that one drug, endogenous DMT, may produce NDEs while the body is near death and under great stress, is a simple hypothesis, it ignores the multiple redundancies and different sets of neurons (and sometimes different neurotransmitters) that yield similar experiences and behaviors. It is also possible that multiple systems contribute to NDEs; perhaps a ketamine- like blockage of the N- methyl- D- aspartate (NMDA) receptor combined with DMT's action are necessary and jointly sufficient conditions for an NDE to occur. Fenwick (1997) also noted that because NDEs occur in many different situations, not all involving a shock to the brain through lack of oxygen or some other issue, it is unlikely that a single neuroprocess is the cause of all or most NDEs.

In addition, one should consider evidence of veridical perceptions occurring that go beyond current explanatory models of brain functioning. Pam Reynolds (Holden, 2009; Sabom, 1998) is a case in point. In order to have a large basilar artery aneurysm safely removed from her brain, there was a need to drain her blood, cool her body, and stop her heart. Near the start of the surgery, before cardiac arrest took place, she was fully anesthetized with eyes taped shut and ears plugged with speakers. Loud, rapid clicks were transmitted to one ear and white noise in the other. Her head was covered except for area around the incision. Yet despite the sensory blockage due both to being anesthetized and to the lack of visual and auditory input by normal means, Reynolds gave a detailed accounting of her surgery afterwards, with a number of specific facts verified, including the use of a bone saw and a groin incision. She heard a female voice saying that her right side vessels were too small and a male voice saying to try making an incision in the other side (Holden, 2009; Sabom, 1998). She also had a transcendental NDE in which she saw deceased relatives, possibly during the time she was in cardiac arrest, though it is impossible to tell for sure. However, it remains an impressive case.

Many NDEs occur after cardiac arrest, a devastating insult to the body that leads to a flat EEG in less than a minute. While the EEG only measures neocortical activity, a lack of cortical activity is at least prima facie evidence for a lack of consciousness—y et NDErs often have experiences in which they present specific, verifiable details about their resuscitations, have transcendental experiences that have a strong narrative structure (instead of the often choppy experiences involving DMT or ketamine), and occur with a clear sensorium (Greyson, 2000, 2010; Greyson, Kelly, and Kelly, 2009). The increasing number of veridical NDEs documented, including some in children, suggests that something other than an endogenous drug-b ased theory is adequate (see Ring & Lawrence, 1993; Rousseau, 2012).

Importantly, adherence to a DMT or ketamine model does not negate the possibility that NDEs are evidence of survival of death, of a soul that is separable from the body, or of some kind of "universal consciousness." Van Lommel (2010) is a case in point, with his belief that the pineal gland, through its release of DMT, is the body's link to universal, nonlocal consciousness. Strassman (2001) believed in the ontological reality of the claims of beings from other dimensions DMT experiencers claim to see. Rodriguez (2006) agreed. Such an emphasis on the pineal gland as

the link between worlds sounds a great deal like René Descartes's (1649/1989) claim that the pineal gland is the central point at which the soul interacts with the body (Lokhorst, 2008).

The most compelling reason against the DMT hypothesis of NDEs is the same reason the ketamine theory is flawed: The phenomenology of drug-facilitated experiences is far more different from than it is similar to the phenomenology of NDEs. An examination of the DMT literature indicates that studies such as Christopher Cott and Adam Rock's (2008) and David Luke's (2011) that argued for a similarity between DMT phenomenology and NDEs—with the former report emphasizing noetic quality and ineffability and the latter the appearance of discarnate entities—do not square with the bulk of the evidence. This is a similar problem to the one ketamine faces: The predominantly emotionally distressing experiences of ketamine do not square with the predominantly emotionally pleasurable NDEs. In the case of DMT, Strassman's list of experiences can be compared to the items of the NDE Scale that reflect common-phenomenology from among hundreds of NDEs. The NDE Scale includes questions about the following (modified from Greyson, 2007, p. 409); components similar to those in DMT phenomenology are italicized:

Cognitive items Time distortion
Thought acceleration
Life review
Sudden understanding
Affective items
Peace
Joy
Feeling of cosmic unity
Light
Purportedly paranormal experiences
Sensory vividness
Extrasensory perception
Precognitive visions
Out-of-body experience
Transcendental items
Unfamiliar environment
Unidentified "presence"
Religious or deceased spirits
Border or "point of no return"

The list of DMT experiences gleaned from Strassman (2001) includes the following; components similar to those in NDE phenomenology are italicized:

Vivid colors
A Taj Mahal-like building
A merry-go-round with people in 1890s outfits
Clowns (very common)
Circus imagery (very common)
Emotional shock
A sense of annihilation of personal identity
Feeling loved
Gaining information
Noetic quality ("realer than real")
DNA-like spirals
Alphabet-like shapes
Reptilian or insectoid alien beings
High-tech machine-like objects
Computer Board
Ballroom
Being on an operating table with "entities" examining the experiencer
"Angelic singing" by "impersonal beings"
Bright light
Sense of separation from the body
Programmed stick figures as in a video game
Crocodiles raping and crushing an experiencer
A great, impersonal power behind all things
Hundreds of forms of beautiful women

Although some similar phenomena are common to both experiences, many unique phenomena characterize each of them. All perception involves interpretation, but it would be difficult in this case to attribute content differences to interpretation alone. In addition, some similarities do not parallel these two experiences alone; ineffability, for example, characterizes mystical or religious experiences in general. on the other hand, the particular ineffability of the two experiences is only superficially similar: The ineffability of being probed by aliens is not similar to the ineffability of NDEs. Both the less common distressing NDEs (Bush, 2009) and DMT experiences involve demonic beings, but NDEs lack the science-fi ction setting that often characterizes DMT experiences. Furthermore, some aspects of DMT experience resemble other psychedelic experiences more than NDEs; for example, the sense of alienation from one's body is similar in DMT and in the other psychedelic experiences psychedelics of ketamine and LSD. And importantly, frequent or key NDE phenomena have not, to my knowledge, been reported among DMT experiencers, such as traveling through a tunnel into a transcendent realm or reporting subsequent to the experience that one perceived veridically during it. And finally, aftereffects of the experiences are dissimilar: Apparently permanent changes after NDEs are the rule rather than the exception (Noyes, Fenwick, Holden, & Christian, 2009) but after DMT experiences are the exception rather than the rule (Strassman, 2001).

This argument is not to claim that DMT plays no contributing role at all in the production of NDEs: It very well may. But thus far the evidence in its favor is not as strong as its advocates, such as Strassman and van Lommel, have claimed. If NDEs are neurally mediated, it is more likely that such complex experiences involve multiple neurotransmitters and regions of the brain other than or in addition to HT serotonin receptors. Veridical perceptions and complex experiences of NDErs during total anesthesia and cardiac arrest support the possibility that nonphysical mechanisms may be at work in NDEs, or if the mechanisms are physical, they appear to defy the prevailing conception of science. At this stage the cause or causes of NDEs cannot be identified with reasonable certainty. Rather, there is, given the evidence, reasonable certainty that DMT is neither the only nor the chief mechanism in the production of NDEs.

References

Becker, C. B. (1982). The failure of saganomics: Why birth models cannot explain near- death phenomena. *Anabiosis: The Journal for Near-D eath Studies, 2*, 102–109.

Bianchi, A. (1997). Comments on "The ketamine model of the near-d eath experience: A central role for the n-m ethyl- d- aspartate receptor." *Journal of Near- Death Studies, 16*, 71–78.

Blackmore, S. (1993). *Dying to live: The science of near-d eath experiences*. Buffalo, NY: Prometheus Books.

Britton, W. B. & Bootzin, R. R. (2004). Near-d eath experiences and the temporal lobe. *Psychological Science, 15*, 254–258.

Bush, N. E. (2009). Distressing Western near-d eath experiences: Finding a way through the abyss. In J. M. Holden, B. Greyson, & D. James (Eds.), *The handbook of near-d eath experiences: Thirty years of investigation* (pp. 63–86). Santa Barbara, CA: Praeger/ABC- CLIo.

Cott, C., & Rock, A. Phenomenology of N,N-d imethyltryptamine use: A thematic analysis. *Journal of Scientific Exploration 22*, 359–370.

Descartes, R. (1989). *The passions of the soul* (H. S. Voss, Trans.). Indianapolis, IN: Hackett. (original work published 1649)

Fenwick, P. (1997). Is the near-d eath experience only n-methyl- d- aspartate block ing? *Journal of Near-Death Studies, 16*, 43–53.

Gable, R. S. (2007). Risk assessment of ritual use of oral dimethyltryptamine (DMT) and harmala alkaloids. *Addiction, 102*, 24–34.

Gliksman, M. D. & Kellehear, A. (1990). Near-d eath experiences and the measurement of blood gases. *Journal of Near-D eath Studies, 9*, 41–43.

Gouzoulis-M ayfrank, E., Heekeren, K., Neukirch, A., Stoll, M., Stock, C., obradovic, M., & Dovar, K.- A. (2005). Psychological effects of (s)- ketamine and N,N- dimethyltryptamine (DMT): A double- blind, cross-o ver study in healthy volunteers. *Pharmapsychiatry, 38*, 301–311.

Granqvist, P., Fredrikson, M., Unge, P., Hagenfeldt, A., Valind, S., Larhammar, D., & Larsson, *M.* (2005). Sensed presence and mystical experiences are predicted by suggestability, not by the application of transcranial weak complex magnetic fields. *Neuroscience Letters, 379*, 1–6.

Greyson, B. (1983). The Near-D eath Experience Scale: Construction, reliability, and validity. *Journal of Nervous & Mental Disease, 171,* 369–375.

Greyson, B. (2000). Near-d eath experiences. In E. Cardeña, S. J. Lynn, & S. Krippner (Eds.), *Varieties of anomalous experience: Examining the scientific evidence*. Washington, DC: American Psychological Association.

Greyson, B. (2007). Consistency of near-d eath experience accounts over two decades: Are reports embellished over time*? Resuscitation, 73*, 407–411.

Greyson, B. (2010). Implications of near- death experiences for a post- materialist psychology. *Psychology of Religion and Spirituality, 2*, 37–45.
Greyson, B., Kelly, E. W., & Kelly, E. F. (2009). Explanatory models for near- death experiences. In J. M. Holden, B. Greyson, & D. James (Eds.), *The handbook of near- death experiences: Thirty years of investigation* (pp. 213–234). Santa Barbara, CA: Praeger/ABC- CLIo.
Grof, S. (1985). *Beyond the brain: Birth, death and transcendence in psychotherapy*. Albany, NY: State University of New York Press.
Grof, S. (2009). *LSD: Doorway to the numinous:Tthe groundbreaking psychedelic research into realms of the human unconscious*. Rochester, VT: Park Street Press.
Heller, B., Narasimhachari, N., Spaide, J., Haskovec, L., & Himwich, H. E. (1970). N- dimethylated indolamines in blood of acute schizophrenics. *Experimentia, 15*, 503–504.
Hill, D. R., & Persinger, M. A. (2003). Application of transcerebral, weak (1 microT) complex magnetic fields and mystical experiences: Are they generated by field- induced dimethyltryptamine release from the pineal organ? *Perceptual and Motor Skills, 97*, 1049–1050.
Holden, J. M. (2009). Veridical perception in near-d eath experiences. In J. M. Holden, B. Greyson, & D. James (Eds.), *The handbook of near-d eath experiences: Thirty years of investigation* (pp. 185–212). Santa Barbara, CA: Praeger/ ABC- CLIO.
Huxley, A. (1954). *The doors of perception*. New York, NY: Harper & Row.
Irwin, H. J. (1993). The near-d eath experience as a dissociative phenomenon: An empirical assessment. *Journal of Near Death Studies, 12*, 95–103.
Jacob, M. S., & Presti, D. E. (2005). Endogenous psychoactive tryptamines reconsidered: An anxiolytic role for dimethyltryptamine. *Medical Hypotheses, 64*, 930–937.
James, W. (1997). *The varieties of religious experience*. New York, NY: Touchstone, 1997. (original work published 1902)
Jansen, K. (1989). Near death experience and the NMDA receptor (Letter). *British Medical Journal, 298*, 1708.
Jansen, K. (1996). Neuroscience, ketamine, and the near-d eath experience: The role of glutamate and the NMDA receptor. In L. W. Bailey & J. Yates (Eds.), *The near-d eath experience: A reader* (pp. 265–282). New York, NY: Routledge.
Jansen, K. (1997). Response to commentaries on "The ketamine model of the near- death experience. . ." *Journal of Near-D eath Studies, 16*, 79–95.
Kärkkäinen, J., Forsström, T., Tornaeus, J., Wähälä, K., Kiuru, P., Honkanen, A., Stenman, U.-H ., Turpeinen, U., & Hesso, A. (2005). Potentially hallucinogenic 5- hdroxytryptamine Receptor ligands bufotenine and dimethyltryptamine in blood and tissues. *Scandinavian Journal of Clinical and Laboratory Investigation, 65*, 189–199.
Kelly, E. W., Greyson, B., & Kelly, E. F. (2007). Unusual experiences near death and related phenomena. In E. F. Kelly, E. W. Kelly, A. Crabrtee, A. Gauld, M. Grosso, & B. Greyson, B., *Irreducible mind: A psychology for the 21st century* (pp. 367–421). Lanham, MD: Rowman and Littlefield.
Klemenc- Ketis, Z., Kersnik, J., & Grmec, S. (2010). The effect of carbon dioxide on near-d eath experiences in out-of- hospital cardiac arrest survivors: A pro spective observational study. *Critical Care, 14*, R56. doi:10.1186/
Kungurtsev, I. (1997). Which comes first: Consciousness or aspartate receptors? *Journal of Near-D eath Studies, 16*, 55–57.
Lange, R., Greyson, B., & Houran, J. (2004). A Rasch scaling evaluation of a 'core' near- death experience. *British Journal of Psychology, 95*, 161–177.
Larsson, M., Larhammar, D., Fredrikson, M., & Granqvist, P. (2005). Reply to M. A. Persinger and S. A. Koren's response to Granqvist et al., "Sensed presence and mystical experiences are predicted by suggestibility, not by the application of transcranial weak magnetic fields." *Neuroscience Letters, 380*, 348–350.
Lokhorst, G.-J . (2008). Descartes and the pineal gland. In E. N. Zalta (Ed.), *Stanford encyclopedia of philosophy*. Stanford, CA: Stanford University Center for the study of Language and Information. Available at http://plato.stanford .edu/archives/sum2011/entries/pineal-g land/
Luke, D. P. (2008) *Psychedelic substances and paranormal phenomena: A review of the research. Journal of Parapsychology, 72*, 77–107.
Luke, D. P. (2011). Discarnate entities and dimethyltryptamine (DMT). *Journal for the Society for Psychical Research, 75*, 26–42.
Moody, R. (1975). *Life after life*. New York, NY: Bantam Books.
Morse, M. L. (1997). Commentary on Jansen's paper. *Journal of Near- Death Studies, 16*, 59–61.
Morse, M. L., Venecia, D., & Milstein, J. (1989). Near-d eath experiences: A neurophysiologic explanatory model. *Journal of Near-D eath Studies, 8*, 45–53.
Neppe, V. M. (1983). Temporal lobe symptomology in subjective paranormal experiments. *Journal of the American Society for Psychical Research, 77*, 1–29.
Neppe, V. M. (1989). Near-d eath experiences: A new challenge in temporal lobe phenomenology? Comments on "A neurobiological model for near-d eath experiences". *Journal of Near-D eath Studies, 7*, 243–248.
Noyes, R., Jr., Fenwick, P., Holden, J. M., & Christian, R. (2009). Aftereffects of pleasurable Western adult near- death experiences. In J. M. Holden, B. Greyson, & D. James (Eds.), *The handbook of near-d eath experiences: Thirty years of investigation* (pp. 41–62). Santa Barbara, CA: Praeger/ABC- CLIo.

Noyes, R., Jr., & Kletti, R. (1976). Depersonalization in the face of life-t hreatening danger: A description. *Psychiatry, 39*, 19–27.
Noyes, R., Jr., & Kletti, R. (1977). Depersonalization in response to life- threatening danger. *Comprehensive Psychiatry, 18*, 375–384.
Parnia, S., Waller, D. G., Yeates, R., & Fenwick, P. (2001). A qualitative and quantitative study of the incidence, features and aetiology of near death experiences in cardiac arrest survivors. *Resuscitation, 48*, 149–156.
Persinger, M. A. (1989). Modern neuroscience and near-d eath experiences: Expectancies and implications. Comments on "A neurobiological model for near- death experiences." *Journal of Near-D eath Studies, 7*, 233–239.
Persinger, M. A., & Koren, S. A. (2005). A response to Grandqvist et al., "Sensed presence and mystical experiences are predicted by suggestibility, not by the application of complex magnetic fields." *Neuroscience Letters, 380*, 346–347.
Potts, M. (2011). Dulling occam's Razor: Parsimony, elegance, and explanations of poltergeist phenomena. Paper presented at the 35th International Conference of the Society for Psychical Research, Edinburgh, Scotland. Abstract available at http://www.spr.ac.uk/main/page/conference-a bstracts-2011potts
Riba, J., Valle, M., Urbano, G., Yritia, M., Morte, A., & Barbancu, M. J. (2003). Human pharmacology of ayahuasca: Subjective and cardiovascular effects, monoamine metabolite excretion, and pharmacokinetics. *Journal of Pharmacology and Experimental Therapeutics, 306*, 73–83.
Ring, K. (1988). Paradise is paradise: Reflections on psychedelic drugs, mystical experience, and the near-death experience (Editorial). *Journal of Near-D eath Studies, 6*, 138–148.
Ring, K., & Lawrence, M. (1993). Further evidence for veridical perception during near-d eath experiences. *Journal of Near-D eath Studies, 11*, 223–229.
Rodriguez, M. A. (2006). A methodology for studying various interpretations of the N,N- dimethyltryptamine-induced alternate reality. *Journal of Scientific Exploration, 21*, 67–84.
Rogo, D. S. (1984). Ketamine and the near-d eath experience. *Anabiosis: The Journal for Near-D eath Studies, 4*, 87–96.
Rousseau, D. (2012). The implications of near-d eath experiences for research into the survival of consciousness. *Journal of Scientific Exploration, 26*, 43–80.
Saavedra- Aguilar, J. C., & G6mez-J eria, J. S. (1989). A neurobiological model for near- death experiences. *Journal of Near-D eath Studies, 7*, 205–222.
Sabom, M. (1982). *Recollections of death: A medical investigation*. New York, NY: Harper & Row.
Sabom, M. (1998). *Light and death: One doctor's fascinating account of near-d eath experiences*. Grand Rapids, MI: Zondervan.
Sagan, C. (1979). *Broca's brain: Reflections on the romance of science*. New York, NY: Random House.
Shen, H., Jiang, X., Winter, J. C., & Yu, A. (2010). Psychedelic 5-m ethoxy- N,N -dimethyltryptamine: Metabolism, pharmacokinetics, drug interactions, and pharmacological interactions. *Current Drug Metabolism, 11*, 659–666.
Siegel, R. K. (1980). The psychology of life after death. *American Psychologist, 35*, 911–931.
Siegel, R. K. (1981). Reply to Stevenson. *American Psychologist 36*, 1461–1462.
Smith, H. (2000). *Cleansing the doors of perception: The religious significance of entheogenic plants and chemicals*. New York, NY: Tarcher/Putnam.
Snyder, S. H., & Richelson, E. (1968). Psychedelic drugs: Steric factors that predict psychotropic activity. *Proceedings of the National Academy of Sciences, 60*, 206–213.
Stafford, P. G., & Bigwood, J. (1993). *Psychedelics encyclopedia* (3rd expanded ed.). Berkeley, CA: Ronin.
St.- Pierre, L. S., & Persinger, M. A. (2006). Experimental facilitation of the sensed presence is predicted by the specific patterns of the applied magnetic fields, not by suggestibility: Re- analysis of 19 experiments. *International Journal of Neuroscience, 116*, 1079–1096.
Stevenson, I. (1981). Comments on "The Psychology of Life after Death." *American Psychologist, 36*, 1459–1461.
Strassman, R. (2001). *DMT: The spirit molecule*. Rochester, VT: Park Street Press.
Strassman, R. J. (1996). Human psychopharmacology of N,N-d imethyltryptamine. *Behavioral Brain Research, 73*, 121–124.
Strassman, R. J. (1997). Endogenous ketamine-like compounds and the NDE: If so, so what? *Journal of Near-D eath Studies, 16*, 27–40.
Strassman, R. J., Qualls, C. R., Uhlenhuth, E. H., & Kellner, R. (1994). Dose- response study of N,N-d imethyltryptamine in humans: II. Subjective effects and preliminary results of a new rating scale. *Archives of General Psychiatry, 51*, 98–108.
Szara, S. (1956). Dimethyltraptamin [sic]: Its metabolism in man; the relation of its psychotic effect to the serotonin metabolism. *Experientia, XII*, 441–442.
Szara, S. (1969). DMT (N,N-d imethyltryptamine) and homologues: Clinical and pharmacological considerations. In D. Efron (Ed.), *Psychotomimetic drugs* (pp. 275–286). El Cerrito, CA: Wonderland Books.
Szara, S. (2007). DMT at 50. *Neuropsychopharmacol Hungarica, 9*(4), 201–205.
Tellegen, A., & Atkinson, G. (1974). Openness to absorbing and self-a ltering experiences ("absorption"), a trait related to hypnotic susceptibility. *Journal of Abnormal Psychology, 83*, 268–277.

Twemlow, S. W., & Gabbard, G. o. (1997). Discussion of "The ketamine model of near- death experience: A central role for the n-m ethyl- d- aspartate receptor" by Karl L. R. Jansen. *Journal of Near-D eath Studies, 16*, 63–69.

van Lommel, P. (2010). *Consciousness beyond life: The science of near-d eath experiences*. New York, NY: Harperone. van Lommel, P., van Wees, R., Meyers, V., & Elfferich, I. (2001). Near-d eath experiences in survivors of cardiac arrest: A prospective study in the Netherlands. *Lancet, 358*, 2039–2045.

Wilson, S. C., & Barber. T. X. (1983). The fantasy-p rone personality: Implications for understanding imagery, hypnosis, and parapsychological phenomena. In A. A. Sheikh *(Ed.), Imagery: Current theory, research and application* (pp. 340– 390). New York, NY: Wiley.

Yensen, R. (1988). Helping at the edges of life: Perspectives of a psychedelic thera pist. *Journal of Near-D eath Studies, 6,* 149–161.

Yritia, M., Riba, J., ortuño, J., Ramirez, A., Castillo, A., Alfaro, Y., de la Torre, R., & Barbanoj, M. J. (2002). Determination of N,N-d imethyltryptamine and ß- carboline alkaloids in human plasma following oral administration of ayahuasca. *Journal of Chromatography, B, 779*, 271–281.

Zaehner, R. C. (1957). *Mysticism: Sacred and profane*. oxford, England: Clarendon Press.

Zingrone, N. L., & Alvarado, C. S. (2009). Pleasurable Western adult near-d eath experiences: Features, circumstances, and incidence. In J. M. Holden, B. Greyson, & D. James (Eds.), *The handbook of near-d eath experiences: Thirty years of investigation* (pp. 17–40). Santa Barbara, CA: Praeger/ABC- CLIo.