

Isness: Using Multi-Person VR to Design Peak Mystical Type Experiences Comparable to Psychedelics

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ABSTRACT

Studies combining psychotherapy with psychedelic drugs (Ψ Ds) have demonstrated positive outcomes that are often associated with Ψ Ds' ability to induce 'mystical-type' experiences (MTEs) – i.e., subjective experiences whose characteristics include a sense of connectedness, transcendence, and ineffability. We suggest that both Ψ Ds and virtual reality can be situated on a broader spectrum of psychedelic technologies. To test this hypothesis, we used concepts, methods, and analysis strategies from Ψ D research to design and evaluate 'Isness', a multi-person VR journey where participants experience the collective emergence, fluctuation, and dissipation of their bodies as energetic essences. A study ($N=57$) analyzing participant responses to a commonly used Ψ D experience questionnaire (MEQ30) indicates that Isness participants reported MTEs comparable to those reported in double-blind clinical studies after high doses of psilocybin & LSD. Within a supportive setting and conceptual framework, VR phenomenology can create the conditions for MTEs from which participants derive insight and meaning.

Author Keywords

Virtual Reality; Meaning in HCI; Psychedelic Drugs; Altered states; User Experience; Mystical-type Experiences

CSS Concepts

• Human-centered computing → Virtual Reality; Empirical Studies in interaction design

1. INTRODUCTION

In *The Doors of Perception*, Aldous Huxley recounted taking mescaline under the guidance of psychiatrist Humphrey Osmond. In a vase of flowers, Huxley reported seeing "the miracle, moment by moment, of naked existence... flowers shining with their own inner light and all but quivering under the pressure of the significance with which they were charged." He recalled how even "the folds of my grey flannel trousers were charged with is-ness." [36] The word 'psychedelic' was coined by Osmond in correspondence with Huxley in 1956. [61] Derived from the combination of the Greek words

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psyche (ψυχη, translated 'soul' or 'mind') and delein (δηλεῖν, 'to reveal', 'to make visible', or 'to manifest'), 'psychedelic' is often translated as 'mind-manifesting' or 'mind-revealed'. [12, 40] Crucially, we highlight that the word's roots are agnostic to the particular form of technology used in order to achieve 'mind-manifesting'.

In what follows, we investigate the extent to which immersive technologies (specifically multi-person VR) enable purer forms of awareness which are undistracted by ego – enabling people to tune into the 'is-ness' to which Huxley alluded. Evaluating such experiences is fraught with difficulties, because they are notoriously difficult to capture in words and metrics. To guide our efforts, we look to the re-surgent field of psychedelic drug (Ψ D) research, marked by Griffiths *et al.*'s influential 2006 article, "*Psilocybin can occasion mystical-type experiences having substantial and sustained personal meaning and spiritual significance*". [22] In the intervening years, Griffiths and co-workers have accumulated evidence that Ψ D efficacy in treating depression, addiction, and end-of-life anxiety correlates with their ability to occasion 'mystical-type experiences' (MTEs) which participants recount as being profoundly meaningful. [40]

Our attempts to understand whether the perceptual affordances of multi-person VR enable phenomenological experiences that create the conditions for MTEs which participants perceive as insightful and meaningful follows recent calls within human-computer-interaction (HCI) to focus on designing tools that enable experiences of meaning. For example, Mekler and Hornbaek [56] defined a conceptual framework for what constitutes an experience of 'meaning' in HCI. Three of their concepts – connectedness, resonance, and significance – have strong overlaps with concepts used to evaluate psychedelic drug experiences (Ψ DEs) – namely, connectedness, ineffability, and noetic quality. [1] Light *et al* [50, 51] outlined concepts for technology makers to adopt in order to stimulate alternative narratives and visions, urging designers to focus on making moral progress at a time of emerging crisis and instability. They emphasize that 'significance' and 'meaning' must acknowledge human mutability and mortality within interconnected ecological systems. Kaptelinin [43, 44] has made calls for HCI to deal directly with the fundamental 'givens' of human existence (e.g.,

mortality, identity, isolation, meaning, etc.), in order to make our lives more ‘authentic’ and ‘meaningful’.

The question of meaning is important right now. With worsening climate predictions and an unprecedented rate of extinction within the biosphere, [50, 51] there is a growing sense that our every action must be balanced with awareness, including how we design and use technology. [43, 50, 51, 59] As the discourse of extinction enters into our collective psychological landscape, so does a sort of end-of-life anxiety as we struggle to shake our addiction to unsustainable growth paradigms. The ACM ‘computing within limits’ community has explicitly acknowledged this problem, pointing out that most computing work depends on industrial civilization’s default worldview that ongoing economic growth is achievable and desirable, with a vision for the future ‘very much like the present, but even more so’ [59], which fails to recognize global material and ecological limits.

To date, calls for meaning-making within HCI lack empirical demonstrations showing how the proposed concepts and theoretical paradigms can be practically applied to enable experiences which participants find meaningful. In what follows, we directly address this knowledge gap. We show how immersive forms of computing can be used to cultivate awareness, ego-dissolution, and a sense of connectedness (to oneself, to others, and to the world-out-there) – all concepts with the potential to foster awareness and help us imagine our way out of the damaging and addictive paradigms in which our culture is stuck. To inspire our approach, we have turned to the ΨD research literature, because it is concerned with how to practically enable meaningful participant experiences that facilitate positive therapeutic outcomes. We outline how we have applied phenomenology from ΨD research to design the Isness multi-person VR experience, and present quantitative and qualitative evidence that Isness leads to peak experiences which occasion MTEs to which participants attribute significant personal meaning and insight, comparable to the MTEs that arise with moderate to strong ΨD doses.

2. BACKGROUND

ΨD Technologies

The ‘classical ΨDs’ include LSD, mescaline, psilocybin, and DMT. Phenomenologically, they produce non-ordinary and variable forms of consciousness which (compared to ordinary waking consciousness) are less centered on one’s normal sense of egoic self, [8, 62] instead producing senses of unity and connectedness. [11] While the classical ΨDs were of prominent interest within psychiatry and neuroscience research in the 1950s and 60s, their recreational use and their association to counterculture prompted an end to their use in human research in the early 1970s. [61] However, the last decade has seen a resurgence in research studies carried out to evaluate their utility for promoting positive psychological health in both clinical and non-clinical settings. Double-blind trials [22, 23] and neuroimaging studies [7, 10] indicate that classical ΨDs hold strong potential as therapeutics for treating depression, addiction, and end-of-life anxiety associated

with terminal illness. [40, 68] Johnson *et al.* discuss the insufficiency of the term “hallucinogen” in referring to ΨDs because it suggests effects limited primarily to visual perception. [40] Given that classical ΨDs do not typically produce stark hallucinations and are instead associated with effects on human consciousness and sense of self, the term “psychedelic” has re-emerged within the scientific literature. [61]

ΨDs and MTEs

Early researchers identified the ability of ΨDs to facilitate powerful MTEs for participants, [28, 47, 65, 66] highlighting the correlation between subjective MTEs and the efficacy of ΨDs in treating addiction and dealing with end-of-life anxiety. The 2006 Griffiths *et al* study showed that participants who had taken psilocybin reported greater psychological well-being compared to those who had ingested methylphenidate placebo. 67% of the study participants identified their psilocybin experience as being amongst the most personally meaningful experiences of their lives, and analysis of their subjective reports showed that many had MTEs. These studies utilized a ‘psychedelic psychotherapy’ approach [15, 54], where the goal is to administer a high drug dose in order to occasion a MTE (sometimes called ‘peak experience’ or ‘ego dissolution’) and inspire subsequent behavior change (this contrasts with so-called ‘psycholytic’ approaches that use lower ΨD doses). The intervening years have seen a number of additional studies, where psilocybin has been administered to healthy volunteers; [24, 26] patients with life-threatening cancer diagnoses; [25, 67] people dealing with addiction; [18, 38, 39] and those afflicted with treatment-resistant depression [13]. Several of these studies reaffirm the fact that participants’ subjective reports of MTEs following ΨD ingestion offers a good predictor of positive therapeutic outcomes.

Characterizing MTEs

The most definitive review of features that can be used to identify a subjective experience as mystical was compiled by Stace [71] who distilled phenomenological descriptions of MTEs from a variety of sources. Building on the work of William James, [37] he identified *a sense of unity* (becoming one with all that exists) as the defining feature of the MTE. Other dimensions of MTE which Stace identified include: (1) *ineffability* (i.e., it cannot be encapsulated in words); (2) *noetic quality* (i.e., insight into the depths of some fundamental truth or ultimate reality which transcends the discursive intellect, as captured by the Huxley quote at the beginning of this article); (3) *sacredness* (i.e., a sense that what is encountered is holy or sacred); (4) *positive mood* (i.e., joy, ecstasy, blessedness, peace, tenderness, gentleness, tranquility, and awe); and (5) *transcendence of time and space* (i.e., conventional experiences of time and space seem to fall away).

The majority of empirical studies which have sought to measure MTEs utilize the Hood Mysticism Scale (M Scale). [35] Based on Stace’s work, this scale was originally developed to measure naturally occurring (i.e., non-drug) MTEs, but Griffiths *et al* showed that high doses of psilocybin could reliably occasion salient MTEs in healthy participants, [22,

23, 26] and moreover that the strength of the MTE could predict positive outcomes for ΨD therapies. To specifically measure MTEs occasioned by ΨDs, Griffiths and co-workers developed and validated the Mystical Experience Questionnaire (MEQ30), [1, 52] which avoids reference to whether participants feel they have engaged with another sentience (e.g. God). It is designed to capture a participant's feeling that their experience: (1) is ineffable; (2) transcends typical experiences of space and time; (3) is mystical (i.e., produces senses of internal/external unity, connectedness, sacredness, and noetic qualities); and (4) produces a positive mood. The MEQ30 has been thoroughly tested: at the time of writing, the literature contains results from 26 previous experiments on 540 total participants, detailed in the Table 1 and 2 in the Supplemental Material (SM).

ΨD Phenomenology and Immersive Technology

Grof wrote that ΨDs, “used responsibly and with proper caution, would be for psychiatry what the microscope is for biology and medicine or the telescope is for astronomy... [making] it possible to study important processes that under normal circumstances are not available for direct observation.” [29] It is difficult to precisely characterize the phenomenological effects whereby ΨD neurochemistry leads to MTEs, in part because ΨDs have multiple physiological effects, not all of which are likely relevant to generating altered perceptual phenomenology. A further question concerns the mechanism whereby phenomenological changes to sense perception arise during ΨDEs. For example, it has been observed that hallucinations [55] and altered perception of time [19] can arise in non-drug contexts, e.g., by placing participants in altered sensory environments. This raises an interesting question: is the ‘psychedelic experience’ primarily a result of ‘top-down’ changes in a participant’s brain? Or can it also arise from ‘bottom-up’ changes to perceptual sensory inputs? If ΨDs offer a kind of microscope for understanding brain function, then immersive technology which achieves comparable subjective effects may have the potential to serve as a kind of microscope to unravel the subjective phenomenological threads which combine to construct MTEs.

Practically, MTEs occasioned using immersive technology might sometimes be preferable to those which arise from ingestion of ΨDs. For example, ΨDs remain subject to a host of regulatory challenges, which makes them a challenge to work with in scientific contexts. Moreover, high doses of classic ΨDs can result in an anxious, dysphoric, confusing, and (less commonly) delusional acute reaction (a “bad trip” colloquially). [40] Given that classical ΨDEs can last anywhere from 6 – 12 hours, being alert to deal with ‘bad trips’ in case they arise requires sustained attention from the facilitators. Finally, ingestion of classical ΨDs often leads to short-term physiological effects, including elevated blood pressure and heart rate, psychological discomfort (e.g., anxious or dysphoric reactions), and physical distress (e.g., nausea, vomiting, and headache). [40]

There are relatively few rigorous empirical studies analysing technological approaches to understand altered states.

A number of VR experiences strive to give participants a glimpse of the ‘trippy’ visuals often associated with ΨDs (swirling geometric fractals, kaleidoscopic light trails, technicolor textures, etc., see e.g., [16]), some of which have been criticized as ‘elaborate screensavers’. [48] Kitson et al have outlined ways in which VR might be used to simulate the experience of lucid dreaming, [46] and Gullapalli et al have carried out studies evaluating the use of wearable technologies to *measure* drug use. [30] To date, we are aware of only one empirical study of a framework designed to *simulate* ΨD phenomenology: the ‘hallucination machine’ which Suzuki *et al.* designed to simulate altered visuals of the sort which participants might experience during ΨDEs. Using panoramic 360 videos (derived from Google’s deep dream convolutional neural nets) which individuals could watch whilst wearing a VR headset, [73, 74] their results (N = 12) suggest that it is possible to induce visual phenomenology similar to psilocybin; however, they were unable to evoke in participants the temporal distortion commonly associated with altered states.

Our work represents a significant departure from previous approaches like that of Suzuki *et al.*: rather than simulate ΨD visuals, our focus is on how immersive technology might be used to construct MTEs comparable to those that arise during ΨDEs. Recent work by Griffiths *et al* [27] comparing MTEs that arise from ΨDs to those that arise naturally (i.e., non drug-induced) highlights the fact that MTEs *per se* are powerful predictors of lasting changes in psychological health regardless of their origins. Inspired by this insight, the remainder of this paper outlines our efforts to design and analyze *Isness*, a multi-person VR experience which we show is able to occasion MTEs similar to those which arise from large ΨD doses. The structure of this paper is as follows: First we outline the overall structure of the three-stage *Isness* experience, prefaced by a description of the participants and the technological components we used to build *Isness*. Then, we highlight specific concepts from ΨD research used to inform the design of *Isness*, describing how these concepts were woven into each of the 3 *Isness* stages. Finally, we present our results, followed by a discussion and conclusions.

3. THE ISNESS EXPERIENCE

Participants

64 healthy adults participated in *Isness*, where it formed part of the art installation program at a biennial psychedelics and consciousness conference held in 2019 at the University of Greenwich (London). *Isness* took place in two rooms on a low traffic corridor off the main conference lobby. All participants were at least 18 years old, were made aware of the potential risks associated with VR, and gave both written and verbal consent to their data being gathered and published. Over three days, *Isness* ran 16 times, with 64 total participants. Each group was led by one of three trained guides. To minimize participant risk, we adopted VR guidelines in line with those recommended by Madary and Metzinger. [53] The video at vimeo.com/386402891 illustrates different aspects of the *Isness* experience, discussed further below.

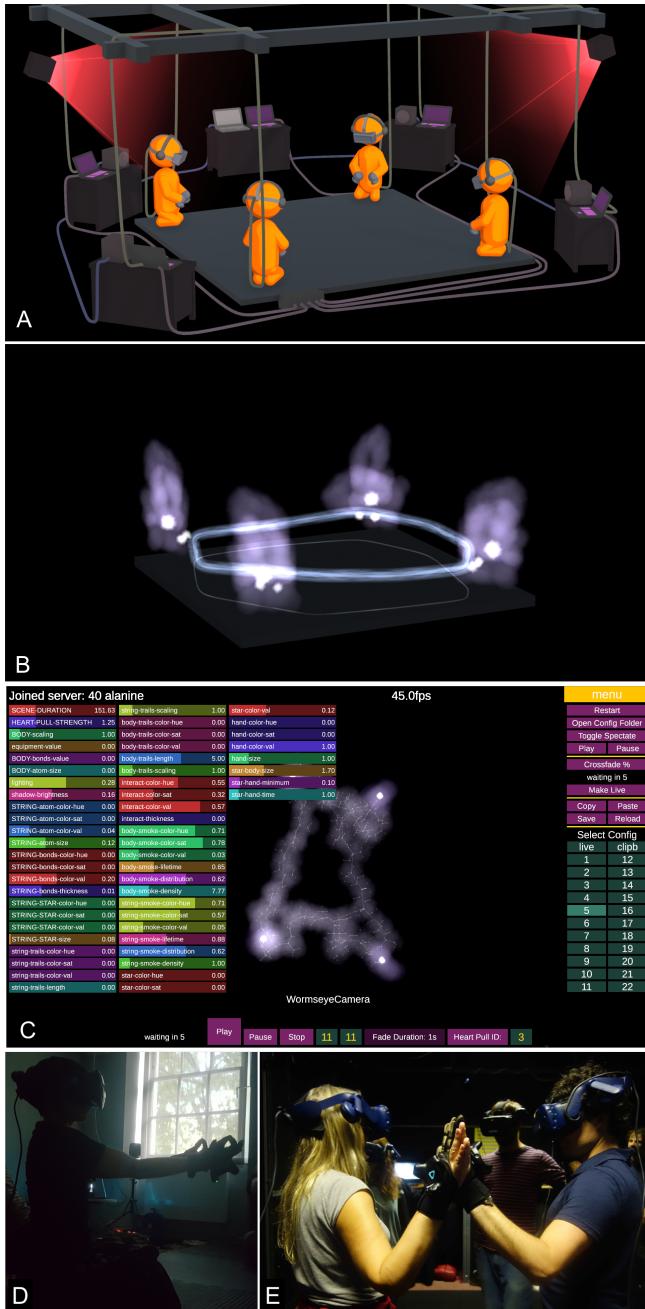


Figure 1: (A) Isness multi-person VR setup; (B) In-world view of an Isness state; (C) Interface screen for tuning aesthetic hyperparameters, showing a top-down view of 4 participants as they manipulate an energetic thread; (D) Introvertive exploration with a participant in a mudra pose; (E) Extrovertive exploration as participants join in a circle to merge fields

Multi-person VR setup

We developed Isness as a fork of the open-source Narupa project, [64] a multi-person room-scale VR framework (Fig 1A) [60] originally designed to enable groups of people to simultaneously cohabit real-time scientific simulation environments where they can reach out and touch molecular objects, manipulating rigorous real-time simulations of their dynamics, made possible by mounting the simulation on

GPU-accelerated servers. [21, 63, 64] The client/server architecture illustrated in Fig 1A provides each VR client access to global position data of all other participants, enabling each participant to see through their headset a co-located visual representation of all the other participants (e.g., Fig 1B). We designed Isness to accommodate 4 participants wearing HTC Vive Pro headsets, each locally connected via LAN cables to the server (Fig 1A).

Using Narupa, we designed MTEs by defining a set of ‘aesthetic hyperparameters’, each of which controls some aspect of the participants’ phenomenological experience and which can be precisely varied using the interface shown in Fig 1C. We defined a phenomenological ‘state’ as a given set of aesthetic hyperparameter values. The overall Isness ‘journey’ is comprised of a set of states, each of which has some specified time duration. This approach ensures reproducibility because it enables rigorous definition of the hyperparameter values used to design the Isness journey. The progression through the Isness journey was synchronized with a narrated soundtrack, which was played through a 4-channel sound system with one speaker mounted at each of the four corners of the VR space, as shown in Fig 1A. The complete Isness journey (comprised of 13 states) involved varying 25 different aesthetic hyperparameters, including for example: the color, distribution, density, and latency of the light bodies; the size of the heart center light; the rendering options for the energetic thread shown in Fig 1B; options for setting interactive forces to achieve different effects; the scene duration, and the global light levels. Our decisions on how to set the aesthetic hyperparameters were grounded in the design concepts discussed in section 4.

Mudra Gloves

The ‘mudra pose’ plays an important role during the Isness experience. Participants adopt a ‘mudra pose’ by bringing the tip of their thumb in contact with the tip of either their forefinger or middle finger (Fig 1D). Within Isness, participants could use this gesture to generate light. The light-generating mudra pose was possible using custom-made ‘mudra gloves’ constructed using four-way stretch technical knit fabric, a sewing machine, soldering iron, and conductive fabrics. The resulting gloves fit a range of participant hand shapes, as shown in Fig 1E. The mudra glove design achieves absolute position tracking using an HTC Vive tracker mounted on a 3d printed connector attached to the glove on the back of the hand. [20] Woven into each glove is a circuit made from copper electronic textile fabric which participants can close by making a mudra pose. [20] Because the mudra gloves require no calibration and have no moving parts, they can be quickly and comfortably slipped onto users’ hands without interrupting the flow of the broader Isness journey.

Set and Setting

The ΨDE is sensitive to a number of non-pharmacological contextual factors, often described as ‘set’ and ‘setting’. [33, 34, 57, 72] ‘Set’ refers to the preparation of the participants, their prior psychological traits, personality structure, and their state of mind at the time of the experience. ‘Setting’

refers to the specific physical, social, and cultural environment in which the experience unfolds, and also the broader cultural and media discourse in which the participants are embedded. [14, 34, 78] Set and setting influence the psychological effects of any psychotropic substance (including common drugs like alcohol and nicotine), but ΨDs are particularly sensitive to these conditions. [72] A number of studies have shown that participants enter into a kind of ‘hyper-suggestable state’ during ΨDEs [41] – i.e., the impacts of set and setting amplify their susceptibility and responsiveness to suggestions, which have the potential to alter the contents of consciousness, magnifying whatever meaning participants bring to the experience, and influencing their perception, sensation, cognition, emotion, and behavior. [9] During Isness, we assumed that suggestibility would play a similarly important role, and therefore paid special attention to both set and setting as part of our design process. To establish a supportive set and setting, Isness was designed as a three-phase journey.

Phase 1: Preparation

The introductory session lasted 15 – 20 mins. Designed by a trained drama therapist, the aim was to build rapport and trust between participants and the guide who would lead their journey, mimicking the strategies used in ΨD studies to minimize adverse reactions. [22] The intro began by addressing a number of practical issues (phones off, toilet locations, placing possessions in a safe place). The guide asked participants about any health issues that might pose a risk to their participation (e.g., epilepsy, light sensitivity, medications, psychological diagnoses, communicable infections that could be spread through the VR equipment, or drugs influencing participants at present). Participants were informed what Isness would involve, made aware of potential risks (nausea, headaches, disorientation, emotional distress), and informed that they could withdraw at any point. Once they gave written and verbal consent, they took their shoes off and rubbed their hands with sanitizing lotion. The guide then explained the matter/energy framework underpinning Isness (described below), and led them through some gentle movement and breath sequences in order to draw awareness to their own embodied perception. They were invited to practice the aforementioned mudra pose, and to imagine the mudra pose as representing a coalescence between ‘individual consciousness’ (represented by the finger) and ‘collective consciousness’ (represented by the thumb). They were invited to build rapport with their fellow participants through a short exercise where they touched the palms of their hands to those of the other participants. They were then blindfolded and led by the guide into the VR room. Upon entering, they felt underfoot a soft mat. They were told that they would be safe throughout so long as they stayed on the mat. The guide then gently moved each person to a separate corner of the mat, inviting them to sit or kneel (Fig 1A).

Phase 2: Multi-person VR Session

Once the participants were comfortably knelt or sat at the corners of the mat, the guide gently slipped the mudra gloves

onto their hands, and initiated a 35-minute pre-recorded narrative soundtrack played on a four-channel sound system. The narrative guided participants through a short meditation, inviting them to imagine their breath as radiant light concentrated at their heart center. Each participant then removed their blindfold and was then fitted with a VR headset, at which point the guide initiated the Isness VR journey, moving through 15 prespecified states, each composed from a different combination of aesthetic hyperparameters. The narrative journey was designed to balance moments of individual introvertive exploration (Fig 1D) with collective extrovertive exploration (Fig 1E). Building on evidence that ΨDs amplify the emotional impact of music, [4, 42] we accompanied the narrative by a soundtrack chosen to broadly reflect the arc of the journey.

Phase 3: Integration

At end of the Isness VR journey, participants were invited to go back to a kneeling or sitting pose and close their eyes. The guide removed their headsets, and they were invited to lie down, noticing what remained in their conscious awareness, and attending to their senses. They were guided on a breath meditation similar to that in Phase 1, and invited to imagine what might happen if they carried awareness of the intrinsic luminosity (they had just experienced in VR) out into the wider world – i.e., their daily reality. They were then guided to open their eyes, notice the space around them, sit up, join their palms again with their fellow participants, and make one last mudra pose. They were then greeted by their guide, who invited them to share in a 10-15 min facilitated discussion, after which they were provided a blank piece of paper for reflective writing, along with a blank MEQ30.

4. CONCEPTUAL FOUNDATIONS

The design of Isness is grounded in the following concepts that have been highlighted in the ΨD research literature:

Matter as Energy

Relationships between matter and energy often emerge in subjective accounts of ΨDEs, with material objects radiating energy and significance (e.g., Huxley’s ‘is-ness’ quote). The Isness narrative consistently referred to the idea that matter and energy are interconvertible essences which exist on the same continuum, with participants told ‘It’s not just you that is made of pure energy; it’s all matter, all of the molecules and atoms that interact to create all that your world contains’. The depth and rigor of this matter-energy narrative was reinforced by the fact that the molecular object which participants experienced in the Isness virtual environment as a kind of fluctuating dynamical organism (referred to at various points in the narrative as a ‘molecular organism’ or ‘energetic thread’) was *more than* some arbitrary animation; rather its dynamics are calculated in real-time using a state-of-the-art GPU-accelerated computational biophysics engine. [17] This sophistication anchored the Isness narrative in physical and scientific reality, encouraging participants to reflect on the fact that everyday material objects *are actually* constructed from the dynamical choreography of molecular organisms whose essences are fundamentally energetic. [21]

The sense of continuity between energy and matter was reinforced also by dissolving the bodies of Isness participants into energetic essences (Fig 1B), and by describing the mudras as ‘symbolic poses which amplify energy.’ As shown in Fig 1B, the mudra light enabled participants to connect with and sculpt the dynamics of the energetic thread, and participants were asked ‘how does it feel to touch pure energy?’

Connectedness

Connectedness is an important characteristic of MTEs, [11] which emerges quite naturally from reimagining conventional matter in terms of a common energetic essence. The mudra motif was an important mechanism for facilitating a sense of connection. For example, there were a number of points during the Isness narrative where participants were encouraged to make contact between their mudras and those of the other participants (Fig 1E), in an effort to enable them to experience the energetic merging that arose in moments of touch. In a number of the Isness states, the participants’ energetic bodies are rendered in a similar way as the energetic thread (Fig 1B), so that the thread is continuous with the energetic essence of the participants themselves, at which point participants were asked ‘How is it to be connected to everything? To everyone?’

Unity

Stace defined unity as a state of pure awareness uninterrupted by the brain’s default tendency to construct egoic identity. [71] During introvertive (internal) unity experiences, the sense of separation of oneself and a transcendent reality is overcome, whilst during extrovertive (external) unity experiences the boundary between oneself and the world around them is dissolved. Invitations to cultivate a sense of external unity occurred during phase 2 of Isness. For example, we represented the energetic essence of each participant in the same way, anonymizing their respective identities, and implicitly encouraging them to recognize their common essence. We also encouraged a choreography whereby participants came into proximity with one another, so they could experience the fluidity of their energetic bodies merging with the other bodies in the space. Invitations to cultivate a sense of internal unity were primarily carried out in phase 1 and 3, where for example participants were guided through a short breath meditation, and encouraged to visualize their breath as light radiating from their heart center, similar to what they saw when they ‘awoke’ into Isness VR, where their heart centers were illuminated as shown in Fig 1B.

Ego-dissolution

ΨDEs are characterized by a reduction in the self-referential awareness of normal waking consciousness (ego ‘death’, ‘loss’, ‘disintegration’, or ‘dissolution’). [62] We sought to encourage a sense of ego-dissolution in two ways. First, we designed the journey around a loose arc of energetic emergence, fluctuation, and eventual dissipation, encouraging reflection on transience and ‘mutability’. [50] Each Isness participant materialized in VR as three shining lights (Fig 1B): one located at the heart center, and the others at the origin of

the mudra pose (Fig 1B). Over the next 25 mins, their energetic light bodies gradually intensified, leaving distinct residues as they moved through the space. Eventually their essences dissipated, leaving only blackness. Second, we recognized that the HMD acts like a kind of blindfold which replaces participants’ visual sensory inputs with different inputs. [75] We sought to encourage a sense of ego-dissolution by inviting participants to focus less on their own internal ego narrative and engage in embodied forms of sensing. For example, participants were invited to ‘move toward one another and form a circle, and place the palms of your hands together’ (Fig 1E). Such moments of contact required tuning into non-visual senses (kinaesthetic, proprioceptive, and tactile), diverting attention away from internal ego narratives.

Transcendence of Space and Time

VR is particularly well suited to exploring alterations in our experience of space and time. [31, 32] Isness included specific states that challenged participants’ conventional understandings of space and time. For example, as they sculpted the dynamics of the energetic thread, they were invited to become aware that whilst their own bodies were subject to normal space constraints and unable to pass through the floor, the same was not true for the energetic essences cohabiting the simulated VR space with them. Over the arc of the VR journey, the states gradually evolve to a point where participants can simultaneously perceive both the past and present, and they are asked ‘what is it like to see the past?’

Noetic Quality

Noetic quality is often associated with a subjective experience of something greater than oneself. For example, encouraging participants to think about themselves, and everything around them as having a fundamental energetic essence was an invitation for them to imagine themselves as part of a larger energetic unfolding. They were reminded that ‘you are simply energy in motion’, a sense which was reaffirmed by the simulated dynamics of the ‘energetic thread’. At various points during the Isness narrative, participants were encouraged to engage with the energetic organism, and actively sculpt its dynamics. These active moments of engagement were balanced by moments of stillness, with participants encouraged to ‘Explore the feeling of both stillness and motion. Of being and doing. Notice what happens if you do nothing.’ In doing nothing, participants discovered that the energetic organism carried on, following its own intrinsic choreography, creating the sense of an object with a sort of otherworldly intelligence – whose ‘is-ness’ is manifest as a kind of perpetual motion which follows a different logic.

5. ANALYSIS

Each of the 64 participants completed all three Isness phases, and made comments during group discussion. There was one report of a participant who experienced a brief period of nausea. 50 participants carried out reflective writing, and 57 answered the MEQ30 afterward. For the 7 participants who did not answer the MEQ30, one was an expert who we judged to be too familiar with the methodology. At least two others

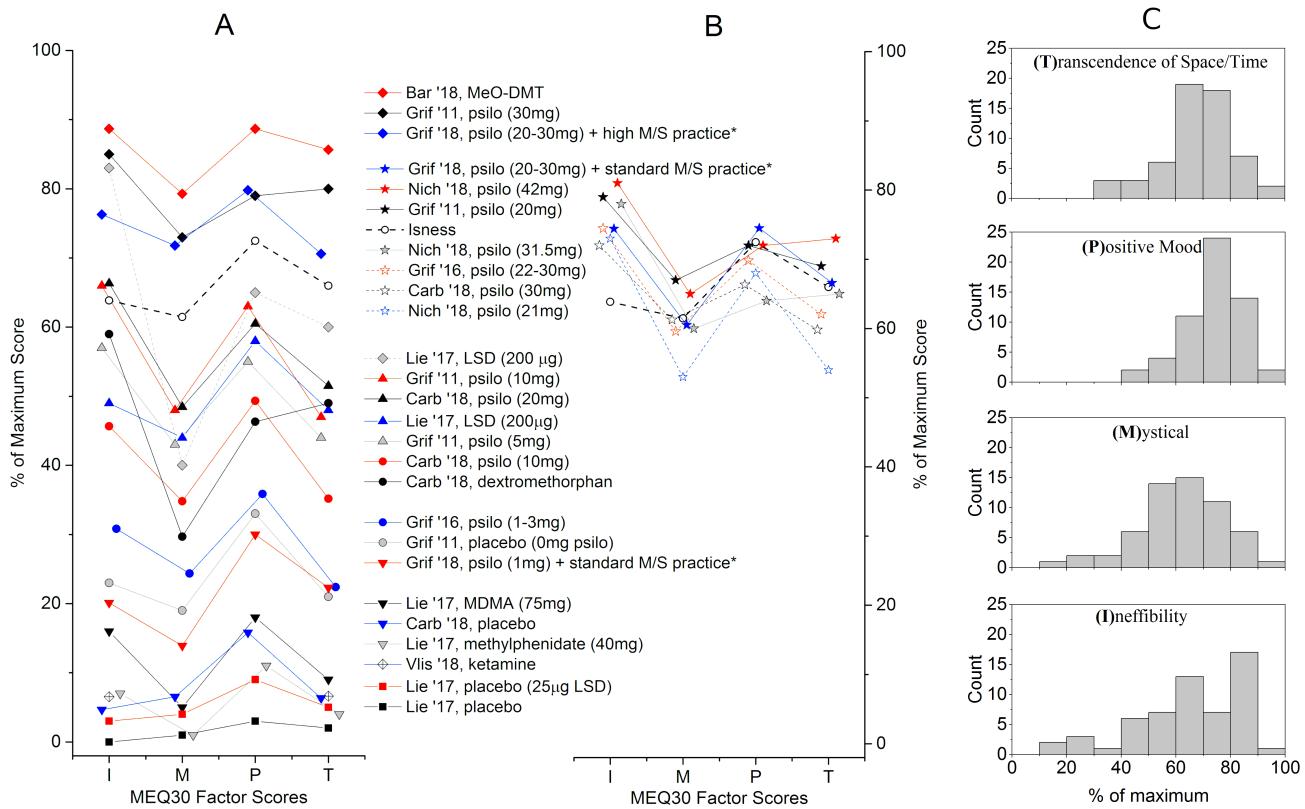


Figure 2: Comparison of the avg Isness factor scores to previously published ΨD research studies where the MEQ30 has been utilized (Bar '18 [69], Griff '11 [26], Griff '18 [27], Nich '18 [70], Griff '16 [28], Carb '18 [71], Lie '17 [72], and Vlis '18 [74]). The SM contains further details on the design of these studies. Panel (A) shows studies with at least 2 M, P, and T scores statistically distinguishable from Isness; (B) shows studies which are statistically indistinguishable from Isness; and (C) shows the distribution of the Isness MEQ30 results for each of the four factor scores. *M/S practice = ‘Meditation & Spiritual’ practice

indicated that they preferred not to answer quantitative questions in their post-Isness emotional state.

Quantitative Analysis

The MEQ30 (available in ref [1]) asks participants to rate the intensity with which they experienced 30 items on a 6-point scale [from “0 = none; not at all” to “5 = extreme (more than ever before in my life and stronger than 4)”, with three questions to capture ineffability **I**, fifteen mystical **M** [capturing unitive experiences, noetic quality, and sacredness], six positive mood **P**, and six transcendence of time/space **T**. Participant responses within each factor (**I**, **M**, **P**, **T**) are then averaged, and reported as a percentage of the maximum score. Fig 2A-B compares the Isness MEQ30 factor scores to the 26 previous studies in the altered states database [70] where the MEQ30 has been used to analyse both ΨD and non-ΨD altered states. Fig 2A-B shows that the MEQ30 can distinguish dose dependent effects of ΨDs. Tabulated data for Fig 2A-B is available in Table SM2.

Fig 2C shows the distribution of the Isness MEQ30 scores for each factor with a histogram bin width of 5%. Compared to the normally distributed **M**, **P**, and **T** scores, **I** is much noisier (see further analysis in Table SM3), and lower than might be expected. This may result from the fact that, by the time participants were given the MEQ30, they had undertaken 10 – 15 mins group discussion and reflective

writing. So participants unable to find words in the immediate wake of their Isness ‘peak experience’ (i.e., a high **I** score) had ample opportunities to articulate their experience by the time they were given the MEQ30. Given these issues with the **I** scores we have restricted statements of statistical significance to the **M**, **P**, and **T** results.

In the absence of an experimental control group, we undertook comparative analysis of Isness to the previously published psychedelic studies in Fig 2AB using independent sample t-tests with $\alpha = 0.05$, following the approach Barsuglia *et al.* [3] used to analyze MEQ30 results obtained during uncontrolled MeO-DMT field tests. Fig 2 and Table SM2 show results of 26 different independent-sample t-tests, comparing the Isness MEQ30 results to each of the studies in Fig 2AB. Despite its simplicity, the independent sample t-test gives results that are broadly aligned with more sophisticated statistical analyses described in Table SM3 & SM4. To make Fig 2, we classified a study as statistically indistinguishable from Isness if it at least two of its **M**, **P**, or **T** factor scores were statistically indistinguishable from the corresponding Isness factor scores. Compared to Isness, Fig 2 depicts:

- **3 published studies which are more intense.** These include: (1) a MeO-DMT study; (2) a 30 mg psilocybin study; and (3) a 2018 study by Griffiths *et al* [26] where participants in a program offering high levels of support

Theme (N statements)	Indicative Quotations
Positive Emotions (42)	<ul style="list-style-type: none"> - <i>[I] cried quite a bit, beginning [when] we all turned red... peaking when the lights went out and we laid down... beautiful</i> - <i>[Isness is] calming, and it's relaxing, and it's transfixing</i> - <i>[Isness] took me away from all of my horrible issues that I'm having at the moment.</i>
Connectedness (40)	<ul style="list-style-type: none"> - <i>A beautiful way to connect... not really connecting with anyone's stories or anyone's appearance... just the simple pure presence of another being... very touching.</i> - <i>[Isness] made me think about our connection with all living beings including plants and animals. quite a paradigm shift</i>
Ego-dissolution (35)	<ul style="list-style-type: none"> - <i>Not knowing who the person [was] next to me allowed me to connect without any pre-judgment... I no longer saw others through the lens of beauty, social structure, age, etc... Rather, it was a pure joy of just being and connecting through light.</i> - <i>You become all anonymous, just beings of light. It allows you to let go of your own sense of ego</i>
Embodied perceptual awareness (35)	<ul style="list-style-type: none"> - <i>One of the ways you become less self-conscious is to be conscious of your senses. this makes you really conscious of your senses.</i> - <i>Felt so light [weightless] during the experience, and heavy afterwards</i> - <i>I feel fully in my body & waves of energy coming over me. I feel the light in my body & I feel present with the other light beings in my environment.</i>
Reflection on Death (28)	<ul style="list-style-type: none"> - <i>The end felt like a peaceful death. The darkness & stillness at the end felt so peaceful</i> - <i>Thought [about] my own death... the energy you give out to the world will always be there</i> - <i>Felt connected to my dad who died 4 years ago</i>
Supportive Setting (25)	<ul style="list-style-type: none"> - <i>I've been very gently guided through a journey of light, stillness and silence</i> - <i>Found the preparation very effective. Its ceremonial quality helped tune into the experience. Super important.</i>
Noetic Quality (20)	<ul style="list-style-type: none"> - <i>Felt so real. More real than real at times... a felt experience of the [knowledge] I already had of the light inside people and beings</i> - <i>First sensation was a huge familiarity and I felt like crying...Peace... Feeling of coming home.</i> - <i>really did make my heart burn with appreciation for the simple fact that I exist</i>
Transcendence of Space & Time (20)	<ul style="list-style-type: none"> - <i>Time runs differently in there.</i> - <i>The vastness of space, the non-linear time, care and gentleness to other humans in this experience, and the self-love, helped push away the torture of existential anxiety</i>
Insights for everyday life (19)	<ul style="list-style-type: none"> - <i>You can radiate light out. And I liked the fact that it was the pressure that made it radiate. Sometimes when things are hard you need to add more pressure to be more light.</i> - <i>The light of the mudra will stay with me for a long while.</i>
Sense of Beauty (18)	<ul style="list-style-type: none"> - <i>Beautiful, gentle and heart opening.</i> - <i>A wonderful and magical experience.</i>
Comparison to Other Altered States (15)	<ul style="list-style-type: none"> - <i>Similar to a 5-MEO-DMT experience... pure energy, pure being, with no reference to physical space</i> - <i>Transporting and illuminating... like the quiet point of an acid trip where calm beauty settles in</i> - <i>Reminds me of mescaline... like a pandora's box has been opened and the universe revealed in its true form, rather than the virtual model created in our own heads. You're seeing a deeper form & fundamental truth</i>
Ineffability (9)	<ul style="list-style-type: none"> - <i>Ok. Words. Huh. I know some words. Huh.</i> - <i>[I] feel moved, touched, quite quiet, words are hard to muster – I appreciate that because it indicates that I've been brought into my body, into my heart/energetic being.</i>
Childlike enchantment (7)	<ul style="list-style-type: none"> - <i>[I had a] Beautiful joyous innocent but also intimate feeling I don't remember feeling since I was a child.</i> - <i>We were like children again, exploring and no judgement or anything.</i>
Metaphors for everyday life (4)	<ul style="list-style-type: none"> - <i>Playing with the [energetic thread] seemed like we were in control, but when [we stopped], the [thread] did its own stuff. It was an acceptance of the co-creation of environment and selves. It was astonishingly calm when we relaxed at the end... a powerful step down of need to control.</i>

Figure 3: themes which emerged from inductive analysis as described in the text, along with indicative quotations. The themes are ranked according to the number of participant statements, N, which could be assigned to each theme

in carrying out meditation and spiritual (M/S) practice were given 20-30 mg psilocybin.

- **7 published studies which are indistinguishable.** All of these studies involved participants being administered moderate to large doses (20-42 mg) of psilocybin. In one of these studies, Griffiths et al. [26] gave 20-30 mg psilocybin to participants involved in a program offering M/S practice support.
- **16 published studies which are less intense.** Amongst these, 6 were baseline studies, and 10 were drug-administration studies. The baseline studies included: 4 placebo studies; a 2016 study where Griffiths et al. gave participants sub-perceptual (1-3 mg) doses of psilocybin [25]; and a 2018 study where Griffiths et al [26] gave 1 mg psilocybin to participants in a program offering M/S practice support. The ten drug-administration studies investigated: MDMA [49, 69]; methylphenidate [49, 69]; ketamine [77]; dextromethorphan [6]; psilocybin [6, 24], and LSD [49].

Griffiths and co-workers identify an MEQ30 respondent as having had a ‘complete MTE’ when each of the **I, M, P, T** factor scores are $\geq 60\%$ of the maximum. [40] In general, the fraction of participants reporting a complete MTE is proportional to the ΨD dose. Barrett and Griffiths [2] reported a meta-analysis of high dose (30 mg/70 kg) psilocybin studies in 119 healthy volunteers [22, 24, 26], and observed that **57%** of participants had ‘complete’ MTEs. Recent studies on 5-MeO-DMT (Fig 2C) [3] reported **75%** of MEQ30 participants having a complete MTE. Analysis of the Isness MEQ30 data indicates that **44%** of participants qualified as having a complete MTE. For comparison, Table SM1 shows complete MTE rates for those studies where it was reported.

Qualitative Analysis

To better understand the quantitative data, we carried out qualitative analysis of participants’: (1) group discussions after exiting VR, and (2) reflective writing. The group discussions were intended to enable maximum conversation amongst the participants, with the guide’s role that of an

active listener. The format of these group discussions was not rigidly prescribed; instead the emphasis was on the guide enabling conversation amongst the group. In many groups, participants did not immediately wish to speak. In such cases, the guide asked a simple question to initiate the conversation – e.g., ‘How are you?’; ‘How did that feel?’; ‘What remains?’; ‘How did you feel when the light faded?’ Qualitative data analysis involved transcribing into digital format ~150 mins of recorded conversations (~14,000 words) and ~3,600 words of reflective handwriting. We then analysed this data by carrying out inductive thematic analysis, as outlined by Braun and Clarke. [5] The 14 themes outlined in Fig 3 were broadly similar across both the interviews and reflective writing, and enabled us to classify ~95% of the transcribed text. The themes in Fig 3 are ranked in order of how many participant statements could be attributed to each, along with some indicative quotations which correspond to each theme. The entire classification is available in the SM.

6. DISCUSSION

In devising Isness, we imagined VR as a form of psychedelic technology, investigating whether it could be used as a tool for eliciting subjective accounts of MTEs. To guide our design process for constructing the multi-person VR phenomenology, we looked to concepts which characterize MTEs. Quantitative analysis shows that, given a supportive setting, Isness produced ‘peak experience’ MTEs which are statistically indistinguishable from the MTEs observed in previous studies administering moderate to high doses of classical ΨDs. The qualitative analysis helps to rationalize the quantitative MEQ30 scores, providing insight into the subjective experiences and themes which arose. The group aspect of Isness appears to have amplified participants’ sense of ego-dissolution, releasing them from the projections associated with typical social interactions, enabling them to ‘connect without any pre-judgment... no longer [seeing] others through the lens of beauty, social structure, age, etc’. The resultant state was ‘like [we were] children again, exploring [without] judgement or anything’. This encouraged a form of ‘pure presence’, making participants ‘really conscious of their senses’ and giving them space to ‘just be’. By focusing awareness on ‘the light in my body and [feeling] present with the other light beings’, Isness left participants calm, relaxed, ‘moved, touched, and quiet’.

The dissolution of ego is the loss of what makes our personality distinct, and represents a kind of experience of death, [41, 76] likely explaining participants’ comments that ‘the end felt like a really peaceful death’, and observations that ‘It’s just a physical body, the energy will remain [after dying], and it will stay in a connection even though this [body] is gone’. Comments like these are aligned with insights from Timmerman et al., [76] who identified a correlation between near-death experiences and the sense of ego dissolution which arise for participants in DMT experiences. Broadly speaking, digital technologies struggle to deal with the existential phenomenology of death; [43, 44, 50, 51] instead focusing on digital heirloom logistics (e.g., managing

social media accounts for the deceased). The ego-dissolution achieved in Isness is an interesting contrast to social media, which enables connection, but encourages individuals to amplify their individual identity, often producing anxiety.

Comments like ‘*I’ve been very gently guided through a journey of light, stillness and silence*’ draw attention to the significance of set and setting for thinking about how participants in VR experiences attribute meaning to an experience like Isness. Clearly, subjective attributions of meaning to Isness (and within HCI more broadly) depend on the supportiveness of the context framing the experience, and the broader conceptual framework in which it is embedded. The importance of set and setting is aligned with the idea that VR participants enter into a sort of ‘hyper-suggestable’ state.

The features which characterize MTEs provide a rich cross-disciplinary conceptual framework for thinking about meaning in HCI. The empirical study presented herein shows how these concepts can be practically implemented so as to design the kinds of meaning-making experiences that HCI workers like Mekler and Hornbaek, [56] Light et al, [50, 51] and Kapteinlin [43, 44] have outlined theoretically. Fig 3 and the SM provide a glimpse of the meaning and insight which participants attributed to their experiences. They reported ‘*a felt sense of [the] knowledge [I] already had*’, and felt they saw ‘*the universe revealed in its true form... this absolute truth that we are made of light*’. Several participants cited insights and practices which they intended to carry into the world ‘out-there’, stating for example ‘*I will be using mudras more in my daily life*’, expressing their intentions to ‘*remember this [experience], and in difficult situations connect back to [the] feeling of being able to create and connect*’ with the luminosity of the material world, and observing how ‘*the pressure made [the mudras] radiate... Sometimes when things are hard you need to add more pressure to be more light*’. Several participants said they cried; one remarked ‘*I hate meditating but you make me want to try*’.

Isness differs from psychedelic psychotherapy studies in some important ways. For example, Isness preparation lasted ~15 mins for a group of four, far less than the preparation for studies carried out by Griffiths et al (see Table SM2) which typically include a total of 4 – 8 individual sessions (occurring before and after drug administration). Additionally, Isness’s three phases last a total of ~70 minutes, considerably shorter than typical psilocybin and LSD experiences, which last anywhere from 6 – 14 hours. This may account for participants’ comparisons to DMT, which usually lasts less than 30 mins. Finally, Isness was constructed as a group experience, whereas most ΨD studies are individual experiences.

Compared to other ΨD studies in Fig 2 (and Table SM1 and SM2), the N=57 Isness sample size was relatively large; however, this study had a number of limitations. For example, because we did not carry out a control experiment, we are unable at this stage to make clear statements about the extent to which sample selection bias may have influenced our results. Our ability to make meaningful comparisons with previous studies depends on the assumption that the baseline MEQ30 responses of our participant sample are not

anomalously high, and within the range spanned by 6 previously published baseline studies. Fig 2A shows that these baseline studies have a broad MEQ30 score distribution; however, our comparative statistical analyses (Fig 2B and Table S2) show that the Isness results are more intense ($p < 1E-12$) than all of them, including for example the 2018 study where Griffiths *et al* [26] gave 1 mg psilocybin to participants who were engaged in a supportive program of meditation and spiritual practice. At this stage, it is unclear how exactly to define a placebo for an experience like Isness, but this is an issue we will investigate in future work. We note that participants may have been more willing to provide mystical-type responses during group discussion, reflective writing, and during the MEQ30 analysis because of their belief (whether accurate or not) that we wanted such responses. On the other hand, because participants were drawn from a psychedelic conference, they were able to compare Isness to previous ΨDEs. For example, some participants specifically indicated to us that they were unable to rate the MTE occasioned by Isness as highly as previous ΨDEs. We also cannot rule out that the results reported herein are subject to the so-called ‘winner’s curse’ [68] whereby effect sizes observed in trials of new treatments are inflated due to a variety of subtle effects. The design of Isness as a group experience suggests that the individual data may be correlated. In future studies we wish to investigate the correlation of the results obtained for participants within specific groups, and compare *intra*-group results to *inter*-group results.

Interesting questions arise concerning the ‘authenticity’ of a VR-occasioned MTE like that which arose during Isness. The term ‘virtual reality’ *per se* almost trivializes any MTE that emerges. Interestingly, the question of ‘authenticity’ has similarly been raised with respect to ΨDEs – i.e., there is a critique that ΨDs represent a sort of *virtual* form of MTE, lacking ‘authenticity’ compared to those which arise without drugs. [45] In a recent paper designed to evaluate this question through analysis of questionnaires from 2000 participants, Griffiths *et al* [27] showed that whilst mystical ‘God encounter’ experiences occasioned with and without ΨDs have some differences, the descriptive details, interpretation, and consequences of these experiences are markedly similar. Because MTEs occasioned by ΨDs are so similar to non-drug MTEs, Griffiths *et al* argue that it is problematic to assert that one is virtual and the other is not. This logic, combined with our evidence that VR can occasion MTEs, suggests that ‘virtual reality’ may be a concept best understood from a wider vantage point, where head mounted displays (HMDs) simply represent one kind of ‘virtual reality’ technology amongst a broader continuum of VR technologies, which include for example ΨDs, mythologies, rituals, meditation practices, lucid dreaming, [46] etc. By comparing the MTEs arising with VR and ΨD ‘technologies’, we can begin to understand where each sits within the broader spectrum of psychedelic technologies and VR technologies.

The approach outlined herein, where aesthetic hyperparameters defining a particular journey can be precisely

defined, offers an interesting complement to ongoing ΨD research, opening up a range of further research directions. [58] It will be interesting to explore how Isness variants, constructed by exploring different domains of the aesthetic hyperparameter space, compare to different ΨDEs. Enabling new phenomenological experiences by designing new ΨD molecules is difficult, and clinical research efforts therefore focus primarily on tuning set and setting. Isness enables direct tuning of aspects of the participants’ phenomenological experience, and different classes of experience almost certainly exist within the hyperparameter space. This idea has some analogy with proposals by Carhart-Harris *et al.*, [8] who suggested that consciousness can access an ensemble of different metastable brain states, each of which uniquely influences aspects of perception. In future work, we hope to analyze Isness peak experience using a wider range of psychometrics (beyond MEQ30), and also to carry out longer-term follow-ups to better understand its impact. We also hope to understand how the neurophysiological impacts of Isness relate to EEG and fMRI observations during ΨDEs.

7. CONCLUSIONS

Within a supportive setting and conceptual framework, we have presented evidence suggesting that it is possible to design phenomenological experiences using multi-person VR which create the conditions for MTEs from which participants derive insight and meaning. Given that colloquial usage of the term ‘psychedelic’ is linked to drugs, we have imagined different words for describing a technology like Isness. Inspired by the Latin *numen* (‘arousing spiritual or religious emotion; mysterious or awe-inspiring’) and the Greek *pneuma* (‘breath’, ‘spirit’, or ‘soul’), perhaps technologies like Isness may be described as *numedelic* (‘spirit-manifesting’, or ‘spirit-revealing’). Analogous to psychedelic psychotherapy, we may imagine Isness as a tool enabling *numedelic psychotherapy*. Much ΨD research aims to help patients deal with addictions and end-of-life anxiety, individual conditions which represent the broader problems facing our culture right now. In a supportive therapeutic context, *numedelic* technologies like Isness may offer an opportunity for a digital culture which is addicted to unhealthy economic growth narratives to meditate on its own mortality.

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