

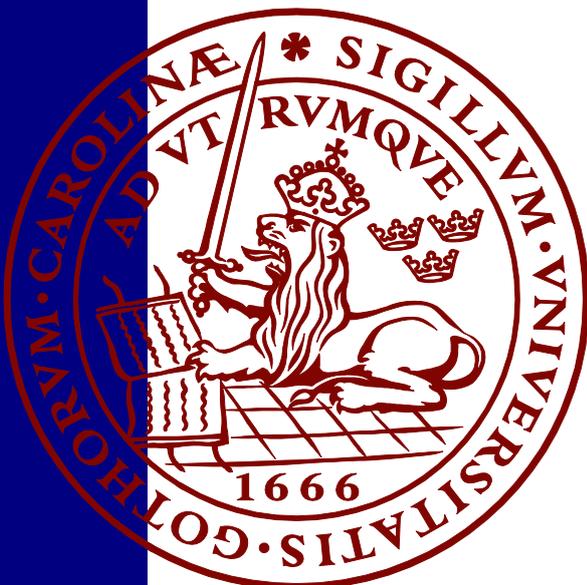
Catalysts for Transformation

A systematic literature review exploring the interlinkages and potential role of classic psychedelics to social-ecological sustainability

Marion Nilsson

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A thesis submitted in partial fulfillment of the requirements of Lund University
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Sustainability Studies



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Submitted September 30, 2020

Supervisor: Sanna Stålhammar, LUCSUS, Lund University

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Abstract

Most of classic psychedelic literature indicate its potential benefit to society and the environment during a time of rapid environmental degradation and climate change— hinting its potential role to sustainability and socio-ecological transformation. There is virtually no study drawing the explicit interlinkages of classic psychedelic research to sustainability science but it is observed that there are overlapping themes to the psychedelic experience and inner-sustainability concepts. Therefore, this paper explores the transformative capacity of psychedelics with the aid of a systematic literature review, 68 scientific articles were identified for analysis. Explicitly elucidating the role of psychedelics *to personality & value orientation, connectedness to nature, political perspectives, spiritual significance and worldviews*. The objective of this study is to explore the extent to which classic psychedelics catalyze inner transformation and promote systemic change, using the frameworks of *Leverage Points*. This paper concludes that classic psychedelics have the capacity to influence inner connections, transcend the cognitive mind, promote enduring changes in personality traits, and convey meaning-making. Therefore, it can potentially be used as a tool for deep leverage, influencing systemic change via interventions (e.g. nature relatedness, mindfulness or spirituality). However, careful discernments must be made as classic psychedelics should not be viewed as a solution to our impending crisis but rather be considered and respected for its healing and transformative capacities, enabling one to recognize the needed behavioral changes required to achieve transformation, systemic change and a more sustainable future for all.

Keywords: (Classic) Psychedelics, Transformation, Connectedness, Spirituality, Worldview, Sustainability

Word count: 11, 262

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1. Introduction

“Alienation from nature and the loss of the experience of being part of the living creation is the greatest tragedy of our materialistic era. It is the causative reason for ecological devastation and climate change. Therefore, I attribute absolute highest importance to consciousness change. I regard psychedelics as catalyzers for this.” (Hofmann, 2013, p.101)

There has been a resurgence of scientific research related to classic psychedelics (CP’s) and its potential implications for psychotherapy, spiritual renewal, and reconnection with nature (Carhart-Harris, 2017b; Kettner et al., 2019). It is observed that there are overlapping themes, interlinking psychedelic research and inner-sustainability concepts, which sparked an interest for further investigation on the potential transformative role of classic psychedelics for sustainability. Inner-sustainability concepts encompasses topics such as subjective wellbeing, sustainable behavior and consumption, human-nature connections, equality issues, and activism (Ives, Freeth & Fischer, 2019). This dimension to sustainability focuses on people’s inner worlds, which encapsulates their emotions, values, worldviews, identities, thoughts, and beliefs (Ives et al., 2019). Ives et al. (2019) argues that the condition of the inner-worlds, lies at the root of our greatest sustainability challenges. The growing western disconnect from nature for example is central to the converging social-ecological crisis and is a primary problem in psychology and consciousness (Zylstra, Knight, Esler & Le Grange, 2014). Therefore, altering or enhancing the dimension of interiority is key to transforming and overcoming some of the world’s greatest social-ecological challenges (Ives et al., 2019).

Recent publications on psychedelic research have indicated the potential role of psychedelics to foster *positive psychology*, which is defined as the “*the scientific study of positive human functioning and flourishing on multiple levels that include the biological, personal, relational, institutional, cultural, and global dimensions of life*” (Jungaberle et al., 2018, p.181). As postulated by Jungaberle et al. (2018), psychedelics are shown to produce acute and long-term effects on mood, personality (e.g. *openness* and *empathy*), subjective wellbeing, pro-social attitudes, compassion, cognitive flexibility, creativity, value orientation, nature-relatedness, spirituality, self-transcendence, and mindfulness. These are the exact traits that also mark personal expressions of sustainability (Ives et al., 2019) and are strong predictors to connection with nature and pro-environmental behavior. This paper will explore the extent to which classic psychedelics (e.g. LSD, Psilocybin, DMT or ayahuasca) catalyze inner transformation and promote inner-outer sustainability, by strengthening the interlinkages and overlapping themes across disciplines, using a systematic literature review.

Understanding the potential role of psychedelics to prompt transformation and systemic change will be explored through the concepts of *leverage points*. This paper will not cover direct environmental sustainability aspects (e.g. the ecological footprint from the production and supply of psychedelic substances) but rather, will focus on the behavioral or mind changing aspects that classic psychedelics can instigate in sustainability. As this study follows the idea that, changes made within the sphere of interiority lies at the heart of actions for sustainability and hold powerful transformative capacity for systemic change (Ives et al., 2019).

1.1. Disclaimer

Given that psychedelics remain under strict legislation, this paper should be considered merely as theoretical inquiry. This paper is written with the intention to inform and enlighten society on the current findings of psychedelic research under the lenses of sustainability concepts. Additionally, legislation for these applications are expected to change in the near future, as advances have been made for its application within the therapeutic field (Rucker, Iliff, & Nutt, 2018). This paper does not promote the widespread recreational use of psychedelics, nor does it claim that psychedelics is the solution to our world problems. These substances must be held at a high regard, recognizing and respecting it for its profound healing and transformative capacities. This research is conducted to explore and attain untapped insights that may be applicable for transformative and integrative learning for sustainability.

1.2. Position and Relevance within Sustainability Science

This study encourages greater attention towards a more eco-centric perspective for sustainable transformation to occur at an individual and societal level. Concepts such as the role of values, interconnectedness between human and natural non-human world, political perspectives, worldviews and spirituality are at the center of transformational learning (Bainbridge & Del Negro, 2019). Classic psychedelics have the capacity to influence inner connections, transcend the cognitive mind, promote enduring changes in personality traits, and convey meaning-making (Jungaberle et al., 2018). Therefore, this study will be presenting concepts that are within the dimension of inner-sustainability as common themes of transformation are found within psychedelic research.

An emerging concept with sustainability studies, *inner transformation* is described by Wamsler (2018) as the change experienced by individuals in relation to changes in their values, behavior, and shift in consciousness. It explains how the concept of mindfulness, compassion and empathy have the capacity to transform mindsets, worldviews, beliefs, values, and motivations towards a more sustainable oriented behavior (Wamsler, 2019).

Changes within the dimension of “interiority” (dimension that encapsulates the identity, values, thoughts, beliefs, and emotions of an individual) is considered as a radical but indispensable prerequisite for attaining desired conservation and environmental behavior outcomes (Zylstra et al., 2014). Transformation within this dimension is considered to be a powerful leverage point that greatly influences societal, environmental, and political transformation. It is a potential new pathway for adaptation, and is supported by indigenous, religious, and spiritual practices (Wamsler, 2018).

1.3. Aim

Most of CP literature indicate its potential benefit to society and the environment during a time of rapid climate change and ecological crisis, as recent scientific publications show a positive relationship between nature connectedness, happiness and other forms of wellbeing (see critical review on positive psychology by Jungaberle et al., 2018). However, there is virtually no research drawing definitive connections between classic psychedelic research and sustainability science but overlapping themes across disciplines are recognized. Therefore, the aim of this research is to explore the potential role of classic psychedelics to sustainability by highlighting the interlinkages and overlapping themes of inner sustainability concepts and psychedelic research.

A transdisciplinary approach is relevant for this study as the nature of sustainability studies and psychedelic research cannot be fully understood without reference to other fields of research (- Nichols, 2016; Polk, 2014). Exploring this area and highlighting its potential role for social-ecological transformation contributes to novel insights for transdisciplinary sustainability research. This paper will be the first to draw such connections and highlight its potential contributions to the field of inner sustainability. Moreover, concepts like deep leverage points (see section 4.4.1) are still understudied (Fischer & Riechers, 2019). Therefore, motivation for this research lies on the possible contributions it may have on the field of transformative learning and sustainability science. Exploring the extent

and capacity of classic psychedelics to be used as a tool to enhance human consciousness, increase human-human and human-nature connectedness, and influence systemic change.

Given these substances are labeled as schedule I drugs (which means the substances are deemed as highly addictive and pose no medical benefits), this paper intends to challenge societal preconception, demystify and uplift taboos associated to classic psychedelics by presenting a literature review on scientific publications. This is of great importance as it enables the masses to recognize and be open to considering the potential role of classic psychedelics within society and the environment as a whole. The objective is to apply inner-sustainability concepts and frameworks such as *leverage points* to explore the potential role and extent to which CP's can be used as a leverage to catalyze transformation and systemic change.

1.4. Problem Description

In light of the impending social-ecological crisis, there is a huge need to explore radical and innovative strategies for mitigation and adaptation. Sustainability research predominantly focuses on external dimensions such as climate change, ecosystems, economic markets, social structures and governance dynamics while neglecting the importance on the role of inner dimensions (Ives et al., 2019). Current mitigation efforts for sustainability mostly focus on institutional changes and technological or economical advancements but still clearly lack the implementation of any tangible solutions. It is apparent that tackling these issues must include inner dimension, analyzing the causes, consequences, and behavioral responses, as culture and climate are intimately related (O'Brien, 2009). The state of the environment is affected by human influence (IPCC, 2018), therefore it is crucial to consider the role of behavioral change aimed at the safeguarding of the environment.

This paper specifically highlights the global social-ecological crisis as a primary issue of consciousness (Zylstra et al., 2014). The common denominator underlying these issues is the sense of disconnect as postulated by Kettner et al. (2019), this is correlated to poor mental health and the destruction of the natural environment. The sense of disconnect is referred to as the physical and psychological (e.g. cognitive, affective, and experiential) separation from nature (Kettner et al., 2019). This so called "blind spot" which is the inability to consider oneself as a part of nature and denial towards on dependency on it, is recognized as one of the key contributing factors to environmental destruction (Kettner et al., 2019). This growing sense of disconnect can be partly explained by rapid urbanization,

technological development, and increase use of western cultural products (e.g. social media) (Kettner et al., 2019; Ives et al., 2019). Humans have lost touch to what is inherently important for the survival of our species and conservation of the environment. Reconnecting individuals with nature and encouraging a broader cultural shift to sustainability can treat the impending crisis and the myriad of current sustainability challenges (see section 2.2.2.) (Ives et al., 2018; Wamsler, 2018; Kettner et al., 2019).

As there is growing literature and evidence on the therapeutic applications and transformative learning capacities of psychedelics, this field of research should not be overlooked as it may hold important insights for the adaptation of our species during a time of rapid ecological crisis. Especially if the current paradigm we live in perpetuates the hegemony of human-nature relations, abandoning old behavioral patterns and accustomed conditioned responses may benefit and serve as the most probable adaptive response for attaining socio-ecological sustainability. Quoting Pollan (2018), *“There are times in the evolution of a species when the old patterns no longer avail, and the radical, potentially innovative perceptions and behaviors that psychedelics sometimes inspire may offer the best chance for adaptation.”* (p.124). It is of importance to further investigate if psychedelics can be used as a tool to catalyze psychological evolution and prompt systemic change within a more sustainable paradigm.

Despite the availability of scientific evidence for the potential applications of psychedelics, it is apparent that there is still currently a knowledge and political gap as these substances are deemed illegal and categorized as schedule I drugs. The motivation behind the widespread prohibition is driven by political agenda and is based on the stigmatization of psychedelics more than the actual risks (Belouin & Henningfield, 2018). This impeded and have brought psychedelic research to a halt, inhibiting 20 years of exploration and investigation (Belouin & Henningfield, 2018). This have had unforeseen consequences within the medical and therapeutic fields as there is unrelenting persistence of behavioral and mental disorders with a lack of effective treatments (Carhart-Harris et al., 2017a; Belouin & Henningfield, 2018). Resurgence of psychedelic research within the late 20th century have challenged fears, misconceptions and misinformation that have been prevalent since its prohibition. This brought to light the potential applications of psychedelics (within a clinical context) to be used as treatment for treatment-resistant psychiatric disorders.

1.5. Research Questions (RQ)

This paper intends to answer an overarching research question with the aid of three sub-research questions. The following section will discuss the motivation and relevance behind each RQ.

Main RQ: What is the potential role of classic psychedelics to social-ecological sustainability?

It is intended for the main RQ to be an open-ended qualitative question, enabling one to explore the different areas classic psychedelics can potentially contribute to sustainability. In this paper sustainability is referred to as social-ecological sustainability as this study focuses on the relation of human-nature connections. This takes into account the interplay between social and natural systems. As there are many facets to sustainability science, discussing the potential role of classic psychedelics to social-ecological sustainability will require the mapping out of interlinkages and overlapping concepts across disciplines. This brings rise to the first sub question.

Sub RQ1: What are the overlapping concepts of classic psychedelic research to sustainability science?

There is a growing amount of published scientific literature on the therapeutic application and transformative capacity of classic psychedelics, and it is apparent that there are overlapping themes to inner-sustainability concepts. Therefore, the first sub-question intends to elucidate the overlapping themes found between psychedelic research and sustainability science, by presenting scientific evidence on peer-reviewed literature or grey literature. Drawing the overlooked interlinkages will strengthen the connections across disciplines and highlight the relevance of classic psychedelics to social-ecological sustainability.

Sub RQ2: What does the bulk of the literature review present?

This question is intended to present the descriptive statistics of the data collected. This will include an overview of the characteristic, results, and limitations of the studies included for this review. This enables an overview and interpretation on what the general outcomes are on classic psychedelic research in terms of its transformative capacities.

Sub RQ3: Can classic psychedelics be used as a tool to create systemic change for sustainable transformation?

Once the relevance of the topic has been presented and clarified, this sub question intends to explore the possibility of classic psychedelics to be used as a tool to create systemic change. To explore this concept, taking a social-ecological perspective is necessary to presenting the notion of leverage points (See section 4.4.1.). This hypothesized mechanism acts as a framework for this study to evaluate the capacity of classic psychedelics to be used as a mode of intervention, bringing about transformative systemic change via strengthening influences such as human-nature connections, worldviews, spirituality.

2. Social-Ecological Systems

This paper outlines the crisis as a symptom of exhausted social-ecological relations on the biosphere. Issues are comprised of but not limited to over exploitation of natural resources, biodiversity loss, ecosystem service collapse, increasing global mental health problems, deepening of socio-economic inequalities, food scarcity, poverty (Ives et al., 2019; Kettner et al., 2019; O'Brien, 2009). According to Fischer et al. (2015), a social-ecological perspective (coupled human-environment systems) provides as an analytical framework illustrating the interlinked dynamics of social-environmental change. Social-ecological systems are complex adaptive systems characterized by feedbacks across human and natural elements that amplify or dampen change (Fischer et al., 2018; Ives et al., 2018). Using such a framework is of relevance when addressing sustainability issues as it takes into account the source of the problem, as well as the complex interplay between environmental, social, and political factors (Ives et al., 2018).

Human beings and society are an integrated part of the biosphere which depends on ecological services for life support (Folke et al., 2011). Stark evidence portrays that we reside within an interconnected world, where actions made in one place have consequences in another (O'Brien, 2009). As the interplay of these relations are webbed within an interconnected system, adopting a systems thinking perspective is vital to recognizing our role and impact in creating geological imprints on the earth's system (Folke et al., 2011). According to Meadows & Wright (2009), a system is a set of things, people, cells etc. that are interconnected in a manner that produces their own behavioral pattern over time. Social systems are said to be external manifestations of cultural thinking patterns related to human needs, emotions, strength and weaknesses (Meadows & Wright, 2009). Once the relation between structure and behavior is realized, it can then be understood how systems work,

what makes them create poor results and how to shift them in improved behavioral patterns (Meadows & Wright, 2009).

Social and ecological systems are expected to undergo transformations as degradations are exacerbated by anthropogenic activity and climate change, increasing the risk of long-lasting or irreversible changes to all aspects of the earth's system (IPCC, 2018). Climate change is considered to be the greatest manmade environmental threat throughout human history, and the biggest challenge to human development for the 21st century (O'Brien, 2009). It is not solely an environmental or political issue, but as well as a psychological one resulting from a neglect on the role of individual cognition, consciousness, collective values and beliefs as an influence on behavior and systems (O'Brien, 2009). Humans have a profound effect on the environment and it is widely recognized that not only institutional and technological fixes are needed in response to the socio-ecological crisis but as well as, changes in human behavior (O'Brien, 2009).

3. Classic Psychedelics (CP's)

3.1. What are classic psychedelics?

Psychedelics by definition is rooted from the Greek words "*psyche*" and "*delos*", which means "mind-manifesting" or "mind-expanding" (Aixelà, dos Santos, Hallak & Buoso, 2018). It is important to distinguish classic psychedelic agents from other classes of drugs, as they have the capacity to induce altered states of consciousness, perception, cognitive processes, thoughts and feelings which are normally not experienced outside of dreams or spiritual contemplative practices (Nichols, 2016). The hallucinogenic effects of psychedelia are coined as the psychedelic experience and is often described as blissful, sacred, mystical, and spiritual (Pollan, 2018). There are many types of psychedelic substances but classic psychedelics in particular such as Psilocybin (active ingredient in magic mushrooms), LSD *lysergic acid diethylamide* (derived from ergot fungus), and DMT *N, N-Dimethyltryptamine* (active ingredient in south American entheogenic brew ayahuasca) are psychotropic substances that are derived from the natural environment and are characterized by their psychological, behavioral and therapeutic applications of the mystical (a.k.a "peak") psychedelic experience (Nour Evans & Carhart-Harris, 2017), acting as agonists on serotonergic receptors in the brain (further explained in section 3.1.2.).

Traditional use of these substances is linked to divination practices, healing and sacramental contexts by indigenous groups for millennia, predating all major contemporary religious beliefs (Johnson,

Richards & Griffiths, 2008; Forstmann & Sagioglou, 2017). Consumption of psychedelics were used to enhance meaningful harmonious connections with the non-human world (Bainbridge & Del Negro, 2019). In fact, some indigenous religious beliefs that have animist views towards the natural environment engage in more pro-environmental behaviors. For the reasoning that anthropomorphizing natural elements fosters an empathic connection to the natural environment (Forstmann & Sagioglou, 2017).

Western cultures became exposed to psychedelics after the discovery of LSD by Albert Hofmann in 1943 and gained popularity for its capacity for intervention within psychiatry and psychotherapy as well as its recreational, introspective and spiritual teachings used by the counterculture in the 60's (Pollan, 2018; Aixelà et al., 2018). Psychedelics were very much intrinsic to the genesis of environmental movements, as well as the evolution of ecology and deep ecology movements in the 70's (Luke, 2013). Unfortunately, the widespread recreational use abuse of psychedelics by the new age subcultures have resulted in the worldwide prohibition and stigmatization of these substances (Belouin & Henningfield, 2018). This is partly due to the encouragement in the use of psychedelics by Harvard professor Timothy Leary whose famous words were, "Turn on, tune in, and drop out" (Belouin & Henningfield, 2018). This fueled the growing divide amongst political leaders, and the youth who were in opposition to the Vietnam war, alongside pressing issues such as racial equality, gender equality, and environmental advocacy (Belouin & Henningfield, 2018); leading to the perpetuation and contribution to an era of misinformation, politicization and irrational societal fear. By 1971, most of CP's were classified as schedule 1 drugs, despite reports of earlier clinical research hinting promising effects of psychedelics for therapeutic applications, and experts claiming its non-toxic and non-addictive traits (Nutt, King & Nichols, 2013). This created administrative hindrances and disproportionate costs for academic institutions, which brought an abrupt halt on clinical trials and research on the effects of psychedelics on the human psyche (Forstmann & Sagioglou, 2017; Nutt et al., 2013).

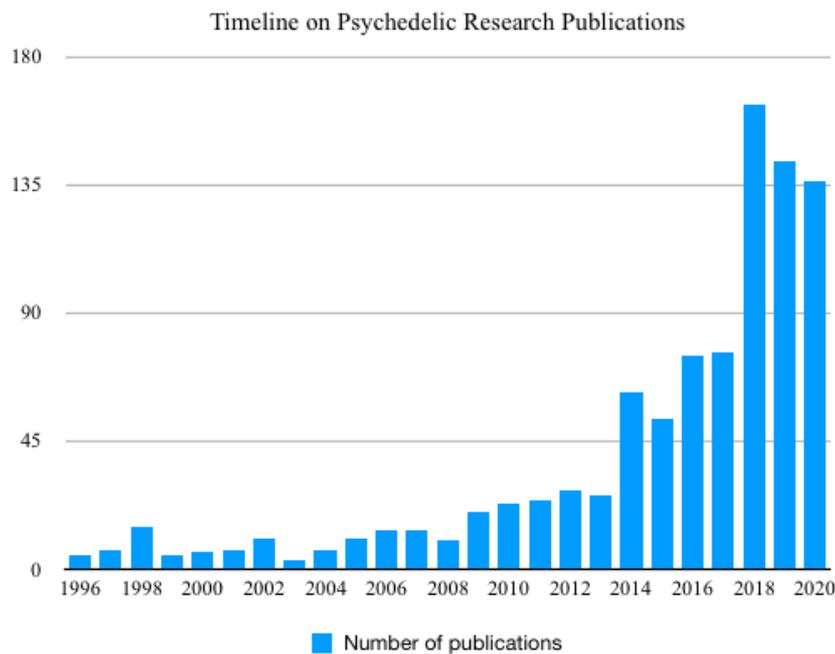
3.1.1. Psychedelic Renaissance

After decades long of legally mandated prohibition on psychedelic drug research, explorations of these substances within the context of psychiatry and psychotherapy in the 21st century is undergoing a renaissance period (see Figure 1) (Pollan, 2018). Resulting from a gradual political shift, resurgence of experimental studies and novel research programs targeting clinical

administration of psychedelics and have shown promising results for addressing a range of serious psychiatric disorders (Forstmann & Sagioglou, 2017). Highlighting its capacity to decrease anxiety for patients who are suffering terminally ill conditions (Gasser, Kirchner & Passie, 2014); reduce symptoms of depression – especially for patients who are immune to treatment (Carhart-Harris et al., 2017a); and aiding treatment for alcohol and other illicit drug addictions (Krebs and Johansen, 2012; Winkelman, 2014; Noorani, Garcia-Romeu, Swift, Griffiths & Johnson, 2018).

Institutions like John Hopkins University, Imperial College London and Beckley Foundation are conducting psychedelic research programmes to drive evidence-based drug policy reforms as well as to develop pioneering studies in exploring innovative treatments for psychotherapy. The dominant approach to psychedelic assisted therapy entails a single high dose session that aims to induce a mystical type experience, which is characterized by its drug induced ego dissolution (Lebedev et al., 2016) and an accompanying sense of connectedness, oneness and unity (Erritzoe et al., 2018). Prior consent is obtained from all subjects, and standardized screening of physical, psychiatric, blood and urine test for illicit substance abuse and pregnancy is conducted to determine whether administration of psychedelic drugs may cause any major adverse effects (Lebedev et al., 2016). Great emphasis must be made in the framework of *set* (psychological factors such as mind-set, preexisting beliefs, current cognitive wellbeing and expectations) and *setting* (environmental factors), as this plays great influence in the nature and shaping of the psychedelic experience (Lebedev et al., 2016). These sessions are aided with a carefully designed music playlist to facilitate emotional release, introspective insights to occasion a mystical experience (Lebedev et al., 2016). The accompaniment of a professional, guides the experience and later helps the individual make sense of or assimilate the experience through a follow up session via an integrative process.

Figure 1



Note: Timeline showing an increase in number of publications on psychedelic research, indicating its status and growing acceptance in the 21st century. The bar graph is generated from the search string “Psychedelic Research OR Psychedelic Therapy” via web of science. (Own figure).

3.1.2. Effects on the Brain

Classic psychedelics produce rapid onset antidepressant and anti-addictive effects, as well as long persistent effects, such as changes in mood, personality and brain function receptors (Calvey & Howells, 2018). These substances act as agonists on the serotonergic system, mainly in 5HT_{2A}, and 5HT_{2C} receptors (Calvey & Howells, 2018). This means the substances bind with the receptors and increase their effects on the neurotransmitter, as they structurally resemble serotonin itself (figure 2) (Gandy, 2019).

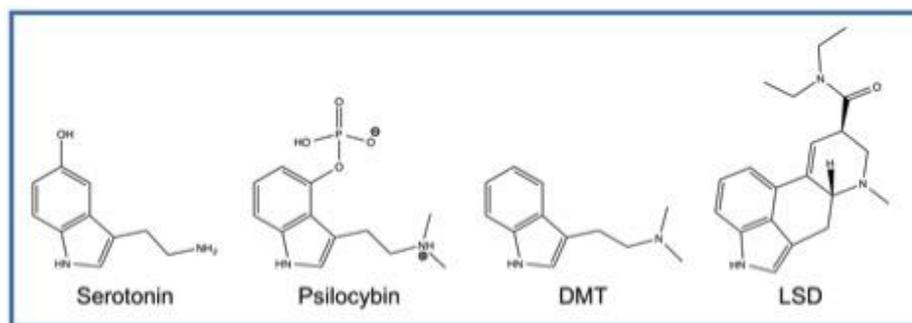
A group of brain regions (medial prefrontal cortex, posterior cingulate cortex and angular gyrus) that is depicted to have a reduction in activity after ingestion of the psychedelics is the Default Mode Network (DMN). This decrease in activity in the DMN is analogous to when the mind is at a meditative state (Palhano-Fontes et al., 2015). Using modern neuroimaging techniques, fMRI scans show that this network is active when one is at rest and is associated to key components of mind wandering, rumination, time travel and self-reflection (Palhano-Fontes et al., 2015), which are important assets to constructing narratives of self-identification (Pollan, 2018).

It is important to highlight this mechanism as it is suggested by scientists that a reduction in activity of the DMN is responsible for causing lines between self and the environment to blur (Tagliazucchi et al., 2016). This sense of ego-dissolution brings rise to the feelings of interconnectedness and unity to the external environment, manifesting a sense of connectedness with all living beings, plants, animals, and nature as a whole (Forstmann & Sagioglou, 2017).

Furthermore, classic psychedelics have been found to facilitate neuroplasticity, this could partly explain the long-term therapeutic effects in healthy psychological functioning (Gandy, 2019). This is a key finding as neuroplasticity is believed to be a key mechanism to developing new behavioral and personality traits as well as in learning and adaptation (Gandy, 2019).

Figure 2

Molecular Structure of Classic Psychedelics and Serotonin.

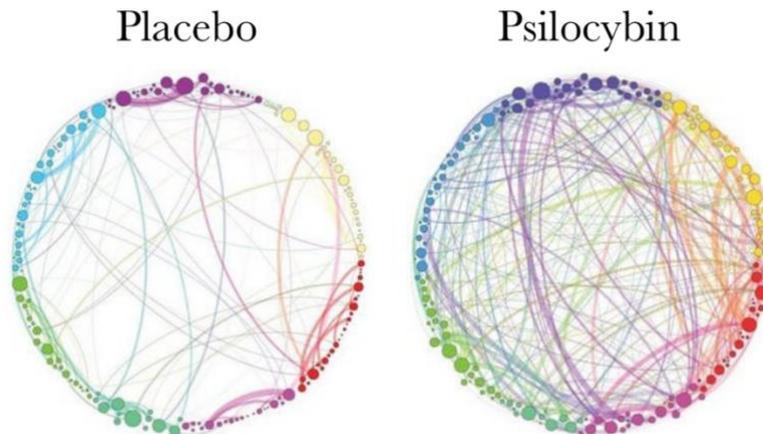


Note. Similarities in molecular structure of serotonin and psychedelic compounds [online image]. (2015). Harvard University. <http://sitn.hms.harvard.edu/flash/2015/worth-the-trip-psychedelics-as-an-emerging-tool-for-psychotherapy/>

In two studies, Tagliazucchi et al. (2016) and Lebedev et al. (2016) explains how psychedelics such as psilocybin and LSD have shown to increase entropy in the brain, this means that it allows neurons to enable connections that are normally not in communication with each other (figure 3). This enables the brain to become more flexible, open and creative, enhance problem solving capacities, making new associations and ways of thinking about the world and ourselves (Pollan, 2018).

Figure 3

Simplified visualization of brain activity in normal state vs. under influence of psilocybin.



Note. Left image shows stable brain activity in normal brain while the right image depicts brain activity under the influence of psilocybin creating diverse connections not normally in communication becoming strongly linked. Image is taken from the book *How to Change Your Mind* (Pollan, 2018, p.318).

3.2. Transformative Capacity of Psychedelics

3.2.1. Role of Psychedelics in Values and Personality

Values and personality play an important role on how an individual perceives and act in their personal reality (Aixalà et al., 2018). It has recently been accepted by environmental and sustainability scholars that a shift in values is integral to combating the environmental crisis (Ives et al., 2019). As communities and societies as a whole hold a set of collective values that may or may not be beneficial for sustainability. Therefore, shifting values for the greater good of the environment and wellbeing of society can ensure transition from a growth-centered model to one that is more eco-centric, acknowledging the biophysical limits, collective wellbeing and conservation for biodiversity. As coined by O'Brien (2013), this is change progressing from the *inside out*. Changes within the hearts and minds of people alters our relation to ourselves, each other, and nature as a whole. Subsequently, experiences engendered by psychedelics have been reported to create long lasting changes in values and personality such as *openness, trust, agreeableness, prosocial behavior, empathy, compassion, mindfulness* and *creativity* (Erritzoe et al., 2018; Lebedev et al., 2016).

Previous research have shown that these traits are strong predictors to environmental concern and behavior, to further this understanding, the following section will outline how these traits can be

modulated by psychedelics to promote transformation for sustainability.

Mindfulness

Mindfulness can be defined as the intentional, non-judgmental attentiveness to the present moment (Wamsler, 2018). It has the capacity to influence sustainable behaviors as it evokes deep awareness to how one's role and actions impact society and the natural environment. As reflections directed towards one's own beliefs and values, shows how actions and decisions are driven habitually often without one taking particular notice and will have its corresponding effects on the interconnected system of life.

The ability to shift one's perspective is a fundamental skill enabling transcendence of personal paradigms and mental models (Ives et al., 2019), this malleability is a powerful tool for transformative change (O'Brien, 2018) and holds potential to facilitate adaptation at all scales (e.g. cognitive, managerial, structural, etc.) (Wamsler, 2018). This can support more positive interactions amongst individuals, allowing for different points of views to be discussed and bring about more fruitful conversations around creative strategies and adaptations for sustainability. As solving the social-ecological crisis requires the communication, negotiation and collaboration of all actors on a planetary scale. Mindfulness is positively correlated to overall motivation for climate adaptation including pro and reactive actions, enabling the expansion of empathy and compassion towards others, by adopting a perspective that includes others' points of view (Ives et al., 2019).

Psychedelics can facilitate drastic alterations to the mind in ways that are similar to meditation, it was worth looking into the phenomenological similarities and its mechanics in relation to contemplative practices (Lebedev et al., 2016; McLean, Johnson & Griffiths, 2011). A study conducted by Murphy-Beiner and Soar (2020) explored the changes in mindfulness and cognitive flexibility before and within the first twenty-four hours after ayahuasca use. Forty-eight participants were assessed, and it's been reported that ayahuasca enhances mindfulness and supports cognitive flexibility in the "after-glow" period which improved subjective wellbeing. Another study conducted by Smigielski et al., (2019) in a mindfulness group retreat shows that administration of psilocybin enhanced post-intervention mindfulness and produced greater positive changes in psychosocial functioning after four month follow up. This was associated with the magnitude of ego-dissolution, which is explicitly aimed in meditative practices and are normally experienced by long-term meditators. For an average person to achieve such depths in meditation would be time demanding and require a certain level of experience but in conjunction, psilocybin has been shown to induce the

experience of self-dissolution and states of dispositional mindfulness without the requirement of time and regular practice (Smigielski et al., 2019).

Empathy

To be able to attribute mind and feelings to an entity is a process coined as *mind perception* (Forstmann & Sagioglou, 2017). This enables empathic concern and can be considered as the “essence of morality” (Forstmann & Sagioglou, 2017). This ability to extend empathy towards people from varying cultures, and non-human subjects such as wildlife and ecosystems has been found to be in relation to altruistic, pro-environmental and pro-social behavior (Pokorny et al., 2017). An example would be the avoidance of consuming animal-based products (Pöllänen & Osika, 2013) and adopting a plant-based diet acknowledges animals as a sentient entity, this is a prerequisite for considering it a moral subject to feelings of pain and should therefore not be harmed. Additionally, considering the greenhouse gas emissions, land use and water consumption within animal husbandry, one comes to realize the grave proportion of exploitation it has on the planet as whole. (Ives et al., 2019).

A study conducted by Pokorny et al. (2017) assessed how multiple components of empathy and moral decision making are influenced by the use of psilocybin. Thirty-three healthy human subjects were assessed using the multifaceted empathy test and moral dilemma task, results depict that psilocybin significantly increase implicit and explicit empathy in comparison to placebo subjects (Pokorny et al., 2017). While moral decision making was unaffected by psilocybin. Similar effects were reported with the use of LSD, enhancing explicit and implicit emotional empathy (Dolder et al., 2016), and long lasting subjective effects on prosocial and altruistic behaviors (Schmid & Liechti, 2017). These findings were assessed one and twelve months after LSD administration with the use of Persisting Effects Questionnaire (PEQ), Mysticism Scale (MS), Death Transcendence Scale NEO-Five Factor Inventory (NEO-FFI), and State-Trait Anxiety Inventory (STAI).

Openness

Openness is considered one of the major dimensions to personality and is linked to openness of novel ideas and values, imagination, appreciation, non-conformity and creativity (Erritzoe et al., 2018). This trait is related to greater cognitive flexibility, it increases environmental concern via greater awareness on the consequences of one’s actions. People who are more open welcomes the concept of change and self-transformation, which suggests greater willingness to change norms by

adopting a more sustainable lifestyle (Hirsh, 2014). Additionally, openness is correlated to liberal political perspectives (Erritzoe et al., 2018). Given that psychedelics are shown to increase openness, it's reasonable to deduce that psychedelics modulate political perspectives (see section 3.2.3.) as well.

A study conducted by Maclean, Johnson & Griffiths (2011) shows how one high dose of psilocybin on healthy psychedelic naïve volunteers experienced an increase in personality trait openness, and remained significantly higher than baseline even one year after the session. Similarly, LSD administration have shown to enhance openness scores in healthy volunteers even two weeks after the conducted sessions (Carhart-Harris et al., 2016). Ayahuasca used regularly in a ceremonial context have also been related to higher openness scores, as compared to non-ayahuasca using controls (Barbosa et al., 2020). Moreover, self-reported lifetime recreational psychedelic use have shown to be positively correlated to openness scores, based on a large online study (n=893) (Nour et al., 2017).

Creativity

Creative behaviors are desirable for human learning, adaptation and responding to change for ecological demand (Bainbridge & Del Negro, 2019). It is an essential component to pro-environmental attitudes and sustainable competency as creative curiosity stimulates the construction of knowledge and environmental skills for innovative problem solving (Cheng, 2018). The ability to come up with alternative solutions to an issue is an aspect of creativity which is coined as (flexible) divergent thinking, in contrast to (rigid) convergent thinking which is about finding the best or optimal solution to a problem (Kuypers, 2018). Divergent thinking appears to be the most useful predictor of creative thoughts in everyday life as opposed to convergent thinking. Moreover, flexible thinking is related to decreased psychopathological conditions like depression, anxiety and post-traumatic stress (Kuypers, 2018).

Fascinatingly, experimental studies show how classic psychedelics can improve creative flexible thinking (Kuypers, 2018). Enhanced creativity and imagination are commonly found in psychedelic states, with long-term enhancements in creative problem-solving abilities (Jungaberle et al., 2018). According to Kuypers et al. (2016), ayahuasca may hold the potential to enhance cognitive flexibility and visual creativity. While psilocybin use has shown to enhance imagination, creativity and aesthetic appreciation after a single high dose session during a two-double blind study conducted by Maclean

et al. (2011). Furthermore, the meaning enhancing capacities of psychedelics play a mediating role in creativity enhancement, spirituality and therapy (Hartogsohn, 2018).

3.2.2. *Psychedelics and Connectedness: Nature Relatedness, Pro-environmental Behavior & Prosocial Attitudes*

Zylstra et al. (2014) defines connectedness with nature (CWN) as “*a stable state of consciousness comprising symbiotic cognitive, affective and experiential dimensions that reflect a realization of the interrelatedness between one’s self and the rest of nature*” (p.1). Motivations to why elucidating connections to nature would be of great societal relevance is due to previous research showing positive relationships between CWN and wellbeing (Zylstra et al., 2014). Additionally, recognizing the reciprocity of the human-nature relationship highlights how aiding the conservation of the environment will require behavioral changes aimed at the protection of the environment (Forstmann & Sagioglou, 2017). CWN is regarded as a more holistic process for realizing transformative outcomes and behavior beneficial for oneself and society (Zylstra et al., 2014). Furthermore, it is linked to physical and psychological wellbeing, distinctively supporting happiness, more purposeful and meaningful lives (Zylstra et al., 2014).

The term *biophilia* explains how humans have in fact a deep unconscious desire to maintain close relationships to the natural environment (Bainbridge & Del Negro, 2019). This hypothesis is supported by a number of studies showing that perceptual and physical exposure to the natural environment have substantial benefits on the physical and mental wellbeing of an individual (Forstmann & Sagioglou, 2017). It is suggested that by healing the disconnect or alienation between human and nature, it would aid the conservation of the planet, by illuminating the mutuality of the relationship which is through the increasing awareness and acceptance of ones “*ecological self*” (Forstmann & Sagioglou, 2017). This is described as nature relatedness (NR) which means, “*ones level of self identification and subjective sense of connectedness to nature*” (Kettner et al., 2019, p.2). NR was originally found to be enhanced from spending time in nature, and nature-contact based activities especially when inducing themes of meaning, beauty, and compassion (Kettner et al., 2019). This exposure to nature has implications to value orientation scores and environmental sustainability intentions, making it desirable for sustainable outcomes as NR is a strong predictor for pro-environmental awareness, attitudes and behavior. It is associated with decreased anxiety, stress, depression, rumination, and increased vitality, psychological restoration & enhanced prosocial orientation (Kettner et al., 2019). NR has also shown to elicit greater valuations for intrinsic

aspirations (e.g. personal growth, intimacy, community) in contrast to extrinsic aspirations (e.g. financial gain, image, popularity) (Kettner et al., 2019).

An online study (n = 654) conducted by Kettner et al. (2019) found NR to increase significantly 2 weeks, 4 weeks, and 2 years after a psychedelic experience. It was found to be positively correlated with increased psychological-wellbeing, extent of ego dissolution and influence of external environment. It is reported that psychedelics instigate a sense of ecological awareness, which can be defined as a state of consciousness in which one feels part of a wider environmental system (Dickins, 2013). It's even been found that psychedelic users scored higher on environmental concern, this was measured via the Life Values Inventory (Nour et al., 2017). This sense of connectedness brings insight to one's individual or collective role in society, realizing how ones actions or consumption patterns affect the environment and society in return. As quoted by a patient from Lyons & Carhart-Harris' (2017) trial, *"Before I enjoyed nature, now I feel a part of it. Before I was looking at it as a thing, like TV or a painting. But now I see, there's no separation or distinction, you are it"* (p.817).

Evidence on current psychedelic research draws linkages and correlations on how classic psychedelics can be used (in a clinical context) to enhance sense of connectedness, nature relatedness, pro-environmental and prosocial behavior amongst individuals (Nour et al., 2017; Griffiths et al., 2018). Forstmann & Sagioglou (2017) posits that people who are more experienced with classic psychedelics are more inclined to enjoy and spend time in nature, as well as construe themselves as being one with nature. This was found to be a positive predictor for self reported engagement in pro-environmental behavior, NR significantly mediates the relationship between experience with classic psychedelics and pro-environmental behavior. They've concluded that lifetime experience with classic psychedelics positively predicts self reported nature relatedness which in turn predicts self-reported engagement in pro-environmental behavior (Forstmann & Sagioglou, 2017). This suggests how classic psychedelics can have significant effects on people's perception of nature and how they engage in ecological behavior.

3.2.3. Psychedelics Influence on Political Perspectives

According to Forstmann & Sagioglou (2017), right-wing authoritarianism was found to be highly negatively correlated with environmental concern. Political conservatism have similarly shown to be negatively correlated with recreational drug attitudes and is historically related to drug

prohibition and authoritarianism. Authoritarians tend to conform to the norms represented by the dominant social paradigm, which depicts growth as the higher value (Schultz, 1994). This poses a negative implication to sustainability as the current business-as-usual, capitalistic and growth-oriented social paradigm is what's driving social inequalities, overconsumption and exploitation of natural resources.

A recent correlational study conducted by Nour et al. (2017) postulated that lifetime use of psychedelics negatively predicts authoritarian political views while positively predicting more liberal political views. This was mediated by the degree of ego dissolution experienced during an intense psychedelic experience, leading to greater openness, liberalism and negatively predictive of authoritarianism (Nour et al., 2017). Similarly, a pilot study conducted by Lyons & Carhart-Harris (2018) reported how a significant decrease was observed in authoritarian political perspective one week after psilocybin treatment, relative to baseline. The decreases in authoritarianism were still observed during seven to twelve months post-dosing.

3.2.4. Psychedelics on Spiritual Significance and Worldviews

The materialistic interpretation of the world has allowed insight into the workings of the physical world, but concurrently tends to devalue nature into a mere object (de Witt, 2016). Meaning this view depicts the environment to hold no real intrinsic value ("valueless" or "worthless"). This perspective of reality results in the dichotomy between human and nature, mind and body, and subject and object. It poses a problematic relationship to sustainability issues, as this creates separation, disconnection, disorientation, alienation, exploitation and commodification of the environment (de Witt, 2016). This is linked to *technological optimism*, the idea that technological advancement and science can solve the current social-ecological crisis by themselves. However, addressing the crisis would require consciousness and cultural change instead of exclusively focusing on political changes and technological fixes (de Witt, 2016).

Changes within are also required as it changes how one relates to themselves, towards others and nature. Considering an *integrative worldview* which is the synthesis of polarized domains and ways of knowing such as science and spirituality, logic and imagination, object and subject, and ecology and economy brings a greater view of reality as it considers duality and opposition of all aspects (de Witt, 2016). It attempts to include a wider range of viewpoints even those conflicting to capture potential unity. This understanding is coined as *spiritual unitive ontology*, which is "an evolutionary

understanding of the universe in which the process of evolution itself is driven by, or a manifestation of, a creative spirit or divine force, rather than a belief in either biblical notion of creation or a purely scientific understanding of random, unconscious evolution” (de Witt, 2016, p.209).

The role of spirituality in reorienting people towards nature has the potential to work as a deep leverage point (Ives et al., 2019). Acknowledging the significance of spirituality and importance of worldviews for sustainability, re-enchants one’s perspective of the world and nature, thus overcoming the materialistic interpretation and modernistic worldview that have led to the current social-ecological crisis. It’s been argued by many that a spiritual sense of awe for the cosmos can result into a great sense of care for the wellbeing and evolution of the planet, which may be essential to addressing sustainability (de Witt, 2016). Moreover, it is empirically proven that individuals who associated with the integrative worldview tend to show more environmental concern and adopt a sustainable lifestyle, in contrast to those ascribing to more traditional and modern worldviews (de Witt, 2016).

For centuries, psychedelics have been used in a spiritual or religious context for healing and divination purposes. It is a vehicle for spiritual access and experience, especially when supported with education, awareness, safety, and planned settings with the aid of a guide (Wolfson, 2018). As they are quite reliable in opening the imaginal and diminishing the ego for a duration of time, it enables a broader view of reality, one that transcends cultural and personal held assumptions (Wolfson, 2018). Many contemplative traditions explicitly aim at dissolving the ego or sense of self by prompting altered states of consciousness via meditation, while CP’s are recognized to make significant disruptions on self-consciousness via a phenomenon coined as drug-induced ego dissolution (Millière et al., 2018).

A double-blind study conducted by Griffiths et al. (2008), looked into the psychological effects of a high dose psilocybin session. A large proportion of the psychedelic naïve patients have reported that a mystical experience occasioned by psilocybin was among the most personally meaningful and spiritually significant of their lives after 14 months follow-up. A core aspect of psychedelics is its ability to occasion a mystical experience, which have been reported to predict an increase in long term psychological wellbeing (Griffiths et al., 2006). In fact, the therapeutic potential of psychedelics is induced by the mystical experience when administered in a supportive environment. It is characterized by states of ego-dissolution or self-transcendence, experience what Freud coined to be as *oceanic boundlessness*, this encompasses four classical elements of mysticism, *“insightfulness, blissful state, experience of unity, and experience of spirituality”* (Ballestros, 2019, p.732). It has also

been reported that when CP's are used with an intention for spiritual introspection in a safe and supportive environment, can evoke "deeper realms" of existential experience, state of wonder, shift in conceptual framing, extend greater capacity for love, and intense sense of connection.

4. Methodology

4.1. Systematic Literature Review

This is a qualitative study based on a systematic literature review. A systematic review is defined as a literature review designed to search, assess, and synthesize available evidence in relevance to a specified research question, providing the best evidence based answers (Boland, Cherry & Dickson, 2017). The information gathered can be utilized to advance certain fields, informing future practice or research, in combination with professional judgement on decision making about the way to deliver interventions or to form policy changes (Boland et al., 2017). This is considered to be the best standard for reviewing and synthesizing findings from several studies of varying disciplines to investigate the same questions (Boland et al., 2017). It follows a well-defined and transparent protocol, always require definitions of the question or problem, identifying critical evaluation of the available evidence, and synthesis of the findings to draw conclusions (Boland et al., 2017). This chosen method is deemed relevant for this research as gathering of current knowledge of psychedelic research is required to identify the overlapping themes and interlinkages across disciplines. This transdisciplinary study includes perspectives from neuroscience, psychology, psychotherapy, psychopharmacology, and inner-sustainability studies. To critically appraise the available evidence on the role of CP to be used as a tool or intervention to create systemic change and catalyze socio-ecological transformation.

4.2. Research Design

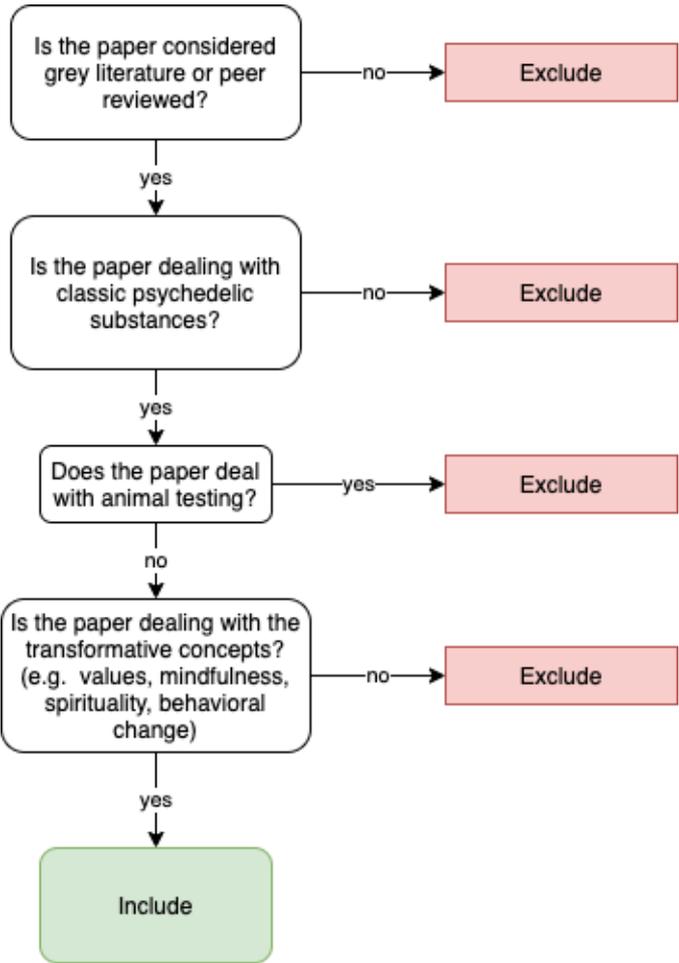
This section will outline the general design of this research, providing a step by step conceptualization on how this literature review was conducted. Specific information on how material is collected will be further explained in section 4.3.

A general search on psychedelic research was the initial step to identifying the background and to get an overview on the current available scientific evidence. After a general overview have been established, areas in which further research can be pursued was identified. In this case the overlapping themes and interlinkages identified were, the roles of values and personality, sense of

nature relatedness or connectedness, role of political perspectives, worldviews and spirituality. Key words were then determined to be used for the desired search string to find relevant papers for inclusion. The next step is to conduct a literature search, using a bibliographic database alongside with a specific search string to address the research question. Based on the total search results, the screening of titles and abstracts determined which papers are to be discarded or deemed relevant for review.

Based off of this preliminary finding, defining and refining review questions were established to set the inclusion and exclusion criteria, acting as a protocol (See Figure 4) for data collection. A protocol is a written plan or set of questions that allows to set out the approach that'll be used to decide which set of papers are to be included or excluded from this review.

Figure 4
Protocol for Data Collection.



Note. (Own figure).

After determining relevant material, the next step involves the obtaining of full text papers of the evidence identified. A second round of screening is conducted with the use of the inclusion criteria to select which full text papers are to be used for a thorough literature review. Additional papers with relevant references found from the initial search were added into the literature review if they were deemed to have significant findings within psychedelic research. Extraction of relevant data from each paper is then performed and is summarized using tables. This will serve as an overview depiction on the strengths and limitations found in the methodology and findings of each of the papers included. Allowing to get an overall understanding on what the main findings, similarities and shortcomings are from the bulk of the research. Analyzing and synthesizing data narratively will be done with the aid of inner-sustainability frameworks (see section 4.4) to connect the whole literature review back to sustainability concepts.

Aside from the literature review on psychedelic research, a manual search on inner-sustainability concepts was necessary to provide background knowledge, enrich and support sustainability themes presented for this study. These articles were not included for the literature review analysis and only served as supporting information.

4.3. Material Collection

Primary and secondary qualitative data were gathered using the database *Web of Science*. An initial search with the search string, TS = (psychedelic* AND sustainability) was made to get a grasp on the availability of literature on these specific topics. It resulted with 3 false positive hits (papers including the keywords but are not within the scope), which strengthened the motivation behind conducting research for this paper. Deciding on the specific keywords that should be used for the search string, overlapping themes between inner sustainability studies and current psychedelic research were used to capture the potential linkages of classic psychedelic use to social-ecological sustainability.

The following search string was used for material collection: TS= (psychedelic* AND behavior) or TS= (psychedelic* AND values) or TS= (psychedelic* AND environment) or TS= (psychedelic* AND sustainability) or TS= (psychedelic* AND Transformation) or TS= (psychedelic* AND nature) or TS= (psychedelic* AND psychotherapy) or TS=(psychedelic* AND climate) or TS=(psychedelic* AND

sustainable) or *TS= (psychedelic* AND ecology)* or *TS= (psychedelic*AND mindfulness)* or *TS= (psychedelic* AND connectedness)* or *TS= (psychedelic* AND spiritual)*. See Table 1 for reasoning behind chosen search string.

Table 1

Justification for the chosen search string and its relevance for sustainability studies.

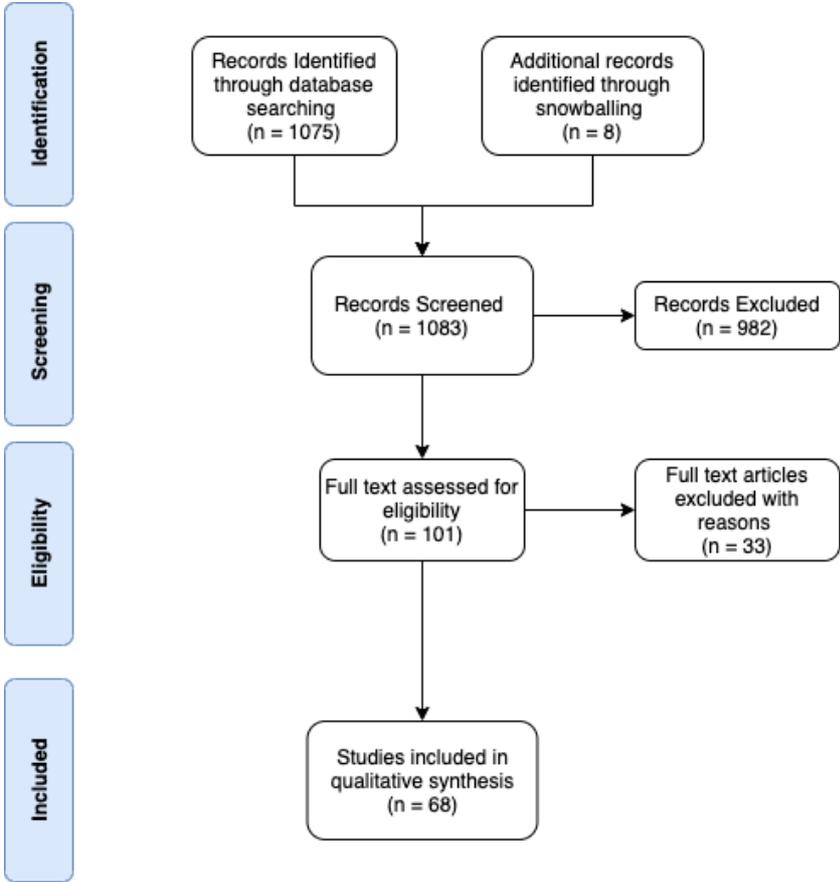
Search String	Relevance
<i>TS= (psychedelic* AND behavior)</i>	To look into the implications of psychedelics to behavior, in light of pro-environmental or prosocial behavior.
<i>TS= (psychedelic* AND values)</i>	Psychedelics implications on values, specifically on openness, empathy, compassion, creativity and mindfulness.
<i>TS= (psychedelic* AND environment)</i>	To capture articles containing the keyword “environment”, for environmental behavior, environmental awareness, environmental concern etc.
<i>TS= (psychedelic* AND sustainability)</i>	To get an overview of psychedelic research under the light of sustainability concepts or studies.
<i>TS= (psychedelic* AND transformation)</i>	To gather papers writing about the transformative aspects of psychedelics. Explicitly dealing with transformative change within the practical sphere (behavioral changes), political views, and personal sphere (beliefs, values, and worldviews).
<i>TS= (psychedelic* AND nature)</i>	To gather papers with keywords “nature”, papers relating to psychedelics’ implications nature relatedness.
<i>TS= (psychedelic* AND psychotherapy)</i>	To gather an overview on the current applications of psychedelics within a clinical

<i>TS= (psychedelic* AND climate)</i>	<p>context. How psychedelics can improve individual and collective or social and ecological wellbeing.</p> <p>To gather papers that have possibly written about the role of psychedelics for climate adaptation.</p>
<i>TS= (psychedelic* AND sustainable)</i>	<p>To gather paper dealing with the keyword “sustainable”, sustainable transition, sustainable development, sustainable behavior, etc.</p>
<i>TS= (psychedelic* AND ecology)</i>	<p>To gather papers with keyword “ecology”, such as papers pertaining to psychedelic research and deep ecology.</p>
<i>TS= (psychedelic*AND mindfulness)</i>	<p>To gather papers dealing with implications of psychedelics on mindfulness. As there is growing recognition on the role of mindfulness for sustainability and transformation.</p>
<i>TS= (psychedelic* AND connectedness)</i>	<p>To gather papers dealing with concepts of connectedness as this theme has been prominent within psychedelic research and found to have an important role within sustainability.</p>
<i>TS= (psychedelic* AND spiritual)</i>	<p>To gather papers dealing with psychedelics and its implications to spirituality. As spirituality has the potential to act as deep leverage for systemic change.</p>

The search string resulted into 1,075 hits. See figure 5 for literature search flow diagram. The screening of abstracts was conducted to eliminate irrelevant material as well as false positive results. False positive results are scientific material with the relevant key words but are deemed irrelevant because of its scope or focus. An example would be psychedelic trials using substances outside of classic psychedelics such as MDMA. Only peer reviewed scientific articles and grey literature were included to the literature review. An example of grey literature included in this study is the books on, *How to Change your Mind* by Michael Pollan as it contained a profound compilation and summary on

the current psychedelic research alongside with its historical background and personal documented experiences using classic psychedelics. After the elimination process, 60 scientific articles were accepted for inclusion in this study, 1 book, plus an additional 7 articles that were found through full proof reading other papers of inclusion. In total, 68 were accepted for the qualitative literature review.

Figure 5
Literature search flow diagram.



Note. (Own figure)

The gathered data were subject to qualitative content analysis in the thematic area, *Transformative Capacity*. Material that falls under the category for transformative capacity includes studies that focus on the dimensions of interiority for inner-societal transformation. This category highlights the

interlinkages to inner sustainability concepts through the implications of psychedelics on the role of values, cognitive flexibility, behavioral change, personality, worldviews and spirituality.

Papers were excluded from the analysis if its focus lies outside this theme, such as papers having strong focus on the therapeutics or neuroscience aspects of psychedelic research. However, these papers still hold important knowledge on the mechanisms, implications and applications of CP's and were therefore used as supplementary material for constructing the background section. Material that falls under the therapeutic application category are studies on the psychotherapeutic and psychopharmacological implication of psychedelics. This includes studies on the use of psychedelics to treat addiction, depression, anxiety, and PTSD. The reason to why papers that had a strong focus on therapeutic applications were excluded is because there is already growing existing literature proving the applicability and effectiveness of psychedelic therapy within a clinical context.

Additionally, the scope of this study focuses on the phenomenological and transformative aspects that classic psychedelics instigate on value orientation and behavioral change. Therefore, conducting another literature review on the therapeutic applications would be unnecessary to the scope of this study.

If the study explores substances that are *not* classified as classic psychedelics (*e.g. MDMA, Ketamine, etc.*), it will be excluded as this study strictly focuses on classic psychedelics (*e.g. psilocybin, LSD, DMT*). MDMA for example is a psychedelic substance that show to have profound psychotherapeutic benefits but is not included in the study as it isn't considered a classic psychedelic – given it doesn't act as an agonist to serotonin receptors and additionally, affects the cardiovascular system. Studies that experiment on animals are also excluded as this study considers the subjective and phenomenological aspect of psychedelics and how it can influence human behavior, personality, and wellbeing. Given the amount and availability of psychedelic research on human behavior, including research conducted on animals is unnecessary and less reliable as it is impossible to decipher their phenomenological effects. In addition, papers that focus on frameworks used to develop or enhance psychedelic psychotherapy were excluded as their focus does not lie on the same scope of this study. Other reasons for exclusion would be if the paper was not written in language of instruction (English), duplicates and inaccessible files.

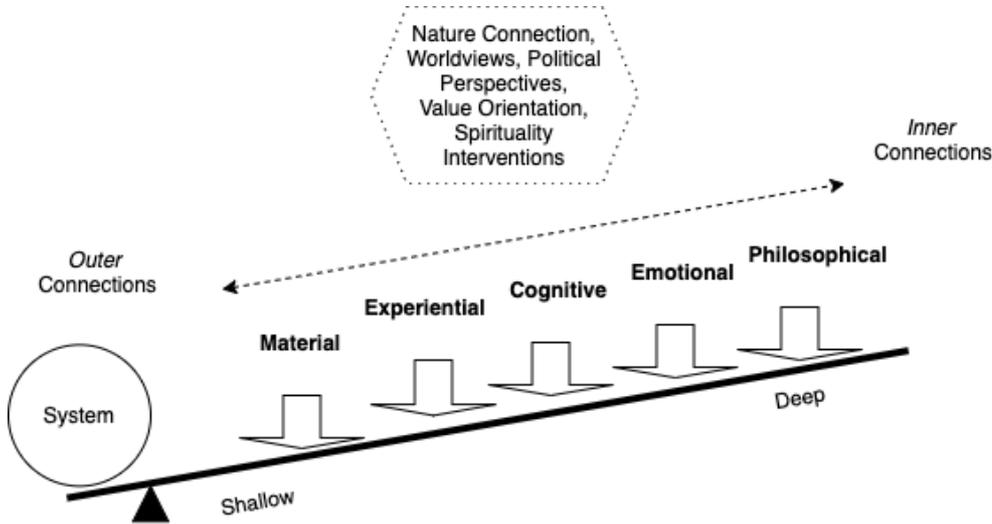
4.4. Framework used for Analysis

The framework presented in the following section will be used to aid the narrative analysis (see section 8).

4.4.1. Leverage Points

The hypothesized mechanisms of systems leverage point is appropriate to exploring how CP's can potentially be used as a tool to influence systemic change via interventions (e.g. nature relatedness) as they affect deeper leverage points, these are points that are difficult to intervene but have great potential to bring about transformative change (Fischer & Riechers, 2019). This concept will be further explored in more detail under the results section (5), how psychedelics influence nature connectedness, values, belief systems, worldviews and spirituality in relation to the material, experiential, cognitive, emotional and philosophical leverage points.

Figure 6
System leverage points. (Own Image).



Note. Adapted from Ives et al. (2018). Highlighting how classic psychedelics can be used as a mode of interventions for reconnecting people with nature, spirituality, shifting worldviews and reorienting values as deep leverage for systemic change.

Meadows (1999) hypothesized that leverage points (figure 6) are areas within complex systems in which interventions can be directed to prompt change in overall system behavior. Drawing inspiration from Meadows (1999) and Ives et al. (2018), it is hypothesized that interventions directed towards reconnecting people with nature can bring about systemic change. Leverage points can create shallow or deep changes within a system depending on its influence. Shallow leverage points create relatively ineffective changes, whereas even the most minute changes within deep leverage points can alter total system behavior (Ives et al., 2018). Shallow leverage points deal with (a) system parameters and (b) feedbacks between variables (e.g. resource stocks and flows), while deep leverage points deal with (c) system design or architecture and (d) goals or intentions pursued through a system (e.g. principal goals, values, changing mindsets and worldviews embodied in a system) (Ives et al., 2018). Solely strengthening “outer” connections are unlikely to invoke transformative change and will only act as potential supporting roles to sustainability transformation. Interventions have been used most frequently at shallow leverage points for the pursuit of sustainability, yet evidently it serves insufficient (Fischer & Riechers, 2019). While addressing “inner” connections enables the catalyzation of sustainability transformation (Ives et al., 2018).

It has been highlighted that deep leverage points can bring about transformative change via (a) restructuring institutions to enable conditions that favor pro-environmental and sustainable behaviors by relevant actors; (b) reconnecting humans back to nature; and (c) reconsider how different areas of knowledge can interact and cooperate to promote sustainability (Fischer & Riechers, 2019). These are fundamental areas that can evoke transformational change within social-ecological systems but there are other deep leverage points that are worth examining. This paper will examine leverage points that include the notions of different *worldviews*, *value orientations*, *political perspectives*, *spirituality* and their influence on sustainability in further detail under the analysis section (see section 7).

5. Results

5.1. Transformative Changes

Table 2

Brief overview on transformative changes instigated by classic psychedelics

Classic Psychedelics	Primary Mechanism of Action	Effects on Cognition	Effects on Perception	Effects on Positive Psychology	Effects on Social Relatedness	Negative Effects
LSD, Psilocybin, DMT (Ayahuasca)	Agonist on Serotonin receptors 5-HT _{2A} and 5-HT _{2C}	Increased cognitive flexibility and creativity	Alterations in visual perception, mystical experience, hallucinations, ego-dissolution	Increased subjective wellbeing and life satisfaction, positive mood, blissful state, sense of awe	Enhanced compassion, empathy, prosocial attitudes and behaviors, openness and trust	Anxiety, Paranoia, Nausea, Flashbacks, Schizophrenia

Note. Changes on the cognitive, perceptual, emotional and social relatedness effects of classic psychedelics. (Own table).

5.2. Interlinkages of Psychedelics and Sustainability

Table 3

Interlinking concepts of psychedelics and sustainability.

Interlinking Concepts	How is it addressing inner sustainability?	How is it addressing Psychedelic Research?
Values and Personality	Shifting values for the greater good of the environment and wellbeing of society can ensure transition from a growth-centered model to one that is more eco-centric, acknowledging the biophysical limits, collective wellbeing and conservation for biodiversity.	Experiences engendered by psychedelics have been reported to create long lasting changes in values and personality such as <i>openness, trust, agreeableness, prosocial behavior, empathy, compassion, mindfulness</i> and <i>creativity</i> .
Connectedness with Nature	Recognizing the reciprocity of the human-nature relationship highlights how aiding the conservation of the environment will require behavioral changes aimed at the protection of the environment from an individual and collective level.	Evidence on current psychedelic research draws linkages and correlations on how classic psychedelics can be used to enhance sense of connectedness, nature relatedness, pro-environmental and prosocial behavior.

Political Perspectives	There is a high negative correlation between right wing authoritarianism and environmental concern.	It's been shown that lifetime use of psychedelics negatively predicts authoritarian political views while positively predicting more liberal political views.
Worldview & Spirituality	Acknowledging the significance of spirituality and importance of worldviews for sustainability, re-enchants one's perspective of the world and nature, thus overcoming the materialistic interpretation and modernistic worldview that have led to the current socio-ecological crisis.	Classic psychedelics are used with an intention for spiritual introspection. In a safe and supportive environment, can evoke "deeper realms" of existential experience, state of wonder, shift in conceptual framing, extend greater capacity for love, and intense sense of connection.

Note. Brief overview showing the interlinking concepts and overlapping themes with justification on its relevance towards inner-sustainability and psychedelic research. (Own table).

5.3. Overview on Literature Review

Table 4

Sample overview of literature review.

Reference	Substance (s)	Study Design	Sample Size	Outcome	Limitations
Forstmann et al. (2020)	LSD, Psilocybin, DMT	Field studies, within subjects	N = 1200	Psychedelics is significantly associated with positive mood.	Self report on substance use. Generalizability on observed effects. Lack random assignments and causal inferences.
Kettner et al. (2019)	Psilocybin, LSD, DMT	Correlation and linear mixed regression modelling	N = 654	Lifetime psychedelic use was positively correlated with nature relatedness baseline. Nature relatedness increased 2-4	Positive sample bias towards psychedelic use may have been present amongst participants. Sample was highly educated and predominantly

				weeks and 2 years after experience.	male. Lack of experimental control.
Smigielski et al. (2019)	Psilocybin	Double blind	N = 39	Psilocybin increased depth of meditation, ego dissolution, perception, hallucination without anxiety.	Mentioning the use of a placebo, and possible recognition of the active and non-active conditions by participants.
Griffiths et al. (2019)	LSD, Psilocybin, Ayahuasca	Within subjects, cross sectional online survey	N = 4285	Most participants reported vivid memories of encounter experience, which usually involved communication with something having attributes of consciousness, benevolence, intelligence, sacred, eternal and all-knowing.	Self reports, limited by social desirability or other implicit biases.
Erritzoe et al. (2018)	Psilocybin	Within Subjects, clinical trial	N = 20 (with moderate to severe, unipolar, treatment resistant depression)	<i>Neuroticism</i> scores significantly decreased. <i>Extraversion</i> and <i>Openness</i> increased. <i>Conscientiousness</i> showed trend level increases, no change observed with <i>agreeableness</i> .	Relatively small sample size. Open label design, no control group.

Lyons & Carhart-Harris (2018)	Psilocybin	Open label pilot study with mixed model designs. Within subjects.	N = 14	Nature relatedness significantly increases & authoritarianism significantly decreases 1 week after dosing sessions. 7-12 months post dosing, NR remained significantly increased and authoritarianism remained decreased.	Small sample size. Control group were healthy patients and are not exposed to the same treatment procedures.
Nour et al. (2017)	Psychedelics	Self report online questionnaire	N = 893	Lifetime psychedelic use positively predicted liberal political views, openness, and nature relatedness. Negatively predicted authoritarian political views.	Cross sectional study, cannot make causal inferences. Homogenous sample population, limited generalizability.

Note. Sample overview of accepted quantitative and qualitative studies on psychedelic research in terms of transformative capacities. The information presented in the table are taken directly from their respective study. A total of 68 literature material was reviewed for the analysis, see appendix 1 for complete review. (Own table).

6. Criticism

Despite experts considering classic psychedelics as the least harmful and least addictive recreationally used substances (Forstmann & Sagioglou, 2017), there are still risks to consider when looking at it at a social context. Classic psychedelics are substances that can still pose a risk for misuse and abuse amongst populations that are not mentally or physically fit or prepared to take on such experiences under unguided circumstances. In fact, psychedelic researchers carefully screen their volunteers prior to any session, excluding individuals who are at risk of developing mental illnesses such as schizophrenia. For reasons that in rare occasions, psychedelics can trigger their first psychotic break (Pollan, 2018). Therefore, it must be stressed how *set* and *setting* is an important factor influencing the psychedelic experience.

When set & setting is ignored, it increases a risk for triggering a “bad trip”, flashbacks (hallucinogen persisting perception disorder), or psychoses. Hallucinogenic persisting perception disorders for example rarely happens in controlled clinical settings (Halpern et al., 2016). They can be described as the re-experiencing of perceptual distortion induced while under the influence of psychedelics, and subsequently cause functional impairment or anxiety (Halpern et al., 2016). They are experienced through brief flashbacks or chronic, waxing and waning over months to years (Halpern et al., 2016).

Having an insight does not necessarily equal to being able to apply that insight. The potency of the psychedelic experience can feel as though one’s newly attained perspective can change the state of things forever, but the transiency and impermanence of the experience dawns in and some return to their “old lives” (Watts & Luoma, 2020). Which is why attention must be directed at the intention and integration processes, as this enables one to make sense and reap the benefits that the psychedelic experience brings forth.

Psychedelics is not the answer or solution to any of the problems we face individually or as a society, but it has the ability to bring to light what actions must be taken to achieve such changes or improvements in our lives via enhancing awareness. Metaphorically speaking, psychedelics can open up the oyster to reveal the pearl; however, it is the subsequent actions or experiences that determines whether the oyster remains open or closed (Watts & Luoma, 2020). The integration phase accompanied with a guide is necessary for the individual to process the psychedelic events that occur during their sessions, to learn key valuable lessons and incorporate them within their daily lives (Watts & Luoma, 2020).

Even within the sacramental contexts, the ingestion of mushrooms or ayahuasca are highly ritualized and are conducted in a controlled manner usually with a guide or shaman involved. However, it must be taken into consideration to also be careful in viewing these cultures as there have also been reports of wicked intent (e.g. bewitching), abuse, and unethical behavior in conjunct use of psychedelics (e.g. human sacrifice) (Johnson et al., 2008). Nonetheless, these cultures are known to live in harmony and alignment with their natural environments and view hallucinogenic plants as beings of divine origin (Johnson et al., 2008).

An ethical concern would be the morality behind altering core personality traits as it can transform the subject to become a different person. Is it ethical to transform an individuals perspective, value orientation and personality with the use of psychedelics to create a more empathic, compassionate, and eco-centric worldview? To approach this question, we would need to consider the individuals consent and intent on partaking in such experiences as well as their current state. If the individual has destructive traits or mental illnesses that they wish to overcome and motivations behind participating a psychedelic experience is for the improvement of ones own wellbeing; they should have the freedom to explore methods in pursuit of attaining transformational learning and adopt traits that are beneficial to themselves, others, and the world at large.

In light of spiritual practices, it is important to note that spiritual leaders view psychedelics only as instruments enabling one to tap into levels of transcendence or enlightenment. These tools should not be used to substitute traditional contemplative practices but instead should be seen as facilitators allowing one to gain brief insight on non-dual awareness or altered states of consciousness. In fact some practitioners keep away from drug use especially when values such as abstinence is respected (Móro et al., 2011). It is argued that other practices such as meditation is a more holistic approach to transforming one's own identity, values, and worldview. However, some culture incorporate psychedelic use as it may be in accordance with some spiritual goals, which may offer sacramental meaning for its consumption (Móro et al., 2011).

7. Limitations

There are limitations to consider for this study. Firstly, this paper does not focus on the direct external sustainability impacts or ecological footprint of classic psychedelics. When considering whether classic psychedelics can “promote” sustainability, more research must be made on the carbon/ecological footprint, resource use, and socioeconomic impacts from the use of these substances. As well as the sociological impacts it may have on indigenous communities.

If classic psychedelics are to be widely accepted for clinical and therapeutic purposes, it is still unknown how large of an ecological footprint it would have in light of its production and supply. Additionally, one should also consider how it may potentially affect indigenous groups as it may increase trade, economic activity, and commodification over instruments considered as sacred to their culture. This may threaten the ecology and biodiversity of their natural habitats where these plants naturally thrive, as economic or tourism activity increases the risk of exploitation in search for psychedelic substances and transcendental experiences.

The concluding statements for this paper are based purely off of theoretical interpretation. Assumptions on the transformative effects and implications of classic psychedelics to society must be made with caution, as these are powerful agents that can be subject of misuse and abuse. Further research must be conducted within the social sciences to fully assess the costs and benefits of its application to society. Additionally, assessing whether classic psychedelic use is of “benefit” to society would be a challenge on its own since opinions will differ on the definition of “beneficial”.

The studies included for the literature review were also limited to the search string and database used. It is possible that more relevant materials were missed for inclusion. The studies reviewed also had its own set of limitations. The methodology varied considerably as well as the study designs for the literature reviewed. When deciphering the results and conclusions, one must consider the sample population, the demographics, heterogeneity, and size. Most of the literature reviewed had a relatively small sample size, making generalizability of the results difficult. This makes it impossible to apply the results at a societal scale as it is a poor representation on the size and diversity of the global population. Furthermore, majority of the tests were conducted in either supportive environments or partaken by participants who are experienced or enthusiasts on the transcendental and therapeutic applications of psychedelics. The results from this sample group for example cannot be applied in a population that is psychedelic naïve or treatment resistant populations.

8. Analysis and Discussion

This paper explores approaches or interventions that can affect transformative change, to bring out a biophysically sustainable and a socially just world, the fundamental goal of sustainability science. Classic psychedelics have become the point of interest in this study for catalyzing self-transformative capacities, it's been identified that psychedelic share overlapping themes with inner-sustainability concepts namely, *values & personality, connectedness with nature, political perspectives, worldviews & spirituality*. This is depicted in table 3 (section 5.2), where a brief description is provided explaining the relevance of each theme for inner sustainability and psychedelic research respectively. This highlights the interlinkages and consistency of ideas found across the different fields of research.

The literature review depicts how psychedelic research concerns the domain of positive psychology, which is supportive of environmental and sustainable behavior. See table 2 (section 5.1) for an overview on the transformative capacity of CP's and its effects on cognitive, perceptual, emotional and social relatedness. The most prominent themes observed from the literature analysis is the theme of *connectedness, mystical experiences/ego dissolution, and personality change (openness, mindfulness, spirituality)*. The literature review depicts how classic psychedelics have beneficial effects on emotional processing, social cognition, cognitive flexibility. Despite the above-mentioned limitations for the literature reviewed, majority of the outcomes and findings show promising therapeutic applications for classic psychedelics. More studies with bigger sample sizes and improved frameworks is required to enhance generalizability of the results as well as to determine causal relations.

In a sustainability context, the framing around deep and shallow leverage points offers a working hypothesis in regard to how different types of interventions may be more or less effective in fostering sustainability. It is important to note that interventions directed to outer connections are crucial however, the ability to increase this parameter is essentially inhibited by the design, goals and intent (inner connections) to which the system is oriented (Ives et al. 2018). Assuming that classic psychedelics can be used as a tool for intervention, how exactly does it aid the social-ecological crisis and bring about systemic change? First off, CP's deal with the inner workings of the minds and emotions of individuals. Therefore, its influence can be seen in the inner realms of deep leverage points which are, the *cognitive, emotional, and philosophical*.

The ability for CP's to enhance creative flexibility in cognition falls under the cognitive leverage point. This is considered as relatively "deep" leverage point as it deals with knowledge or awareness of the environment. CP's have the ability to evoke creative problem solving and construct innovative solutions, changes made within this leverage point can simultaneously influence shallower leverage points. Material and experiential changes for example, when cognitive flexibility is enhanced it allows for practical solutions to surface such as, changing consumption patterns or increasing margins for conservation parameters.

The use of CP's has also been linked to emotional enhancements such as increases in empathy, compassion, love, openness and trust. Changes within this realm deals with the emotional leverage point, which lies on the deeper end of the spectrum. When the aforementioned emotions are strengthened, pro-social and pro-environmental attitudes are enhanced. Openness allows for the concept of change and self-transformation to take place, as well as to reconnect to nature. Nature connectedness is posited by Ives et al. (2018) to have different types of connections, which influences the material, experiential, cognitive, emotional and philosophical leverage points. If CP's have the capacity to strengthen nature connectedness, it may provide as a valuable tool for deep leverage to create transformative systemic change. As this change deals with cooperative changes from the outer and inner connections.

The philosophical leverage point is depicted in figure 6 (see section 4.4.1.) as the deepest. This deals with perspectives, worldviews and spirituality (Ives et al., 2018), it is related to the shifting and transcending of paradigms (Fischer & Riechers, 2019). As mentioned in the transformative capacity of psychedelics section (see section 2.2), classic psychedelics have shown to evoke spiritually meaningful experiences, reorient values, and shift worldviews to more inclusive and liberal perspectives, thus creating a great foundation for transformative systemic change to take place.

9. Conclusion

In this systematic review, it is highlighted that classic psychedelics have the capacity to influence *value orientation, alter personality traits, shift political perspectives, worldviews* and *enhance cognitive flexibility*. These are the interlinking themes found in inner-sustainability concepts and psychedelic research. It must be taken into account though that these findings have their own limitations such as lack of a control group, small sample size or study design. Causal inferences still cannot be made, further prospective and qualitative studies are still necessary to be able to compare and elucidate short-term, long-term assessments. However, Classic psychedelic research shows its effectiveness to individual wellbeing, enhance nature relatedness and facilitate prosocial, pro-environmental behaviors. This suggests how classic psychedelics can potentially be used as a tool to promote social-ecological sustainability via enhancing connections with nature, re-enchanting ones perspective of the world, and reorienting eco-centric values.

Given this orientation, to strive for a more sustainable and just world would require a shift in consciousness and transcending the current materialistic worldview. Classic psychedelics have shown to provide the foundations to support such changes. As it works within the inner dimensions with deep leverage, predominantly influencing the cognitive, emotional, and philosophical points.

Based off of what was presented in this study, classic psychedelics have promising implications within a clinical context as it has shown to strengthen the sense of connectedness, increase wellbeing and life satisfaction. Therefore, it can be suggested that legitimizing the use of classic psychedelic for therapy can aid many with mental suffering and addictions. Aside from this, political measures such as reclassifying these substances to a more suitable classification will help abolish the hindrances and limitations faced with conducting psychedelic research. This can prompt for novel insights and information that can be of benefit to understanding the human psyche and its relationship to the non-human world. This can help narrow the political and knowledge gap mentioned earlier.

Personal development programs, retreat centers or psychotherapy camps can be spaces in which classic psychedelics can be used as an instrument for self-actualization, healing and spiritual purposes. With the aid of a professional guide, licensed and trained to administer the substance can create a space where compassion, empathy, mindfulness and creativity can thrive. To allow for these treatments and spaces to exist in collaboration, can create a community of self-actualizers. These are agents of change and have the ability to influence and inspire people around them through their

behavior and lifestyle choices. It is these ripple effects that can transform society and an entire culture from the inside-out.

10. Reference

- Agin-Liebes, G., Malone, T., Yalch, M., Mennenga, S., Ponté, K., & Guss, J. et al. (2020). Long-term follow-up of psilocybin-assisted psychotherapy for psychiatric and existential distress in patients with life-threatening cancer. *Journal Of Psychopharmacology*, *34*(2), 155-166. doi: 10.1177/0269881119897615
- Aixalà, M., dos Santos, R., Hallak, J., & Bouso, J. (2018). Psychedelics and Personality. *ACS Chemical Neuroscience*, *9*(10), 2304-2306. doi: 10.1021/acschemneuro.8b00237
- Anderson, T., Petranker, R., Rosenbaum, D., Weissman, C., Dinh-Williams, L., & Hui, K. et al. (2019). Microdosing psychedelics: personality, mental health, and creativity differences in microdosers. *Psychopharmacology*, *236*(2), 731-740. doi: 10.1007/s00213-018-5106-2
- Argento, E., Capler, R., Thomas, G., Lucas, P., & Tupper, K. (2019). Exploring ayahuasca-assisted therapy for addiction: A qualitative analysis of preliminary findings among an Indigenous community in Canada. *Drug And Alcohol Review*, *38*(7), 781-789. doi: 10.1111/dar.12985
- Bache, C. (1991). Mysticism and psychedelics: The case of the dark night. *Journal Of Religion & Health*, *30*(3), 215-236. doi: 10.1007/bf00986399
- Bainbridge, A., & Del Negro, G. (2019). An Ecology of Transformative Learning: A Shift From the Ego to the Eco. *Journal Of Transformative Education*, *18*(1), 41-58. doi: 10.1177/1541344619864670
- Ballesteros, V. (2019). APPLIED MYSTICISM: A DRUG-ENABLED VISIONARY EXPERIENCE AGAINST MORAL BLINDNESS. *Zygon*[®], *54*(3), 731-755. doi: 10.1111/zygo.12544
- Barbosa, P., Strassman, R., da Silveira, D., Areco, K., Hoy, R., & Pommy, J. et al. (2020). Psychological and neuropsychological assessment of regular hoasca users. Retrieved 19 September 2020, from
- Barrett, F., & Griffiths, R. (2017). Classic Hallucinogens and Mystical Experiences: Phenomenology and Neural Correlates. *Behavioral Neurobiology Of Psychedelic Drugs*, 393-430. doi: 10.1007/7854_2017_474

- Belouin, S., & Henningfield, J. (2018). Psychedelics: Where we are now, why we got here, what we must do. *Neuropharmacology*, *142*, 7-19. <https://doi.org/10.1016/j.neuropharm.2018.02.018>
- Bogenschutz, M., Podrebarac, S., Duane, J., Amegadzie, S., Malone, T., & Owens, L. et al. (2018). Clinical Interpretations of Patient Experience in a Trial of Psilocybin-Assisted Psychotherapy for Alcohol Use Disorder. *Frontiers In Pharmacology*, *9*. doi: 10.3389/fphar.2018.00100
- Boland, A., Cherry, M., & Dickson, R. (2017). *Doing a systematic review* (2nd ed.). SAGE.
- Bouso, J., dos Santos, R., Alcázar-Córcoles, M., & Hallak, J. (2018). Serotonergic psychedelics and personality: A systematic review of contemporary research. *Neuroscience & Biobehavioral Reviews*, *87*, 118-132. doi: 10.1016/j.neubiorev.2018.02.004
- Bouso, J., Palhano-Fontes, F., Rodríguez-Fornells, A., Ribeiro, S., Sanches, R., & Crippa, J. et al. (2015). Long-term use of psychedelic drugs is associated with differences in brain structure and personality in humans. *European Neuropsychopharmacology*, *25*(4), 483-492. doi: 10.1016/j.euroneuro.2015.01.008
- Calvey, T., & Howells, F. (2018). An introduction to psychedelic neuroscience. *Progress In Brain Research*, 1-23. doi: 10.1016/bs.pbr.2018.09.013
- Carhart-Harris, R., Bolstridge, M., Day, C., Rucker, J., Watts, R., & Erritzoe, D. et al. (2017a). Psilocybin with psychological support for treatment-resistant depression: six-month follow-up. *Psychopharmacology*, *235*(2), 399-408. doi: 10.1007/s00213-017-4771-x
- Carhart-Harris, R., Erritzoe, D., Haijen, E., Kaelen, M., & Watts, R. (2017b). Psychedelics and connectedness. *Psychopharmacology*, *235*(2), 547-550. doi: 10.1007/s00213-017-4701-y
- Carhart-Harris, R., Kaelen, M., Bolstridge, M., Williams, T., Williams, L., & Underwood, R. et al. (2016). The paradoxical psychological effects of lysergic acid diethylamide (LSD). *Psychological Medicine*, *46*(7), 1379-1390. doi: 10.1017/s0033291715002901
- Cheng, V. (2018). Views on Creativity, Environmental Sustainability and Their Integrated Development. *Creative Education*, *09*(05), 719-743. doi: 10.4236/ce.2018.95054

- Császár-Nagy, N., Kapócs, G., & Bókkon, I. (2019). Classic psychedelics: the special role of the visual system. *Reviews In The Neurosciences*, 30(6), 651-669. doi: 10.1515/revneuro-2018-0092
- de Witt, A. (2016). Global Warming Calls for an Inner Climate Change: The Transformative Power of Worldview Reflection for Sustainability. *Spirituality And Sustainability*, 199-214. doi: 10.1007/978-3-319-34235-1_13
- Dickins, R. (2013). Preparing the Gaia connection: An ecological exposition of psychedelic literature 1954-1963. *European Journal of Ecopsychology*, 4 (Ecopsychology and the Psychedelic Experience), 9-18.
- Doblin, R., Christiansen, M., Jerome, L., & Burge, B. (2019). The Past and Future of Psychedelic Science: An Introduction to This Issue. *Journal Of Psychoactive Drugs*, 51(2), 93-97. doi: 10.1080/02791072.2019.1606472
- Dolder, P., Schmid, Y., Müller, F., Borgwardt, S., & Liechti, M. (2020). LSD Acutely Impairs Fear Recognition and Enhances Emotional Empathy and Sociality. Retrieved 21 September 2020, from
- Domínguez-Clavé, E., Soler, J., Elices, M., Pascual, J., Álvarez, E., & de la Fuente Revenga, M. et al. (2016). Ayahuasca: Pharmacology, neuroscience and therapeutic potential. *Brain Research Bulletin*, 126, 89-101. doi: 10.1016/j.brainresbull.2016.03.002
- Edwards, A. (2015). *Heart of sustainability*. New Society Publishers.
- Erritzoe, D., Roseman, L., Nour, M., MacLean, K., Kaelen, M., Nutt, D., & Carhart-Harris, R. (2018). Effects of psilocybin therapy on personality structure. *Acta Psychiatrica Scandinavica*, 138(5), 368-378. doi: 10.1111/acps.12904
- Fischer, J., Gardner, T., Bennett, E., Balvanera, P., Biggs, R., & Carpenter, S. et al. (2015). Advancing sustainability through mainstreaming a social–ecological systems perspective. *Current Opinion In Environmental Sustainability*, 14, 144-149. doi: 10.1016/j.cosust.2015.06.002

- Fischer, J., & Riechers, M. (2019). A leverage points perspective on sustainability. *People And Nature*, 1(1), 115-120. doi: 10.1002/pan3.13
- Folke, C., Jansson, Å., Rockström, J., Olsson, P., Carpenter, S., & Chapin, F. et al. (2011). Reconnecting to the Biosphere. *AMBIO*, 40(7). doi: 10.1007/s13280-011-0184-y
- Forstmann, M., & Sagioglou, C. (2017). Lifetime experience with (classic) psychedelics predicts pro-environmental behavior through an increase in nature relatedness. *Journal Of Psychopharmacology*, 31(8), 975-988. <https://doi.org/10.1177/0269881117714049>
- Forstmann, M., Yudkin, D., Prosser, A., Heller, S., & Crockett, M. (2020). Transformative experience and social connectedness mediate the mood-enhancing effects of psychedelic use in naturalistic settings. *Proceedings Of The National Academy Of Sciences*, 117(5), 2338-2346. doi: 10.1073/pnas.1918477117
- Franquesa, A., Sainz-Cort, A., Gandy, S., Soler, J., Alcázar-Córcoles, M., & Bouso, J. (2018). Psychological variables implied in the therapeutic effect of ayahuasca: A contextual approach. *Psychiatry Research*, 264, 334-339. doi: 10.1016/j.psychres.2018.04.012
- Gandy, S. (2019). Psychedelics and potential benefits in "healthy normals": A review of the literature. *Journal Of Psychedelic Studies*, 3(3), 280-287. doi: 10.1556/2054.2019.029
- Gasser, P., Kirchner, K., & Passie, T. (2014). LSD-assisted psychotherapy for anxiety associated with a life-threatening disease: A qualitative study of acute and sustained subjective effects. *Journal Of Psychopharmacology*, 29(1), 57-68. doi: 10.1177/0269881114555249
- Geiger, H., Wurst, M., & Daniels, R. (2018). DARK Classics in Chemical Neuroscience: Psilocybin. *ACS Chemical Neuroscience*, 9(10), 2438-2447. doi: 10.1021/acschemneuro.8b00186
- Griffiths, R., Hurwitz, E., Davis, A., Johnson, M., & Jesse, R. (2019). Survey of subjective "God encounter experiences": Comparisons among naturally occurring experiences and those occasioned by the classic psychedelics psilocybin, LSD, ayahuasca, or DMT. *PLOS ONE*, 14(4), e0214377. doi: 10.1371/journal.pone.0214377

- Griffiths, R., Johnson, M., Richards, W., Richards, B., McCann, U., & Jesse, R. (2011). Psilocybin occasioned mystical-type experiences: immediate and persisting dose-related effects. *Psychopharmacology*, *218*(4), 649-665. doi: 10.1007/s00213-011-2358-5
- Griffiths, R., Johnson, M., Richards, W., Richards, B., Jesse, R., & MacLean, K. et al. (2017). Psilocybin-occasioned mystical-type experience in combination with meditation and other spiritual practices produces enduring positive changes in psychological functioning and in trait measures of prosocial attitudes and behaviors. *Journal Of Psychopharmacology*, *32*(1), 49-69. doi: 10.1177/0269881117731279
- Griffiths, R., Richards, W., Johnson, M., McCann, U., & Jesse, R. (2008). Mystical-type experiences occasioned by psilocybin mediate the attribution of personal meaning and spiritual significance 14 months later. *Journal Of Psychopharmacology*, *22*(6), 621-632. doi: 10.1177/0269881108094300
- Griffiths, R., Richards, W., McCann, U., & Jesse, R. (2006). Psilocybin can occasion mystical-type experiences having substantial and sustained personal meaning and spiritual significance. *Psychopharmacology*, *187*(3), 268-283. doi: 10.1007/s00213-006-0457-5
- Haijen, E., Kaelen, M., Roseman, L., Timmermann, C., Kettner, H., & Russ, S. et al. (2018). Predicting Responses to Psychedelics: A Prospective Study. *Frontiers In Pharmacology*, *9*. doi: 10.3389/fphar.2018.00897
- Halpern, J., Lerner, A., & Passie, T. (2016). A Review of Hallucinogen Persisting Perception Disorder (HPPD) and an Exploratory Study of Subjects Claiming Symptoms of HPPD. *Behavioral Neurobiology Of Psychedelic Drugs*, 333-360. doi: 10.1007/7854_2016_457
- Hartogsohn, I. (2018). The Meaning-Enhancing Properties of Psychedelics and Their Mediator Role in Psychedelic Therapy, Spirituality, and Creativity. *Frontiers In Neuroscience*, *12*. doi: 10.3389/fnins.2018.00129
- Hofmann, A., Grey, A., & Rättsch, C. (2013). *LSD and the Divine Scientist*. Rochester: Inner Traditions International, Limited.

- Heuschkel, K., & Kuypers, K. (2020). Depression, Mindfulness, and Psilocybin: Possible Complementary Effects of Mindfulness Meditation and Psilocybin in the Treatment of Depression. A Review. *Frontiers In Psychiatry, 11*. doi: 10.3389/fpsy.2020.00224
- Hirsh, J. (2014). Environmental sustainability and national personality. *Journal Of Environmental Psychology, 38*, 233-240. doi: 10.1016/j.jenvp.2014.02.005
- IPCC. (2018). Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.
- Ives, C., Abson, D., von Wehrden, H., Dorninger, C., Klaniacki, K., & Fischer, J. (2018). Reconnecting with nature for sustainability. *Sustainability Science, 13*(5), 1389-1397. doi: 10.1007/s11625-018-0542-9
- Ives, C., Freeth, R., & Fischer, J. (2019). Inside-out sustainability: The neglect of inner worlds. *Ambio, 49*(1), 208-217. doi: 10.1007/s13280-019-01187-w
- Johnson, M., Hendricks, P., Barrett, F., & Griffiths, R. (2019). Classic psychedelics: An integrative review of epidemiology, therapeutics, mystical experience, and brain network function. *Pharmacology & Therapeutics, 197*, 83-102. doi: 10.1016/j.pharmthera.2018.11.010
- Johnson, M., Richards, W., & Griffiths, R. (2008). Human hallucinogen research: guidelines for safety. *Journal Of Psychopharmacology, 22*(6), 603-620. doi: 10.1177/0269881108093587
- Jungaberle, H., Thal, S., Zeuch, A., Rougemont-Bücking, A., von Heyden, M., Aicher, H., & Scheidegger, M. (2018). Positive psychology in the investigation of psychedelics and entactogens: A critical review. *Neuropharmacology, 142*, 179-199. doi: 10.1016/j.neuropharm.2018.06.034

- Kettner, H., Gandy, S., Haijen, E., & Carhart-Harris, R. (2019). From Egoism to Ecoism: Psychedelics Increase Nature Relatedness in a State-Mediated and Context-Dependent Manner. *International Journal Of Environmental Research And Public Health*, 16(24), 5147. doi: 10.3390/ijerph16245147
- Krebs, T., & Johansen, P. (2012). Lysergic acid diethylamide (LSD) for alcoholism: meta-analysis of randomized controlled trials. *Journal Of Psychopharmacology*, 26(7), 994-1002. doi: 10.1177/0269881112439253
- Kuypers, K. (2018). Out of the box: A psychedelic model to study the creative mind. *Medical Hypotheses*, 115, 13-16. doi: 10.1016/j.mehy.2018.03.010
- Kuypers, K., Riba, J., de la Fuente Revenga, M., Barker, S., Theunissen, E., & Ramaekers, J. (2016). Ayahuasca enhances creative divergent thinking while decreasing conventional convergent thinking. *Psychopharmacology*, 233(18), 3395-3403. doi: 10.1007/s00213-016-4377-8
- Lea, T., Amada, N., & Jungaberle, H. (2019). Psychedelic Microdosing: A Subreddit Analysis. *Journal Of Psychoactive Drugs*, 52(2), 101-112. doi: 10.1080/02791072.2019.1683260
- Lea, T., Amada, N., Jungaberle, H., Schecke, H., & Klein, M. (2020). Microdosing psychedelics: Motivations, subjective effects and harm reduction. *International Journal Of Drug Policy*, 75, 102600. doi: 10.1016/j.drugpo.2019.11.008
- Lebedev, A.V., Kaelen, M., Lövdén, M., Nilsson, J., Feilding, A., Nutt, D.J. & Carhart-Harris, R.L. (2016). LSD-induced entropic brain activity predicts subsequent personality change. *Human Brain Mapping*, 37(9), 3203-3213
- Letheby, C. (2015). The Philosophy of Psychedelic Transformation. *Journal Of Consciousness Studies*, 22(9-10), 170-193.
- Letheby, C. (2017). NATURALIZING PSYCHEDELIC SPIRITUALITY. *Zygon*®, 52(3), 623-642. doi: 10.1111/zygo.12353

- Luke, D. (2013). Ecopsychology and the psychedelic experience. *European Journal Of Ecopsychology*, 4, 1-8.
- Lyons, T., & Carhart-Harris, R. (2018). Increased nature relatedness and decreased authoritarian political views after psilocybin for treatment-resistant depression. *Journal Of Psychopharmacology*, 32(7), 811-819. doi: 10.1177/0269881117748902
- Madsen, M., Fisher, P., Stenbæk, D., Kristiansen, S., Burmester, D., & Lehel, S. et al. (2020). A single psilocybin dose is associated with long-term increased mindfulness, preceded by a proportional change in neocortical 5-HT_{2A} receptor binding. *European Neuropsychopharmacology*, 33, 71-80. doi: 10.1016/j.euroneuro.2020.02.001
- MacLean, K., Johnson, M., & Griffiths, R. (2011). Mystical experiences occasioned by the hallucinogen psilocybin lead to increases in the personality domain of openness. *Journal Of Psychopharmacology*, 25(11), 1453-1461. doi: 10.1177/0269881111420188
- Malone, T., Mennenga, S., Guss, J., Podrebarac, S., Owens, L., & Bossis, A. et al. (2018). Individual Experiences in Four Cancer Patients Following Psilocybin-Assisted Psychotherapy. *Frontiers In Pharmacology*, 9. doi: 10.3389/fphar.2018.00256
- Meadows, D. (1999). *Leverage Points: Places to Intervene in a System*. Hartland: The Sustainability Institute.
- Meadows, D., & Wright, D. (2009). *Thinking in systems*. London: Earthscan.
- Metzner, R. (2017). Entheogenesis: Toward an Expanded Worldview for Our Time. *Journal Of Humanistic Psychology*, 57(5), 443-449. doi: 10.1177/0022167817723405
- Millière, R., Carhart-Harris, R., Roseman, L., Trautwein, F., & Berkovich-Ohana, A. (2018). Psychedelics, Meditation, and Self-Consciousness. *Frontiers In Psychology*, 9. doi: 10.3389/fpsyg.2018.01475
- Móró, L., Simon, K., Bárd, I., & Rác, J. (2011). Voice of the Psychonauts: Coping, Life Purpose, and Spirituality in Psychedelic Drug Users. *Journal Of Psychoactive Drugs*, 43(3), 188-198. doi: 10.1080/02791072.2011.605661

- Murphy-Beiner, A., & Soar, K. (2020). Ayahuasca's 'afterglow': improved mindfulness and cognitive flexibility in ayahuasca drinkers. *Psychopharmacology*, *237*(4), 1161-1169. doi: 10.1007/s00213-019-05445-3
- Nicholas, C., Henriquez, K., Gassman, M., Cooper, K., Muller, D., & Hetzel, S. et al. (2018). High dose psilocybin is associated with positive subjective effects in healthy volunteers. *Journal Of Psychopharmacology*, *32*(7), 770-778. doi: 10.1177/0269881118780713
- Nichols, D. (2016). Psychedelics. *Pharmacological Reviews*, *68*(2), 264-355. doi: 10.1124/pr.115.011478
- Nichols, D. (2018). Dark Classics in Chemical Neuroscience: Lysergic Acid Diethylamide (LSD). *ACS Chemical Neuroscience*, *9*(10), 2331-2343. doi: 10.1021/acscchemneuro.8b00043
- Noorani, T., Garcia-Romeu, A., Swift, T., Griffiths, R., & Johnson, M. (2018). Psychedelic therapy for smoking cessation: Qualitative analysis of participant accounts. *Journal Of Psychopharmacology*, *32*(7), 756-769. doi: 10.1177/0269881118780612
- Nour, M., Evans, L., & Carhart-Harris, R. (2017). Psychedelics, Personality and Political Perspectives. *Journal Of Psychoactive Drugs*, *49*(3), 182-191. doi: 10.1080/02791072.2017.1312643
- O'Brien K, Hochachka G (2011) Integral adaptation to climate change. *J Integr Theory Pract* 5:89–102
- O'brien, K. (2009). RESPONDING TO CLIMATE CHANGE The Need for an Integral Approach.
- O'Brien, K. (2018). Is the 1.5°C target possible? Exploring the three spheres of transformation. *Current Opinion In Environmental Sustainability*, *31*, 153-160. doi: 10.1016/j.cosust.2018.04.010
- Palhano-Fontes, F., Andrade, K., Tofoli, L., Santos, A., Crippa, J., & Hallak, J. et al. (2015). The Psychedelic State Induced by Ayahuasca Modulates the Activity and Connectivity of the Default Mode Network. *PLOS ONE*, *10*(2), e0118143. doi: 10.1371/journal.pone.0118143

- Pittaway, D. (2018). "To learn healing knowledge": Philosophy, psychedelic studies and transformation. *South African Journal Of Philosophy*, 37(4), 438-451. doi: 10.1080/02580136.2018.1532186
- Pokorny, T., Preller, K., Kometer, M., Dziobek, I., & Vollenweider, F. (2017). Effect of Psilocybin on Empathy and Moral Decision-Making. *International Journal Of Neuropsychopharmacology*, 20(9), 747-757. doi: 10.1093/ijnp/pyx047
- Polk, M. (2014). Achieving the promise of transdisciplinarity: a critical exploration of the relationship between transdisciplinary research and societal problem solving. *Sustainability Science*, 9(4), 439-451. doi: 10.1007/s11625-014-0247-7
- Pöllänen, E. & Osika, W. (2013). Vi och "de andra" — social hållbarhet kopplat till hur vi känner, tänker och agerar i relation till andra djur. [English translation: We and "the others" — social sustainability connected to how we feel, think and act in relation to other animals). *Socialmedicinsk tidskrift*, 90(2), 209-213.
- Preller, K., & Vollenweider, F. (2016). Phenomenology, Structure, and Dynamic of Psychedelic States. *Behavioral Neurobiology Of Psychedelic Drugs*, 221-256. doi: 10.1007/7854_2016_459
- Reiff, C., Richman, E., Nemeroff, C., Carpenter, L., Widge, A., & Rodriguez, C. et al. (2020). Psychedelics and Psychedelic-Assisted Psychotherapy. *American Journal Of Psychiatry*, 177(5), 391-410. <https://doi.org/10.1176/appi.ajp.2019.19010035>
- Roseman, L., Haijen, E., Idialu-Ikato, K., Kaelen, M., Watts, R., & Carhart-Harris, R. (2019). Emotional breakthrough and psychedelics: Validation of the Emotional Breakthrough Inventory. *Journal Of Psychopharmacology*, 33(9), 1076-1087. doi: 10.1177/0269881119855974
- Rucker, J., Iliff, J., & Nutt, D. (2018). Psychiatry & the psychedelic drugs. Past, present & future. *Neuropharmacology*, 142, 200-218. <https://doi.org/10.1016/j.neuropharm.2017.12.040>
- Sampedro, F., de la Fuente Revenga, M., Valle, M., Roberto, N., Domínguez-Clavé, E., & Elices, M. et al. (2017). Assessing the Psychedelic "After-Glow" in Ayahuasca Users: Post-Acute

Neurometabolic and Functional Connectivity Changes Are Associated with Enhanced Mindfulness Capacities. *International Journal Of Neuropsychopharmacology*, 20(9), 698-711. doi: 10.1093/ijnp/pyx036

Schmid, Y., & Liechti, M. (2017). Long-lasting subjective effects of LSD in normal subjects. *Psychopharmacology*, 235(2), 535-545. doi: 10.1007/s00213-017-4733-3

Schultz, P., & Stone, W. (1994). Authoritarianism and Attitudes Toward the Environment. *Environment And Behavior*, 26(1), 25-37. doi: 10.1177/0013916594261002

Smigielski, L., Kometer, M., Scheidegger, M., Krähenmann, R., Huber, T., & Vollenweider, F. (2019). Characterization and prediction of acute and sustained response to psychedelic psilocybin in a mindfulness group retreat. *Scientific Reports*, 9(1). doi: 10.1038/s41598-019-50612-3

Soler, J., Elices, M., Dominguez-Clavé, E., Pascual, J., Feilding, A., & Navarro-Gil, M. et al. (2018). Four Weekly Ayahuasca Sessions Lead to Increases in “Acceptance” Capacities: A Comparison Study With a Standard 8-Week Mindfulness Training Program. *Frontiers In Pharmacology*, 9. doi: 10.3389/fphar.2018.00224

Soler, J., Elices, M., Franquesa, A., Barker, S., Friedlander, P., & Feilding, A. et al. (2015). Exploring the therapeutic potential of Ayahuasca: acute intake increases mindfulness-related capacities. *Psychopharmacology*, 233(5), 823-829. doi: 10.1007/s00213-015-4162-0

Sweat, N., Bates, L., & Hendricks, P. (2016). The Associations of Naturalistic Classic Psychedelic Use, Mystical Experience, and Creative Problem Solving. *Journal Of Psychoactive Drugs*, 48(5), 344-350. doi: 10.1080/02791072.2016.1234090

Tagliazucchi, E., Roseman, L., Kaelen, M., Orban, C., Muthukumaraswamy, S., & Murphy, K. et al. (2016). Increased Global Functional Connectivity Correlates with LSD-Induced Ego Dissolution. *Current Biology*, 26(8), 1043-1050. doi: 10.1016/j.cub.2016.02.010

Tennison, M. (2012). Moral Transhumanism: The Next Step. *Journal Of Medicine And Philosophy*, 37(4), 405-416. doi: 10.1093/jmp/jhs024

- Uthaug, M., van Oorsouw, K., Kuypers, K., van Boxtel, M., Broers, N., & Mason, N. et al. (2018). Sub-acute and long-term effects of ayahuasca on affect and cognitive thinking style and their association with ego dissolution. *Psychopharmacology*, *235*(10), 2979-2989. doi: 10.1007/s00213-018-4988-3
- van Mulukom, V., Patterson, R., & van Elk, M. (2020). Broadening Your Mind to Include Others: The relationship between serotonergic psychedelic experiences and maladaptive narcissism. *Psychopharmacology*, *237*(9), 2725-2737. doi: 10.1007/s00213-020-05568-y
- Wamsler, C. (2018). Mind the gap: The role of mindfulness in adapting to increasing risk and climate change. *Sustainability Science*, *13*(4), 1121-1135. doi: 10.1007/s11625-017-0524-3
- Watts, R., & Luoma, J. (2020). The use of the psychological flexibility model to support psychedelic assisted therapy. *Journal Of Contextual Behavioral Science*, *15*, 92-102. doi: 10.1016/j.jcbs.2019.12.004
- Watts, R., Day, C., Krzanowski, J., Nutt, D., & Carhart-Harris, R. (2017). Patients' Accounts of Increased "Connectedness" and "Acceptance" After Psilocybin for Treatment-Resistant Depression. *Journal Of Humanistic Psychology*, *57*(5), 520-564. doi: 10.1177/0022167817709585
- Wolfson, P. (2018). Psychedelics, the Spiritual and Consciousness—an Evolving Confluence in the Cultural Stream. *Tikkun*, *33*(1-2), 5-9. doi: 10.1215/08879982-4354390
- Zylstra, M., Knight, A., Esler, K., & Le Grange, L. (2014). Connectedness as a Core Conservation Concern: An Interdisciplinary Review of Theory and a Call for Practice. *Springer Science Reviews*, *2*(1-2), 119-143. doi: 10.1007/s40362-014-0021-3

11. Appendix

Appendix 1: Complete Literature Review

Reference	Substance (s)	Study Design	Sample Size	Outcome	Limitations
Mulukom, Patterson & van Elk, (2020)	Psilocybin, LSD, DMT	Online retrospective survey	N = 414	Classic psychedelics increased feelings of connectedness and affective empathic drive. Decrease in exploitive entitled narcissism was observed.	Cross-sectional study, cannot draw conclusions on the causality regarding the effects of psychedelics on narcissistic personality traits.
Murphy-Beiner & Soar, (2020)	Ayahuasca	Within subjects, self select sample	N = 54	Mindfulness, decentering and cognitive flexibility significantly improved/increased 24h after ayahuasca use.	Drug use data is self reported and not biologically verified. Dose taken is unknown.
Heuschkel & Kuypers, (2020)	Psilocybin	Review	-	Psilocybin can induce transient but powerful neuroplastic boost, cognitive flexibility,	Impossible to compare studies due to the variety of methodologies used.

				improve prosocial behavior. Psilocybin shows promising therapeutic applications for treating depressions.	
Madsen et al. (2020)	Psilocybin	Within subjects, healthy psychedelic naïve participants	N = 10	Induced altered state of consciousness, 8/10 had complete mystical experience. Personality trait openness and mindfulness significantly increased.	Small sample size. No placebo control. Time discrepancy between follow-ups.
Forstmann et al. (2020)	LSD, Psilocybin, DMT	Field studies, within subjects	N = 1200	Psychedelics is significantly associated with positive mood.	Self report on substance use. Generalizability on observed effects. Lack random assignments and causal inferences.
Agin-Liebes et al. (2020)	Psilocybin	Long term within subjects follow up analysis	N = 15	Psilocybin-assisted psychotherapy promotes long term relief from (cancer related) psychiatric distress. Psilocybin enhances	The cross over design of the study does not enable a true control group for comparison. Small number of participants.

				psychological, emotional and spiritual wellbeing.	
Lea et al. (2020)	Psilocybin, LSD	Online international study.	N = 525	Primary motivation to microdosing were for mental improvement reasons, personal development, and cognitive enhancement development, and cognitive.	Most participants are from high income countries. No control group. Impossible to determine causal inferences or longitudinal mental health outcomes.
Kettner et al. (2019)	Psilocybin, LSD, DMT	Correlation and linear mixed regression modelling	N = 654	Lifetime psychedelic use was positively correlated with nature relatedness baseline. Nature relatedness increased 2-4 weeks and 2 years after experience.	Positive sample bias towards psychedelic use may have been present amongst participants. Sample was highly educated and predominantly male. Lack of experimental control.
Lea et al. (2019)	LSD, Psilocybin	Subreddit Analysis	174 discussion threads, 714 total reddit users	Motivation for microdosing included self-management of mental health issues, improvement of	Sample bias, participants may not be representative of microdoser population - may be psychedelic enthusiasts

				psychosocial wellbeing, and cognitive enhancement.	
Smigielski et al. (2019)	Psilocybin	Double blind	N = 39	Psilocybin increased depth of meditation, ego dissolution ,perception hallucination without anxiety.	Mentioning the use of a placebo, and possible recognition of the active and non-active conditions by participants.
Argento et al. (2019)	Ayahuasca	Qualitative Study	N = 11	All participants reported reduction in substance use & cravings. Increased connection with self, others and nature/spirit.	Small sample.
Ballesteros (2019)	LSD, Psilocybin	Exploratory Study	-	The mystical experience induced by psychedelics is responsible for both the benefits in the field of mental health and short term/long term changes.	N/A
Bainbridge & Del Negro (2019)	LSD	Explorative Study	-	Narratives, literature, and evidence from clinical psychedelic drug studies elucidate how an increase in sensitivity towards the	N/A

				natural nonhuman world diminishes ego defenses, enhancing the possibility for transformative learning.	
Császár-Nagy et al. (2019)	Psilocybin, LSD, Ayahuasca	Literature Review	-	CP's create a transient perturbation of the regular neural hierarchy via reducing top-down inhibition and increasing bottom-up information transport that allows the brain to switch to a more ancient and preverbal cognitive unconscious like state. Allows patients to achieve a transient emotional resolution, enhancing introspection and positive mood .	-
Roseman et al. (2019)	Psilocybin, DMT, LSD	Online Survey	N = 379	Emotional breakthrough is a distinct component of the psychedelic experience that appears	Sample population were mostly healthy psychedelic experienced users. Therefore the

				to be a key mediator of subsequent long term psychological changes.	results do not necessarily apply to clinical population.
Johnson et al. (2019)	Psilocybin, LSD	Integrative Review	-	Classic psychedelics has shown promising effects for both cancer-related psychological distress, and alcohol/tobacco addiction.	-
Griffiths et al. (2019)	LSD, Psilocybin, Ayahuasca	Within subjects, cross sectional online survey	N = 4285	Most participants reported vivid memories of encounter experience, which usually involved communication with something having attributes of consciousness, benevolence, intelligence, sacred, eternal and all-knowing.	Self reports, limited by social desirability or other implicit biases.
(Anderson et al. 2019)	LSD, Psilocybin	Within subjects, observational study, online survey on microdosing behaviors	N = 909	Microdosing predicted lower scores of dysfunctional attitudes, higher wisdom scores,	Cross sectional design contained no longitudinal component or experimental

				lower negative emotionality, greater open-mindedness, higher scores on all three creativity facets.	manipulation and cannot be used to infer causal relationships.
Doblin et al. (2019)	LSD, Psilocybin	Exploratory Review	-	Psychedelics have the capacity to catalyze spiritual and mystical experiences.	-
Haijen et al. (2018)	LSD, Psilocybin, Ayahuasca,	Prospective Study	Sample size for five timepoints: N = 654, N = 535, N = 379, N = 315, and N = 212 respectively	Psychological wellbeing increased 2 weeks after psychedelic experience and remained in the same level 4 weeks after.	Lack experimental control. Impossible to know if participants complied with online instructions.
Erritzoe et al. (2018)	Psilocybin	Within Subjects, clinical trial	N = 20 (with moderate to severe, unipolar, treatment resistant depression)	<i>Neuroticism</i> scores significantly decreased. <i>Extraversion</i> and <i>Openness</i> increased. <i>Conscientiousness</i> showed trend level increases, no change observed with <i>agreeableness</i> .	Relatively small sample size. Open label design, no control group.

Jungaberle et al. (2018)	Psilocybin, LSD, Ayahuasca	Critical literature review	N = 77	Psychedelics produce acute and long term effects on mood, well-being, prosocial behaviors, empathy, cognitive, flexibility, creativity, personality factors: <i>openness, value orientations, nature-relatedness, spirituality, self transcendence and mindfulness.</i>	The studies included for the review varied in methodology. Most of the studies are correlational, impossible to make causal inferences.
Geiger et al. (2018)	Psilocybin	Review	-	Psilocybin shows promising results for OCD, alcohol and smoking addiction, and major depressive disorders.	-
Uthaug et al. (2018)	Ayahuasca	Within subjects	N = 57	Ratings of depression significantly decreased after ayahuasca ceremony and changes persisted 4 weeks after.	No placebo/control group present.

Aixalà et al. (2018)	Classic psychedelics	Critical overview	-	<p>Psychedelics are more emotionally impactful in comparison to talking therapy procedures.</p> <p>Dramatic changes in personality can be found after single high dose session.</p>	-
Nichols (2018)	LSD	Exploratory Study	-	<p>LSD proved to be physiologically very safe and nonaddictive. LSD proves to be a powerful tool for psychotherapy especially when combined with modern brain imaging methods.</p>	-
Millière et al. (2018)	Psilocybin, LSD, Ayahuasca	Exploratory Study	-	<p>Converging evidence shows how high doses of psychedelic drugs and certain forms of meditation practice for highly experienced practitioners can produce strong, short term and</p>	<p>Empirical data is sparse to reliably determine the phenomenological and neurophysiological specificity.</p>

				reversible disruptions of self consciousness.	
Nicholas (2018)	Psilocybin	Clinical Study	N = 12	High doses of psilocybin elicited subjective effects just as strong as low doses and resulted in positive persisting subjective effects 30 days after.	Small sample size. Limited statistical power to capture possible differences between doses.
Lyons & Carhart-Harris (2018)	Psilocybin	Open label pilot study with mixed model designs. Within subjects.	N = 14	Nature relatedness significantly increases & authoritarianism significantly decreases 1 week after dosing sessions. 7-12 months post dosing, NR remained significantly increased and authoritarianism remained decreased.	Small sample size. Control group were healthy patients and are not exposed to the same treatment procedures.
Franquesa et al. (2018)	Ayahuasca	Within subjects	N = 122	Ayahuasca users scored higher than non users in decentering and positive self, but not in valued	Evaluation was performed only through self report questionnaires.

				living, life fulfillment, self in social relations, self in close relations and general self.	
Kuypers (2018)	Psilocybin	Exploratory Study	-	Psilocybin can increase creativity and affect state of mind (mood, empathy, openness).	-
Malone et al. (2018)	Psilocybin	Double-blind controlled study, Narrative review	N = 29	Personal narratives extended beyond the cancer diagnosis itself, it frequently revolved around themes of self-compassion and love, acceptance of death, and memories of past trauma.	-
Bouso et al. (2018)	Ayahuasca, LSD, Psilocybin	Systematic Literature Review	N = 18	Psilocybin administered in controlled settings may induce personality changes, increased openness and self transcendence.	Lack of well controlled studies researching the responses of different people with different personality profiles to the psychedelic experience. Need of prospective

					studies to understand causal relations.
Soler et al. (2018)	Ayahuasca	Comparative Study	N = 20	Ayahuasca increases scores in non-judging and non-reacting subscales, which focus on the acceptance domain of mindfulness.	Small sample size and limited statistical power.
Hartogsohn (2018)	Classic Psychedelics	Exploratory Review	-	Psychedelics have meaning enhancing properties. Evidence points to potential significant implications psychedelic meaning enhancement model might have for fortifying society's resistance to mental pathology.	-
Bogenschutz et al. (2018)	Psilocybin	Clinical Trial, randomized controlled trial, double-blind	N = 3	Reported experiences involved themes of self-compassion, love, connection, catharsis, and psychodynamic material and mystical content.	Small sample

Barrett & Griffiths (2017)	Classic Psychedelics	Literature Review	-	With proper set and setting, preparation and dose, mystical experiences can be occasioned at high probability	-
Pittaway (2018)	Classic Psychedelics	Exploratory Study	-	Psychedelics have the potential to play an important role in fostering deeply transformative “philosophical learning” that is the condition for genuine, positive social change considering that in all three disciplines (i.e. science, philosophy, indigenous knowledge).	-
Griffiths et al. (2017)	Psilocybin	Double blind, within subjects	N = 75	Psilocybin can occasion enduring trait level increases in prosocial attitudes/behaviors and in healthy psychological functioning.	Homogeneity of population sample (predominantly white, college educated, and employed).

Preller & Vollenweider (2016)	LSD, Psilocybin	Review	-	Psychedelics alters sensory perception, emotion, cognition and time perception	-
Sampedro et al. (2017)	Ayahuasca	Within subject comparison	N = 16	Results indicate that ayahuasca and potentially other psychedelics induce neural modifications beyond the time frame of the acute inebriation. Mindfulness enhanced.	Small sample, no controls, no placebo or time effects.
Letheby (2017)	LSD, Psilocybin	Exploratory Study	-	Transformative experiences occasioned by classic psychedelics may reveal the nature of a viable practical solution to the (problematic & disenchanting) <i>naturalistic</i> worldview .	-
Metzner (2017)	LSD, Psilocybin	Narrative	-	Findings from psychedelic research suggest that key elements of psychedelic spirituality are consistent	-

				with naturalism. Ego-dissolution, self transcendence and the decoupling of personal concerns can liberate people and enable a broader perspective to the development, wonder, and appreciation for life.	
Watts et al. (2017)	Psilocybin	Open-label trial, within subjects, thematic analysis	N = 20	Psilocybin treatment aided the change from a sense of disconnection to connection (self, others and world), and avoidance (emotion) to acceptance.	Small sample size
Forstmann & Sagioglou (2017)	Classic Psychedelics	Online self report questionnaire	N = 1487	Lifetime use of psychedelics increased self reported engagement in pro-environmental behavior.	Limited to correlation, can't make causal inferences. Measurements are based off of self reports. Identity and dosage of

					substance used cannot be confirmed.
Nour et al. (2017)	Psychedelics	Self report online questionnaire	N = 893	Lifetime psychedelic use positively predicted liberal political views, openness, and nature relatedness. Negatively predicted authoritarian political views.	Cross sectional study, cannot make causal inferences. Homogenous sample population, limited generalizability.
Domíngues-Clavé et al. (2016)	Ayahuasca	Literature Review	-	Ayahuasca intake can increase certain facets of mindfulness related to acceptance and ability to detach from ones own thoughts and emotions. It can be used for treating impulse-related, personality and substance use disorders and handling trauma.	-
Lebedev et al. (2016)	LSD	Balanced order, placebo controlled	N = 19	Increased global effect on brain entropy, sensory, and hierarchically higher	Some participants have had prior experience with psychedelics.

				networks across multiple timescales. Shifts in brain entropy predict enduring increases in trait openness.	
Kuypers et al. (2016)	Ayahuasca	Within Subjects	N = 26	Increase in divergent thinking and decrease in convergent thinking	Design of the study (quasi-experimental) limits the conclusion that may be drawn
Soler et al. ((2015)	Ayahuasca	Within Subjects	N = 25	Ayahuasca enhances creative divergent thinking. Ayahuasca increases psychological flexibility, which may facilitate psychotherapeutic interventions and support clinical trial initiatives.	Small sample size. All participants had prior experience with ayahuasca. No control group. Causal inferences cannot be made.
Sweat et al. (2016)	Classic Psychedelics	Correlational Study	N = 68	Participants reporting classic psychedelic use concurrent with mystical experience exhibited significantly faster times on the functional	No causality, only correlation evidence. Small sample size.

				fixedness task and greater lifetime mystical experience. Classic psychedelics may increase creativity independent of its effects on mystical experience.	
Letheby (2015)	-	Narrative Review	-	Psychedelic transformation appears to be transparent and involves meaning making.	-
Buoso et al. (2015)	Ayahuasca	Within subjects, group comparison	N = 44	Harm avoidance decreased, self transcendence increased.	Cannot infer causal relations
Tennison (2012)	Psilocybin	Exploratory Study	-	Evidence show how psilocybin may represent a viable and practical option for moral enhancement.	Further research in the context of moral psychology is required.
Griffiths et al. (2011)	Psilocybin	Double-blind, quasi-random, placebo controlled	N = 18	Produced acute perceptual and subjective effects including extreme anxiety/fear (39%) and/or	Generalizability is limited to the study population.

				mystical type (72%). One month after, sustained positive changes in attitudes, mood and behavior.	
Maclean et al. (2011)	Psilocybin	Double-blind, comparison	N = 52	In participants who had mystical experiences during their psilocybin sessions, <i>openness</i> remained significantly higher than baseline more than 1 year after the session.	-
Móro et al. (2011)	Psilocybin	Online Review	N = 667	The use of psychedelics with a purpose to enhance self-knowledge is less associated with problems and correlates positively with coping and spirituality.	-
Griffiths et al. (2008)	Psilocybin	Follow-up	N = 36	Volunteers rated psilocybin occasioned experience to be among the five most spiritually	Generalizability is limited to study population.

				significant experiences of their lives. Increased wellbeing and satisfaction .	
Bache (1991)	LSD	Narrative Review	-	Therapeutic use of LSD can dramatically alter inner programming of the individual by forcing confrontations with ones deepest fears, dissolving blocks to healthy functioning, and discharging large quantities of negative energy.	-
Carhart-Harris et al. (2017b)	Classic Psychedelics	Explorative/Narrative Review	-	The theme of <i>connectedness</i> is pervasive in psychedelic research. Increased global functional connectivity in psychedelic brain and its relationship to ego dissolution may be	-

				considered neural correlate of the <i>unitive experience</i> .	
Dolder et al. (2020)	LSD	Double-blind, random, placebo-controlled cross over	N = 16	LSD induced altered states of consciousness. LSD produced feelings of happiness, trust, closeness to others, enhanced explicit and implicit emotional empathy.	Dose effects of LSD were only studied in different participants rather than within-subject. Only assessed emotion recognition and no other measures.
Gandy (2019)	Classic Psychedelics	Literature Review	-	Psychedelics have been found to modulate neuroplasticity, and usage in a supportive setting can result in enduring increases in traits such as well-being, life satisfaction, life meaning, mindfulness, and a variety of measures associated with prosocial behaviors and healthy	-

				psychological functioning.	
Griffiths et al. (2006)	Psilocybin	Double-blind, counterbalanced comparison	N = 36	Psilocybin produced a range of acute perceptual changes, subjective experiences, and labile moods including anxiety. Also increased measures of mystical experience.	The generalizability on the results may or may not be limited to the study population.
Pokorny et al. (2017)	Psilocybin	Double-blind, Randomized, Counter balanced, Cross over	N = 24	Increased positive affect ratings, increased implicit and explicit empathy, no increase in cognitive empathy.	-
Schmid & Liechti (2017)	LSD	Double-blind, randomized, placebo-controlled, cross over	N = 16	Positive attitudes about life/self, positive mood changes, altruistic behavior/positive social effects, positive behavioral changes, and well-being/life satisfaction significantly increase at 1 and 12	No true control condition. Effects may be due to expectations of positive long-term changes. Study was conducted in healthy subjects and results cannot be generalized to patient groups.

				months after LSD experience.	
Pollan (2018)	Classic Psychedelics	Book. Narrative review on psychedelic research	-	Classic psychedelics have the capacity to be used in a therapeutical context, relieving people suffering from depression, addiction and anxiety. It can improve behavior, personality, and wellbeing.	-
Carhart-Harris et al. (2016)	LSD	Within subjects, placebo-controlled	N = 20	LSD produced robust psychological effects; include heightened mood. Increased optimism and trait openness were observed 2 weeks after LSD (and not placebo) and there were no changes in delusional thinking.	Short duration follow-up period. Single-blind design. No active placebo control.