Long-Term Changes in Emotion Regulation and Defense Mechanisms Following Psilocybin Retreat.

A naturalistic 12-Month Follow-Up Study of participants attending a legal, non-clinical psilocybin retreat.

Sebastian Östlind

Stockholms universitet/Psykologiska Institution
Examensarbete, 30 hp
Psykologi
International 2-year Master in Psychology, 120 HP
Höstterminen 2021
Supervisor: Joel Gruneau Brulin

Stockholms universitet

Abstract

Amid the resurgence of psychedelic research, psilocybin has shown promise for psychological change, yet its long-term effects remain underexplored, with studies often lacking sustained follow-ups to assess the degree to which benefits endure. This study investigated whether participation in a legal psilocybin retreat leads to long-term improvements in emotion regulation skills and defense mechanisms among healthy adults, hypothesizing changes associated with experiential factors like mystical experiences (MEQ), emotional breakthroughs (EBI), and psychological insights (PIS-6). As an exploratory effort aimed at paving ground for further research, it seeks to address this gap in longitudinal data.

Employing a naturalistic prospective pre-post design, data were collected from a total of 207 participants with follow-ups at 2 weeks, 3, 6, and 12 months post-retreat. Mixed-effects models analyzed changes in Emotion Regulation Skills Questionnaire (ERSQ) scores and Overall Defensive Functioning (ODF), with exploratory associations for experiential factors.

Results indicated significant ERSQ increases sustained through 12 months (estimates 0.39–0.48, $p < .001$) and modest ODF improvements peaking at 2 weeks (estimate 0.20, $p < .001$) before tapering (estimate 0.10, $p = .005$ after 12 months), driven by mature defense gains and immature defense reductions. MEQ showed consistent associations with ERSQ (Bs 0.11–0.28, $ps < .001$–$.14$) while EBI's role was limited to short term ER improvements, and PIS-6 showed no significant links.

These findings suggest psilocybin retreats may foster enduring adaptive emotional processing, emphasizing mystical experiences' role and informing future research on sustained effects, though causal inferences are limited by the exploratory design.

Keywords: Psilocybin, Psychedelics, Emotion Regulation, Defense Mechanisms

Long-Term Changes in Emotion Regulation and Defense Mechanisms Following Psilocybin Retreat.

1. Introduction

1.1. Opening Statement

The resurgence of interest in psychedelic substances, particularly psilocybin, has highlighted their potential to facilitate profound psychological changes. Alongside clinical trials and medicalization, extra-clinical use is becoming more widespread, yet limited research exists on their effects in non-clinical settings such as retreats. This master's thesis aims to examine the impact of participation in a non-clinical psilocybin retreat on emotion regulation skills and defense mechanism utilization among healthy adults, employing a prospective pre-post self-report design with follow-up assessments at 3, 6, and 12 months post-retreat. By exploring potentially mediating experiential factors like emotional breakthroughs, psychological insights, and mystical experiences, the study seeks to elucidate mechanisms underlying potential long-term changes in adaptive emotional processing, contributing to the understanding of psilocybin's transdiagnostic benefits beyond controlled clinical environments. Considering the limitations of observational self-report methods this study's aims are considered exploratory and hypothesis-generating.

1.2. Psilocybin research

Psilocybin, a classical psychedelic compound found in certain mushrooms, acts primarily as an agonist at serotonin 5-HT2A receptors, producing profound alterations in perception, cognition, and emotion (Nichols, 2016). As a prodrug, it is metabolized into psilocin, which drives its effects, including enhanced neuroplasticity that may support therapeutic changes (Ly et al., 2018). While historically stigmatized, contemporary research

has revived interest in its potential for mental health applications, particularly in controlled and naturalistic settings. This section reviews therapeutic applications, insights from non-clinical studies, and theoretical models informing the study's hypotheses.

1.2.3. Therapeutic Applications in Contemporary Research

Recent research has focused on psilocybin-assisted therapy (PAT), a structured approach combining psilocybin sessions with psychological support, rather than daily dosing. This model emphasizes preparation, guided administration, and integration to leverage the substance's effects within a therapeutic context, highlighting the influence of set and setting on outcomes.

Strong evidence supports PAT for depressive disorders. An open-label study in treatment-resistant depression showed significant reductions in symptoms lasting three months after two sessions (Carhart-Harris et al., 2016). A randomized trial comparing psilocybin to escitalopram found non-inferiority, with faster onset and broader benefits in the psilocybin group (Carhart-Harris et al., 2021). A phase-2b trial (N = 233) demonstrated a dose-response effect, where a single 25-mg dose yielded superior response and remission rates at week 3 compared to a low-dose control (Goodwin et al., 2022).

PAT also addresses existential distress in life-threatening illnesses. Double-blind studies in cancer patients reported rapid, sustained reductions in depression, anxiety, and demoralization (>6 months) following a single session, often linked to experiences of interconnectedness and reframed mortality (Griffiths et al., 2016; Ross et al., 2016).

In addictive disorders, pilot work on tobacco cessation achieved 60% abstinence at 12 months with psilocybin plus cognitive-behavioral therapy (Johnson et al., 2017). PAT reduced heavy-drinking days by approximately 47% over 32 weeks compared to a 22% reduction with placebo (Bogenschutz et al., 2022). Smaller studies extend to obsessive-compulsive disorder,

with acute symptom reductions (Moreno et al., 2006), and anorexia nervosa, showing feasibility and improvements in psychopathology (Peck et al., 2023).

These findings suggest transdiagnostic potential, but outcomes depend on structured support, limiting direct applicability to naturalistic use.

1.2.4. Preliminary Insights from Naturalistic and Non-Clinical Studies

Naturalistic studies examine psilocybin use in real-world contexts like retreats, prioritizing ecological validity but facing challenges such as self-selection and variable conditions. These complement clinical trials by capturing diverse intentions and settings.

Several studies report reduced psychological distress following psilocybin use, in both retreat and non-retreat-based settings. In retreat settings, Calnan et al. (2024) found veterans experienced improved well-being, PTSD symptoms, and sleep post-use. Other retreat studies noted reduced shame (Mathai et al., 2024) and anxiety (Kiraga et al., 2024). Longitudinal surveys reported sustained reductions in depression and anxiety (Agin-Liebes et al., 2020). A large prospective survey (N = 2,833) linked naturalistic use to lower anxiety, depression, and alcohol misuse, alongside increased cognitive flexibility, though 7–11% reported negative effects like mood fluctuations (Nayak et al., 2023).

Comparisons reveal retreat settings may amplify benefits via group dynamics and nature exposure, differing from clinical protocols (Kettner et al., 2021). Individual factors like personality and intentions moderate outcomes (Haijen et al., 2018). While lacking standardization raises safety concerns, these studies include diverse populations, generating hypotheses for optimizing facilitation and integration.

Overall, naturalistic research suggests broad psychological benefits but requires cautious interpretation due to biases, informing harm reduction amid varying legal contexts.

1.2.5. Notes on the importance of RElaxed Beliefs Under pSychedelics (REBUS) and Pivotal Mental States (PiMS)

Relaxed Beliefs Under pSychedelics (REBUS) and Pivotal Mental States (PiMS) are two theoretical models accounting for the rapid domain-abridging changes characteristic of psychedelics. As elaborated in section 1.5. below, the models inform the hypotheses and choice of measures used in this study. The REBUS model explains from a neuroscientific perspective how psychedelics may lead to rapid and sustained cognitive changes and predicts which domains of cognition may be most affected. The PiMS model describes a special case of REBUS where a particularly receptive high intensity state may further catalyze changes.

Both frameworks build on predictive processing, or hierarchical predictive coding, which views the brain as a prediction machine that generates top-down expectations, or "priors," about sensory input and updates them through prediction errors arising from mismatches with reality (Clark, 2013; Friston, 2010; Hohwy, 2013). Such processes shape perception, cognition, and emotion across the brain's hierarchical structure, where lower levels handle sensory data and higher levels manage abstract functions like self-representation and emotional processing (Buckner et al., 2008; Margulies et al., 2016; Mesulam, 1998).

Psilocybin targets serotonin 2A receptors, which are densely concentrated in higher cortical areas, implying a preferential impact on high-level priors such as those related to the self and emotions (Beliveau et al., 2017; Carhart-Harris & Friston, 2019). When these priors become rigid, they can entrench maladaptive patterns, such as unhelpful emotion regulation strategies (e.g., suppression; Gross, 2015) or immature defense mechanisms (e.g., denial; Vaillant, 1992), thereby limiting psychological flexibility (Barrett & Satpute, 2013; Carhart-Harris et al., 2014).

According to the REBUS model, psilocybin relaxes precision of high-level priors, which reduces rigidity of established cognitive patterns (such as conceptions about the self or

others) while amplifying bottom-up signaling (including interoceptive and emotional information) (Carhart-Harris & Friston, 2019). Phenomenologically, this may manifest as a sense of diminished self-boundaries which renders rigid self-representations more pliable and open to revision, accompanied by high emotional intensity and amplification of otherwise suppressed emotional content (Lebedev et al., 2015; Letheby & Gerrans 2017; Millière, 2017; Nour et al., 2016).

This intense disruption to normal cognition can trigger Pivotal Mental States (PiMS)—transient, highly plastic conditions that enable profound psychological shifts through heightened neuroplasticity, enhanced associative learning, and increased perceptual sensitivity (Brouwer & Carhart-Harris, 2021). Although these states may be conducive to transformative growth, the receptivity carries a dual edge: in chaotic or distressing environments, PiMS may heighten vulnerability, exposing individuals to destabilizing or harmful experiences. This duality underscores the need for carefully designed settings, robust harm reduction strategies, and structured integration protocols in both clinical and non-clinical contexts.

Specifically relating to this study, PiMS offer the potential for cathartic emotional breakthroughs and reconfiguration of self-concepts that may enhance adaptive emotion regulation and mature defense mechanisms. But they also risk producing emotionally overwhelming or disruptive experiences that could prove difficult to integrate and reinforce immature defenses. For this reason, a two-tailed hypothesis is appropriate: while PiMS may facilitate transformative shifts in emotional processing and defenses in supportive settings, they may also lead to adverse outcomes for some without adequate guidance or skills.

1.3. Outcome Variables: Emotion Regulation and Defense Mechanisms

The present study uses two main outcome measures: Emotion Regulation Skills Questionnaire (ERSQ) and Self-Rated Defense Mechanism Rating Scale (DMRS-SR-30). The

choice of main outcomes was motivated by the fact that they are both i) trans-diagnostically relevant while also being relevant for mental health of non-clinical populations ii) predicted to be impacted by REBUS-model and empirical findings, and iii) conceptually overlapping yet distinct while drawing from different sub-disciplines of psychology. The theoretical background of the measures and associated constructs are outlined below. The psychometric properties of the measures are outlined in the *Methods* section.

1.3.1. Emotion regulation

1.3.1.1. Modern Definition and Conceptual Models. Emotion regulation (ER) encompasses the processes individuals use to influence the onset, intensity, duration, and expression of emotions in response to environmental demands (Gross, 1998). These processes, which can be conscious or unconscious, help maintain psychological equilibrium while achieving personal or social goals. Contemporary perspectives also highlight interpersonal dimensions, such as modulating emotions in relational contexts (Zaki & Williams, 2013).

Prominent models include Gross's (1998) process model, which distinguishes antecedent-focused strategies (e.g., situation selection or cognitive reappraisal) that occur before full emotional activation from response-focused ones (e.g., suppression) that follow it. Antecedent strategies are generally more adaptive, as they pre-emptively shape emotional trajectories. Extensions of this model emphasize contextual flexibility in strategy choice (Sheppes et al., 2014; Bonanno & Burton, 2013).

Multidimensional frameworks, like those from Gratz and Roemer (2004), identify core ER components such as emotional awareness, acceptance, and impulse control, underscoring transdiagnostic implications. Berking et al.'s (2008) skills-based approach outlines competencies like tolerance and self-support, aligning with phasic models of ER stages (Naragon-Gainey et al., 2017). Mindfulness-oriented models promote non-judgmental

acceptance (Chambers et al., 2009), while interpersonal views stress social influences on ER (Hofmann et al., 2016). Collectively, these models frame ER as adaptive when flexible and context-sensitive, distinguishing it from maladaptive rigidity (Aldao & Nolen-Hoeksema, 2010).

1.3.1.2. Clinical Relevance of Emotion Regulation. Emotion regulation (ER) plays a pivotal transdiagnostic role in psychopathology, influencing the development, maintenance, and treatment of various mental health disorders (Aldao et al., 2010; Sheppes et al., 2015). Deficits in ER, such as overreliance on maladaptive strategies like rumination or suppression, are associated with heightened symptoms across internalizing and externalizing conditions, while adaptive strategies correlate with resilience and symptom reduction (Compas et al., 2017). This relevance underscores ER as a core mechanism in clinical psychology, extending beyond diagnostic boundaries to inform interventions.

In internalizing disorders, ER difficulties exacerbate negative affect and cognitive biases. Meta-analytic evidence shows strong positive associations between maladaptive ER (e.g., rumination, $r = .49$; avoidance, $r = .38$) and symptoms of depression and anxiety, with effects more pronounced in clinical samples (Aldao et al., 2010). For instance, in major depressive disorder, impaired cognitive reappraisal contributes to persistent rumination, prolonging episodes (Joormann & Stanton, 2016). Similarly, in anxiety disorders, suppression of emotional expression heightens physiological arousal and avoidance behaviors, maintaining cycles of fear (Cisler et al., 2010). ER deficits also feature in trauma-related conditions like PTSD, where poor distress tolerance predicts symptom severity and comorbidity (Vujanovic et al., 2011).

Externalizing disorders reveal comparable patterns, though with greater emphasis on impulse control. In substance use disorders, ER impairments mediate the link between negative affect and relapse, as individuals suppress emotions through substance misuse

(Berking et al., 2011). Among youth with externalizing symptoms (e.g., conduct problems), disengagement coping correlates with higher aggression and rule-breaking (Compas et al., 2017).

Therapeutically, targeting ER may yield broad benefits. Interventions like dialectical behavior therapy (DBT) enhance ER skills to reduce emotionally unstable (previously known as borderline) personality disorder symptoms (Linehan et al., 2006), and cognitive-behavioral therapy (CBT) promotes reappraisal to alleviate anxiety and depression (Hofmann et al., 2012). Transdiagnostic approaches, such as the Unified Protocol, address ER deficits across disorders, demonstrating efficacy in reducing symptom severity (Barlow et al., 2017). These findings highlight ER's clinical utility, yet the multifaceted nature of emotion regulation makes assessment complex, as explored next.

1.3.1.3. Assessment Methods and the ERSQ. Assessing emotion regulation (ER) employs varied approaches, including self-report questionnaires, behavioral tasks, and physiological measures, each balancing accessibility with objectivity (Naragon-Gainey et al., 2017; Zeman et al., 2007). Self-reports, like the Emotion Regulation Questionnaire (Gross & John, 2003) or Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004), capture subjective experiences but may overlook implicit processes. Behavioral methods observe ER in tasks, offering direct insights but requiring resources. Physiological tools, such as heart rate variability or neuroimaging, reveal neural correlates without self-report bias (Etkin et al., 2015), though they lack experiential depth.

The Emotion Regulation Skills Questionnaire (ERSQ; Berking & Znoj, 2008; Grant et al., 2018) draws from the Adaptive Coping with Emotions model, which integrates cognitive-behavioral, mindfulness, and acceptance principles to emphasize sequential ER skills like awareness, acceptance, and modification (Berking, 2010; Berking & Whitley, 2014). Unlike deficit-oriented tools, the ERSQ focuses on successful skill application, making it ideal for

monitoring changes in interventional contexts, whether the population is clinical or normally functioning. Detailed psychometrics and item structure are described in the methods section.

1.3.1.4. Psilocybin's Effects on Emotion Processing. Psilocybin modulates emotional processing across acute, subacute, and long-term phases, potentially enhancing emotion regulation (ER) through neural and phenomenological changes (Nichols, 2020; Vollenweider & Preller, 2020). These effects involve reduced negative bias, increased empathy, and neuroplasticity.

Acutely, psilocybin intensifies emotions while diminishing amygdala reactivity to negative stimuli, correlating with lower negative affect (Kraehenmann et al., 2015; Kometer et al., 2012). This may relax rigid top-down controls, allowing repressed emotions to emerge Brouwer & Carhart-Harris, 2021; Carhart-Harris et al., 2014). Experiences often include positive states like unity but can involve anxiety or paranoia, especially without support (Barrett et al., 2016; Carbonaro et al., 2016). Acute enhancements in emotional empathy promote prosocial processing (Pokorny et al., 2017; Preller et al., 2024), though microdosing shows minimal impact (Cavanna et al., 2022).

Subacutely, effects include improved emotional face recognition and flexibility in treatment-resistant depression, reducing anhedonia (Stroud et al., 2018; Roseman et al., 2018). Psilocybin may cause negative emotional bias to normalize, reviving emotional responsiveness (Grimm et al., 2018), with empathy gains persisting weeks post-dose (Preller et al., 2024). Cathartic releases may prompt reevaluation of emotional patterns (Lyons & Carhart-Harris, 2018a, 2018b; Roseman et al., 2018).

Long-term, sustained plasticity via BDNF (Brain Derived Neurotrophic Factor - a protein supporting neuronal growth) supports lasting changes, such as reduced neuroticism and increased openness (Erritzoe et al., 2018; Ly et al., 2018). Reviews confirm positive modifications in emotional processing without cognitive harm (Calder & Hasler, 2023).

Mechanisms may include attenuating suppression via amygdala modulation, enhancing ER flexibility through DMN changes, promoting acceptance in mystical experiences, and rewiring patterns via plasticity (Gross, 1998; Sheppes et al., 2014; Brouwer & Carhart-Harris, 2021). Taken together, studies reveal multiple ways in which psilocybin may influence emotion processing, including evidence of positive impact on emotion regulation and adjacent functions.

1.3.2. Defense mechanisms

Defense mechanisms originate in psychoanalytic theory, where Sigmund Freud described them as unconscious ego strategies to mitigate anxiety from intrapsychic conflicts between impulses, moral standards, and reality (Freud, 1894/1962). Mechanisms like repression push unacceptable thoughts into the unconscious, modulating overwhelming emotions to preserve conscious functioning while highlighting their adaptive yet potentially pathological nature (Freud, 1926/1959). This links defenses to emotion regulation, as they automatically adjust affective intensity for psychic balance, anticipating modern views of proactive emotional monitoring (Gross, 1998).

Anna Freud expanded this in 1936, cataloging defenses such as denial and projection, emphasizing the ego's role against internal and external threats and their developmental formation through caregiver interactions (Freud, 1936/1966). She introduced a maturity continuum, from immature to mature, underscoring their dual potential and overlap with emotion regulation strategies like avoidance or reappraisal (Gratz & Roemer, 2004).

Contemporary models integrate these roots with cognitive and neurobiological insights, viewing defenses as implicit processes that filter emotional input to reduce distress, complementing explicit regulation (Cramer, 2015). Recent work bridges defenses with

implicit and explicit emotion regulation, emphasizing their transdiagnostic role in psychopathology (Rice & Hoffman, 2014; Di Giuseppe et al., 2022).

Defenses overlap with but also differ from emotion regulation: While both defenses and emotion regulation may have conscious and unconscious components, defenses are primarily conceived of as unconscious and may distort reality to ease internal anxiety, while emotion regulation often have an explicit and goal-oriented dimension (Cramer, 1998). Mature defenses align with adaptive emotion regulation for positive outcomes, immature ones with dysregulation (Vaillant, 1992; Kramer, 2010). The overlapping but complementary role of defenses in understanding emotional stability reinforces their relevance for both basic and applied emotion research.

1.3.2.1. Assessment and Operationalization of Defense Mechanisms. Defense mechanisms are assessed via observer-rated scales, self-report questionnaires, and clinical interviews, each capturing their unconscious aspects with varying objectivity and practicality. Observer methods, like the Defense Mechanisms Rating Scale (DMRS; Perry, 1990), code defenses from transcripts, providing depth but demanding training. Self-reports, such as the Defense Style Questionnaire (Andrews et al., 1993) offer efficiency but risk bias from limited self-insight (Cramer, 2015). Interviews and observer methods yield qualitative nuance but require expertise (Vaillant, 1992).

The DMRS, based on Vaillant's hierarchy (1971), categorizes 30 defenses into seven levels mapping to mature, neurotic, and immature groups, influencing DSM-IV's Defensive Functioning Scale (American Psychiatric Association, 1994; Skodol & Perry, 1993). It yields scores like Overall Defensive Functioning for empirical use, with validity tied to psychopathology and outcomes (Perry & Bond, 2012). The DMRS-SR-30, used in this study, is a self-report adaptation of the DMRS. Studies on the DMRS-SR-30 report good to excellent internal consistency, as well as strong criterion and concurrent validity for overall defensive

functioning (ODF) and defense levels when compared to observer-rated versions (including the DMRS and DMRS-Q). ODF scores show good convergent validity with symptom measures of psychological distress, depression, and post-traumatic symptoms, with negative correlations indicating that better defensive functioning relates to fewer symptoms and better mental health (e.g., correlations with SCL-90, BDI were around r = -0.45 to -0.54) (Di Giuseppe et al., 2020). Detailed psychometrics and structure of the DMRS-SR-30 are outlined in the methods section (2.9.1).

1.3.2.2. Defense Mechanisms and Psychological Wellbeing. Defense mechanism maturity directly shapes psychological wellbeing, with mature defenses linked to adaptive outcomes and immature ones to distress. Mature mechanisms enable constructive emotional processing, reducing psychopathology and boosting resilience (Vaillant, 1976; Perry & Bond, 2012). They promote flexible regulation, integrating distress without avoidance, similar to reappraisal (Rice & Hoffman, 2014).

Immature defenses, conversely, perpetuate dysregulation through distortion or evasion, predicting poorer treatment responses in mood disorders and sustaining anxiety or interpersonal issues (Babl et al., 2019; Bond & Perry, 2004). Transdiagnostically, they mediate adversity's impact on conditions like PTSD and personality disorders, reinforcing avoidance (Ma et al., 2024). This ties defenses to ER frameworks: Mature defenses support effective affective modulation, whereas immature ones foster rumination or suppression, sustaining pathology (Gross, 1998; Cramer, 1998).

1.3.2.3. Potential Impact of Psilocybin on Defense Mechanisms. The influence of psilocybin on defense mechanisms is largely speculative due to limited direct research, but analogies from ego dissolution suggest psilocybin may yield shifts in people’s use of defensive mechanisms (Buchborn et al., 2023). Early psychedelic research, notably psycholytic therapy in the mid-20th century, used low to moderate doses of LSD to reduce

ego defenses, facilitating access to unconscious material and emotional catharsis (Grof, 1975). Although these studies reported shifts toward mature defenses, they often lacked rigorous controls and standardized measures, limiting their applicability by modern standards (Passie, Guss, & Krähenmann, 2022). Still, they provide context for hypothesizing psilocybin's effects on defenses, particularly through ego dissolution, which may alter defensive patterns (Nour et al., 2016). Acutely, psilocybin-induced ego dissolution—marked by blurred self-other boundaries—may relax rigid defenses, enabling access to repressed content and reducing reliance on immature mechanisms (Nour et al., 2016; Buchborn et al., 2023). However, effects may vary: defenses could also intensify due to anxiety or cognitive dissonance from altered reality perceptions (Carbonaro et al., 2016). Mindset is likely to play a moderating role: a "letting go" approach may foster acceptance, while resistance can heighten paranoia (Wolff et al., 2020). Some researchers (e.g. Fischman, 2023; Buchborn et al., 2023) note that the psychedelic state mirrors therapeutic regression, where the ego loosening reworks defenses with support, but risks fragmentation without it.

Long-term, indirect evidence suggests psilocybin facilitates shifts toward mature defenses. Increased openness and reduced avoidance post-psilocybin imply a move to flexible patterns (Erritzoe et al., 2018). In treatment-resistant depression, non-dreadful ego dissolution predicted symptom relief at 5 weeks, explaining 54% of outcome variance, potentially recalibrating defenses by accessing repressed material (Roseman et al., 2018), aligning with benefits in emotion regulation and wellbeing and warranting further study (Kramer, 2010).

1.4. Experiential Factors: Emotional breakthroughs, Mystical Experiences, and Psychological Insights

The study uses three measures pertaining to the phenomenological aspects of psychedelic experiences: Mystical Experience Questionnaire (MEQ), Emotional

Breakthrough Index (EBI) and Psychological Insight Scale (PIS). These the relevance of these factors stem from i) that they may predict changes in the outcome measures, ii) their conceptual affiliation with pivotal mental states and iii) that they may provide process-level mechanistic insight for explaining potential changes in emotional processing and defensive functioning.

1.4.1. Emotional Breakthroughs and the EBI

Emotional breakthroughs in psychedelic experiences involve the confrontation and resolution of emotionally difficult material, often manifesting as a cathartic release followed by relief and a sense of closure on personal conflicts or traumas (Roseman et al., 2019). This process aligns with psychodynamic notions of catharsis, where suppressed emotions are engaged and integrated, potentially reducing reliance on maladaptive defenses and enhancing emotion regulation by fostering greater acceptance and flexibility (Freud & Breuer, 1895/1955).

The Emotional Breakthrough Inventory (EBI; Roseman et al., 2019) is a brief self-report measure developed to quantify this phenomenon in psychedelic contexts. It consists of six items rated on a visual analogue scale, capturing elements like facing pushed-aside feelings, exploring challenging emotions, and achieving emotional release with relief. Validated in a sample of participants from psychedelic retreats and clinical trials, the EBI shows a unidimensional structure and discriminates from related constructs like mystical or challenging experiences. Emotional breakthrough scores increase with dose, therapeutic intent, and supportive settings, and predict therapeutic efficacy, such as sustained improvements in well-being and lower depressive symptoms (Roseman et al., 2019).

1.4.2. Psychological Insights and the PIS

Psychological insights post-psychedelics involve novel realizations about one's thoughts, behaviors, emotions, relationships, or life patterns, emerging subacutely and promoting long-term growth (Peill et al., 2022). These cognitive discoveries may bolster self-awareness, enabling flexible emotion regulation and shifts toward mature defense mechanisms by integrating previously unrecognized self-aspects.

Distinct from acute emotional breakthroughs (Roseman et al., 2019), which emphasize immediate catharsis, the Psychological Insight Scale (PIS; Peill et al., 2022) focuses on reflective insights consolidating days or weeks later, including behavioral changes. Related but separate from tools assessing in-session realizations, the PIS evaluates their evolution and practical impact.

The PIS is a seven-item self-report scale rated on a visual analogue scale, with six core items on insights and one on implementation. It demonstrates a single-factor structure and predicts well-being gains, mediating links between acute experiences and long-term outcomes in psychedelic therapy trials (Peill et al., 2022). Psychometric details are outlined in the methods section.

1.4.3. Mystical Experiences and the MEQ30

Mystical experiences entail profound alterations of consciousness marked by unity, transcendence, sacredness, ineffability, and noetic insight, often yielding transformative meaning (James, 1902; Stace, 1960). Operationalized through criteria like ineffability and intuitive truth, these states are refined into dimensions such as timelessness and paradoxicality.

Various questionnaires capture these, including Hood's Mysticism Scale for life-time occurrence of mystical experiences (Hood, 1975) and the Altered States of Consciousness

Questionnaire's Oceanic Boundlessness subscale for broader altered states (Dittrich, 1998; Studerus et al., 2010).

The Mystical Experience Questionnaire (MEQ30; Barrett et al., 2015), revised from Pahnke (1963), was chosen here for its prominence in psychedelic research. It includes 30 items across four subscales: mystical (unity, sacredness), positive mood, transcendence of time/space, and ineffability. Validated in psilocybin studies, it shows strong internal consistency and convergence with similar measures. MEQ scores consistently predict lasting benefits, such as reduced depression, anxiety in cancer patients, and addiction cessation (Roseman et al., 2018; Ross et al., 2016; Garcia-Romeu et al., 2015). Detailed psychometrics appear in the methods section.

1.5. The Present Study: Conceptual Framework, Missing Pieces and Aims/Hypotheses

Drawing from the reviewed literature on psilocybin's effects, theoretical models, and psychological constructs, this study conceptualizes emotion regulation (ER) strategies and defense mechanisms (DMs) as high-level priors within a predictive processing framework. These priors supposedly govern how individuals perceive, process, and respond to emotional stimuli while protecting the self from distress. When rigid, these priors can entrench maladaptive patterns, such as habitual suppression in ER or immature defenses like denial, limiting psychological flexibility and perpetuating emotional dysregulation (Carhart-Harris & Friston, 2019; Vaillant, 1992). Psilocybin is posited to disrupt these entrenched patterns in line with the REBUS model. This relaxation allows for the influx of novel information, facilitating updates to self-models and emotional schemas that may foster more adaptive ER habits, such as increased acceptance and reappraisal, and a shift toward mature DMs that promote integration rather than avoidance (Brouwer & Carhart-Harris, 2021; Gross, 1998).

Complementing REBUS, the concept of Pivotal Mental States (PiMS) frames psilocybin-induced experiences as high-intensity hyper-plastic states. PiMS are characterized by disrupted self-related processing, increased receptivity to emotional content, and enhanced learning, which align with the study's experiential variables: emotional breakthroughs, psychological insights, and mystical experiences. These potential mediators capture phenomenological elements such as cathartic releases of suppressed emotions, novel realizations about personal patterns, and transcendent states of unity and ineffability, which may serve as catalysts for revising rigid priors (Peill et al., 2022; Roseman et al., 2019; Barrett et al., 2015). For instance, an emotional breakthrough might enable the confrontation of avoided feelings, loosening immature defenses and enhancing ER flexibility, while mystical experiences could promote a sense of interconnectedness that reframes self-protective mechanisms. Collectively, these frameworks suggest that psilocybin's impact in a retreat setting could yield long-term adaptations in ER and DMs by leveraging PiMS to drive belief updating, though outcomes may vary based on individual mindset, setting, and integration practices, highlighting both therapeutic potential and risks of destabilization without adequate support (Buchborn et al., 2023; Wolff et al., 2020).

Despite the growing body of evidence on psilocybin's therapeutic applications, significant gaps persist in understanding its effects in non-clinical contexts, particularly regarding ER and DMs. Much of the existing research centers on clinical psilocybin-assisted therapy (PAT) for specific disorders, such as depression or anxiety, with controlled protocols that emphasize structured support and short to medium-term outcomes (e.g., Carhart-Harris et al., 2021; Goodwin et al., 2022). In contrast, there is limited longitudinal data on how non-clinical retreats influence general ER skills and DM maturation among healthy adults, where self-selection, variable dosing, and group dynamics introduce ecological validity but also methodological challenges (Kettner et al., 2021; Nayak et al., 2023). Key missing pieces

include sparse examinations of mediators (like emotional breakthrough, psychological insights, and mystical experiences) in naturalistic settings, which could elucidate mechanisms beyond clinical trials; brief follow-up periods that overlook trajectories extending to 12 months, potentially missing sustained or delayed effects; and a relative neglect of psychodynamic constructs, such as DMs, in favor of cognitive or neurobiological models, despite the relevance of psychodynamic constructs to implicit emotional processing (Buchborn et al., 2023; Perry & Bond, 2012). This study addresses these gaps by employing a prospective pre-post design to assess changes in ER and DMs in a retreat cohort, with assessments at baseline, immediately post-retreat, and at 3-, 6-, and 12-month follow-ups, while testing for associations with emotional breakthrough, psychological insights, and mystical experiences.

A rationale for investigating these changes in a naturalistic retreat setting stems from the increasing prevalence of extra-clinical psilocybin use amid evolving legalization trends, which necessitates research with ecological validity to inform harm reduction, integration strategies, and public health guidelines (Marks, 2023). By focusing on healthy adults in a retreat setting, the study extends insights from clinical populations to broader contexts, exploring transdiagnostic benefits in adaptive emotional processing and psychological defenses outside the confounds of severe psychopathology. The overarching aim is to determine whether participation in a non-clinical psilocybin retreat leads to improvements in ER skills and DM maturation, and to identify the extent to which acute experiential mediators predict these outcomes. To guide this investigation, the following hypotheses are proposed:

- Hypothesis 1: Emotion regulation skills will increase post-retreat, with increases potentially sustained at 3-, 6-, and 12-month follow-ups.

- Hypothesis 2: Defense mechanism utilization will demonstrate hierarchical maturation post-retreat, characterized by decreased reliance on immature defenses and increased use of adaptive (mature) defenses with potential long-term persistence.
- Hypothesis 3: The experiential factors and proposed mediators— emotional breakthrough, psychological insights, and mystical experiences —will be associated with changes in ER and DM outcomes, such that higher scores on experiential factors will predict greater adaptations in ER skills and DM maturation.

2. Method

2.1 Study Design

The study followed a longitudinal repeated measures design, with data collected at 7 timepoints (of which 6 were included in this paper): baseline, immediately before retreat, immediately post-retreat, two weeks after the retreat and three subsequent follow-ups (after 3 months, 6 months, 12 months). While the same participant cohort was targeted throughout, the response format did not necessitate response at a previous time point in order to respond at a later time point.

2.2 Participants

Participants were recruited from individuals attending psilocybin retreats organized by a private company independent from the researchers. The retreats were led by Swedish licensed psychologists and took place in the Netherlands, where psilocybin-containing truffles are legal. The cost of attending the retreat was c.a. 2000-4000 euro, depending on the price set by the organization. All retreat attendees were invited to participate in the study, with participation being entirely voluntary and independent from their retreat participation.

Although the researchers responsible for this study did not conduct screening (all participants attending the retreat were eligible to participate), the retreat organizers conducted their own screening process to determine eligibility for attending the retreat (and consequently this study). The organizers' screening was as follows: participants had to be at least 18 years old, have no psychiatric or medical history that could pose risks in this context (e.g., bipolar disorder, family history of psychotic disorders, previous cardiac events, hemorrhagic stroke, uncontrolled hypertension), and not be taking psychiatric medications that could potentially cause unpredictable interaction effects or otherwise pose a risk when combined with psilocybin. Prior to the retreat, participants completed a health declaration regarding their physical and mental health and underwent a screening process with a medically trained professional to assess both mental and physical health.

2.3 Procedure

Two weeks before the retreat, during the first session, participants were provided with a link where they could register for the study. The link contained a description of the study's purpose and design, and participants could register their email address if they wished to participate. Participation in the study was separate from participation in the retreat program. Automatic emails were sent to participants at the following times: T1: Two weeks before retreat, T2: immediately before the retreat (questions not used in this study), T3: 24 hours after retreat, T4: 2 weeks after retreat, T5: 3 months after retreat, T6: 6 months after retreat, T7: 12 months after retreat.

Participants could unsubscribe from these mailings at any time by clicking on a link in the emails sent to them. At each measurement point, participants were informed that their participation would be voluntary, that they could withdraw at any time, that the collected data was pseudonymized, and they were given the opportunity to provide feedback about the

questionnaire. Contact information for a psychologist was also provided at each questionnaire session, whom participants can contact if they experience any discomfort while completing the questionnaires.

2.4 Data Collection, Data Management and Pseudonymization

If participants chose to join the study, their email address was registered in the psychedelicsurvey.com portal. This is an automated platform that sends emails to participants at specific predetermined times. The emails contained links to the current questionnaire to be completed at the various measurement points in the study. The questionnaires were administered via the Qualtrics.com platform and used pseudonymization techniques to protect participant identity.

Each participant received a unique link in their email that makes it possible to connect the responses in the different questionnaires with each other. This represents a pseudonymization process where the unique link serves as a participant identifier that researchers can access, while the email addresses (direct identifiers) were stored separately in the psychedelicsurvey.com platform and not accessible to the researchers. This approach ensured that researchers could not directly identify individual participants but could still track longitudinal data across measurement points.

2.5. Ethical Considerations

This naturalistic survey study ensures ethical compliance through voluntary participation, informed consent via detailed information sheets, and pseudonymity by separating email registration from data collection without personal identifiers. Risks to participants are minimal, as involvement is limited to online questionnaires, with no intervention in the retreat. The research does not fall under Sweden's ethics review law and

received an advisory opinion from Etikprövningsmyndigheten (Sweden's Ethics Review Authority) confirming no formal ethics review was necessary (Dnr 2022-03652-01).

2.6. Transparency of AI Use

I have used AI for generating and correcting R code (Grok and Cursor) and for proofreading including spellcheck, advice on layout and using academic terminology (Grok).

2.7 Retreat Protocol

While not determined or controlled by the researchers, it is relevant to understand the retreat format. The retreat program had the following structure, sequentially: a preparation phase in Stockholm consisting of an individual meeting with a psychologist; an online group meeting; a full-day in person group workshop; a four-day retreat in the Netherlands where participants have the opportunity to intake psychedelic truffles on two occasions; and an integration phase in Stockholm consisting of a full-day group workshop and a subsequent online group meeting.

During the retreat, participants had the opportunity to take psychedelic truffles on two occasions at a dose individually agreed upon together with the responsible psychologists. Typically, the strength was equivalent to 25-35 mg, which is comparable to doses commonly used in clinical studies. For some participants, the second dose was significantly higher in order to balance out the rapid desensitization characteristic of serotonergic psychedelics. Group activities were also arranged during the retreat, and participants had the opportunity for individual conversations with the psychologists. The retreats accommodated up to 15 participants and were led by three individuals with training in psychedelic therapy, of whom at least one was a licensed psychologist. The retreat program was focused on increasing self-awareness and personal development. It did not provide clinical treatment or therapy for mental illness.

2.8 Questionnaire Administration Schedule

- T1 – (two weeks before retreat): Background questions: Age, Gender; ERSQ, and DMRS-SR-30.
- T2 – (immediately before the retreat): Questions not used in this study.
- T3 – (24 hours after retreat): "How many grams of truffles did you take at the first/second session?"; Experience measures: PIS-6, MEQ, EBI.
- T4, T5, T6, and T7 – (two weeks, three months, six months, and twelve months after retreat, respectively): ERSQ, and DMRS-SR-30.

2.9 Measures

2.9.1 Primary Outcome Measures

2.9.1.2. Emotion Regulation Skills Questionnaire (ERSQ). Emotion regulation skills were assessed using the Emotion Regulation Skills Questionnaire (ERSQ; Berking & Znoj, 2008), a 27-item self-report scale measuring nine facets of adaptive emotion regulation (e.g., awareness, clarity, acceptance) on a 5-point Likert scale (0 = "not at all" to 4 = "almost always"). Total scores range from 0 to 108, with higher scores indicating better skills. Example items include "I paid attention to my feelings" (awareness subscale), "My physical sensations were a good indication of how I was feeling" (sensations subscale), "I accepted my emotions" (acceptance subscale), and "I did what I had planned, even if it made me feel uncomfortable or anxious" (readiness to confront subscale). The scale demonstrates strong internal consistency (Cronbach's $\alpha = .90$ for total score; subscale $\alpha = .68–.86$) and test-retest reliability ($r = .74$ over 2 weeks), with validity supported by correlations with depression measures ($r = –.52$) and emotion regulation difficulties ($r = –.65$).

2.9.1.2. Defense Mechanisms Rating Scale–Self-Report 30 (DMRS-SR-30). Defense mechanisms were measured with the Defense Mechanisms Rating Scale–Self-Report 30

(DMRS-SR-30; Prout et al., 2022), a 30-item self-report adaptation of the observer-rated DMRS, assessing 30 defenses organized into seven hierarchical levels (e.g., mature: sublimation; immature: denial) on a 5-point Likert scale (1 = "not like me" to 5 = "very much like me"). It yields an Overall Defensive Functioning (ODF) score (1–7; higher = more mature) and proportional scores for levels/categories. The ODF is calculated as a weighted average: ODF = (sum of [Level Score times Maturity Weight]) / (sum of Level Score)), where Level Score is the proportional score for each of seven defense levels, and Maturity Weight is the predefined value for each level (1 for least mature, e.g., action level, to 7 for most mature, e.g., high-adaptive level). Example items include "Did you try, consciously or unconsciously, to provoke someone in an indirect or irritating way?" (passive aggression, immature) and "Did you try to reduce inner tension by engaging in creative activities?" (sublimation, mature). Internal consistency is good (Cronbach's α = .82 for total score; subscale α = .70–.85), with test-retest reliability (r = .78 over 1 month) and convergent validity via correlations with the Defense Style Questionnaire (r = .62–.75).

2.9.2. Experiential Measures

2.9.2.1. Emotional Breakthrough Inventory (EBI). The Emotional Breakthrough Inventory (EBI; Roseman et al., 2019) is a 6-item visual analogue scale (0 = "No, not more than usually" to 100 = "Yes, entirely or completely") measuring cathartic emotional releases. Total scores range from 0 to 600. An example item is "I faced emotionally difficult feelings that I usually push aside." It shows high internal consistency (Cronbach's α = .93) and test-retest reliability (r = .85 over 1 week), with predictive validity for well-being changes (β = .29).

2.9.2.2. Psychological Insight Scale (PIS). The Psychological Insight Scale (PIS; Peill et al., 2022) is a 7-item visual analogue scale (0 = "No, not more than usually" to 100 = "Yes,

entirely or completely") evaluating post-acute insights (PIS-6) and behavioral changes (item 7). Total PIS-6 scores range from 0 to 600. An example item is "I have had new insights into patterns in my behaviour, thoughts, or emotions." Internal consistency is excellent (Cronbach's α = .94) with test-retest reliability (r = .82 over 1 week), and it mediates acute effects on well-being (indirect B = 0.10).

2.9.2.3. Mystical Experience Questionnaire 30 (MEQ30). The Mystical Experience Questionnaire 30 (MEQ30; Barrett et al., 2015) is a 30-item scale rated on a 6-point Likert scale (0 = "none; not at all" to 5 = "extreme") with four subscales (mystical, positive mood, transcendence, ineffability). Total scores range from 0 to 150 (higher = stronger experience). An example item is "Feeling of unity or oneness with all that exists" (mystical subscale). It has high internal consistency (Cronbach's α = .93) and test-retest reliability (r = .84 over 2 weeks), with validity via correlations to long-term outcomes (r = .45–.60).

2.10. Data Analysis

Data were analyzed using R version 4.4.1 (or latest available) with packages lme4 for linear mixed-effects models, lmerTest for statistical tests, broom.mixed for tidying model outputs, dplyr for data manipulation, flextable for table formatting, knitr for display, and ggplot2 for visualization. Timepoint was treated as a categorical factor (T1 baseline, T3 immediately after retreat, T4 2 weeks post-retreat, T5 3 months post-retreat, T6 6 months post-retreat, T7 12 months post-retreat), and gender as a binary factor (male, female). Models were fit using restricted maximum likelihood (REML) estimation, with Satterthwaite's method for degrees of freedom in t-tests. Significance was set at p less than 0.05 .

2.10.1. Statistical Models. Linear mixed-effects models (LMMs) were fitted using lmerTest in R, with timepoint (categorical: T1, T4, T5, T6, T7), age, and gender as fixed

effects and a random intercept for participant ID. Fixed effects estimates, 95% confidence intervals, standard errors, t-values, and p-values were reported.

2.10.2. Primary Outcomes. For the Emotion Regulation Skills Questionnaire (ERSQ) total score and Overall Defensive Functioning (ODF), linear mixed models (LMM) were used to assess changes over time, with fixed effects tables summarizing estimates, CIs, SEs, t-values, and p-values.

2.10.3. Subscales. ERSQ subscales (Understanding, Awareness, Clarity, Sensations, Acceptance, Tolerance, Self-Support, Confrontation, Modification) and Defense Mechanisms Rating Scales (DMRS-SR-30) categories (C1: Mature, C2: Neurotic, C3: Immature) were analyzed using the same LMM structure, reporting fixed effects estimates, CIs, SEs, t-values, and p-values, reported in Appendix.

2.10.4. Descriptive Statistics. Means, standard deviations, minima, maxima, and sample sizes were calculated for ERSQ total, ODF, and DMRS categories at each timepoint.

2.10.5. Attrition. Attrition was assessed by comparing baseline ERSQ, ODF, age, and gender across participants with varying numbers of completed timepoints using boxplots.

2.10.6. Exploratory Association Analyses. Associations of T3 experiential factors (MEQ, EBI, PIS-6) with post-T3 changes in ERSQ and ODF were explored using linear models for each post-T3 timepoint, adjusting for baseline outcome values, age, and gender. Scores were scaled so they could be represented in the same axis (0 = minimum possible score, 1 = maximum possible score). Estimates and standard errors for experiential factors were extracted and reported in a table.

2.10.7. Missing Data. Missing data was handled via listwise deletion within models, as mixed models used all available observations.

3. Results

3.1. Participant Characteristics and Attrition

Data was collected from 207 unique participants across six timepoints: baseline (T1), immediately after the retreat (T3), 2 weeks (T4), 3 months (T5), 6 months (T6), and 12 months (T7) post-retreat. Ages ranged from 27 to 81, mean age was 50.35 (SD =11.26). 90 participants were male (43%) and 117 were female (57%). Effective sample sizes for analysis varied due to missing data. For ERSQ total, participants with complete data were 191 at T1, 160 at T4, 110 at T5, 80 at T6, and 58 at T7. For ODF, complete data were available for 186 at T1, 150 at T4, 109 at T5, 80 at T6, and 58 at T7.

Baseline ERSQ total averaged 3.57 (SD = 0.74), ODF 5.13 (SD = 0.46). Attrition analysis showed no systematic differences in baseline ERSQ, ODF, age, or gender across participants with varying numbers of completed timepoints, suggesting minimal attrition bias.

3.2. Emotion Regulation Skills (ERSQ)

Emotion regulation skills (ERSQ) were analyzed using a mixed-effects model to examine changes over time and the influence of age and gender. The results, presented in Table 1, indicate a significant overall increase in ERSQ scores from baseline (T1) across all subsequent timepoints (T4–T7), with each comparison to T1 showing significant increase ($p < .001$). The largest increase was observed at T7, where the estimate of 0.48 indicates a notable enhancement compared to T1, reflecting a sustained development in skills by the end of the study. Age and gender were non-significant ($p = .26$), ($p = .34$).

Table 1.Fixed Effects Estimates for Table.1 Emotion Regulation Skills (ERSQ)

Variable	Estimate	SE	95% CI	t	p
Intercept	3.27	0.21	[2.86, 3.69]	15.42	< .001*
T4 vs T1	0.44	0.05	[0.35, 0.53]	9.48	< .001*
T5 vs T1	0.44	0.05	[0.33, 0.54]	8.24	< .001*
T6 vs T1	0.39	0.06	[0.27, 0.51]	6.42	< .001*
T7 vs T1	0.48	0.07	[0.35, 0.62]	6.97	< .001*
Age	0.01	0.00	[-0.00, 0.01]	1.13	.26
Gender	0.09	00.9	[-0.09, 0.27]	0.97	.34

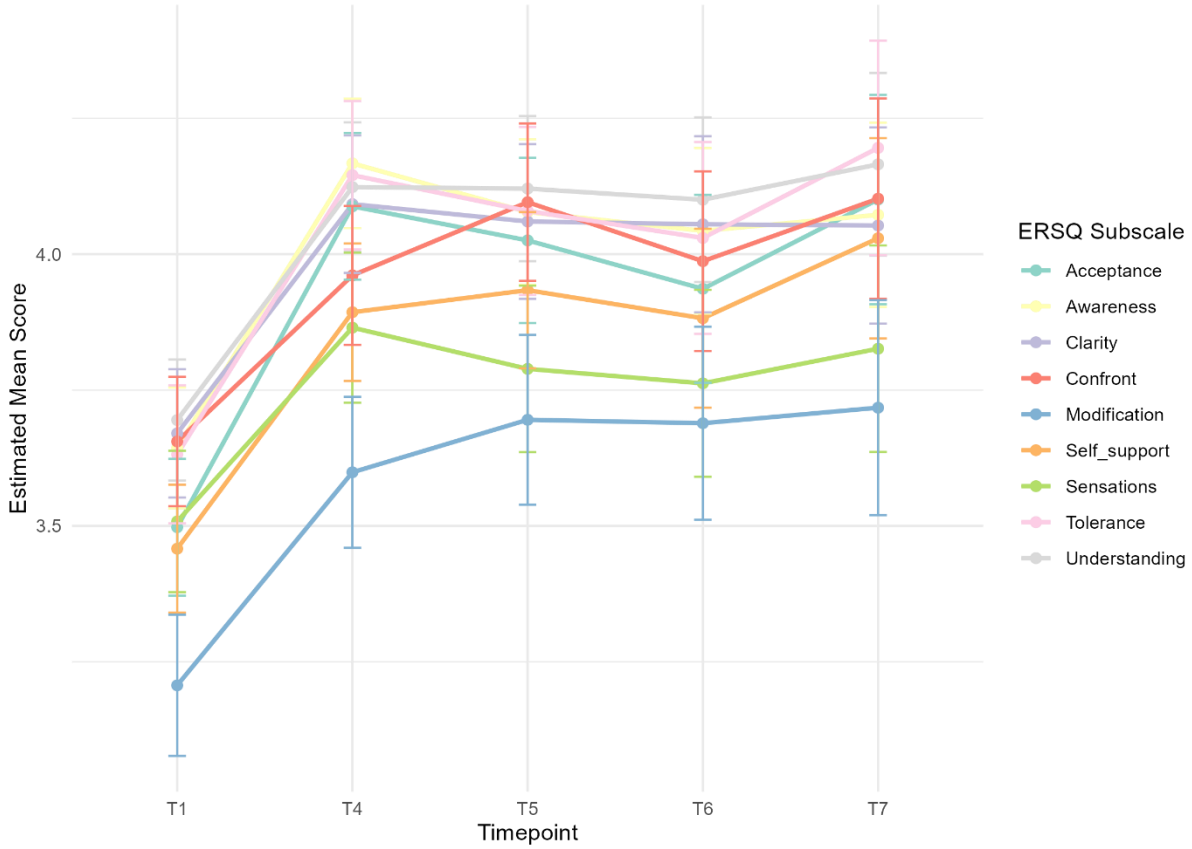
Note. ODF = Emotion Regulation Skills Questionnaire; SE = Standard Error; CI = Confidence Interval; Timepoints: T1 = baseline, T4 = 2 weeks, T5 = 3 months, T6 = 6 months and T7 = 12 months post-retreat.. p < .001 indicates statistical significance at the .001 level.

3.2.1. ERSQ Subscales

Mixed-effects models examined changes in the nine ERSQ subscales (Understanding, Awareness, Clarity, Sensations, Acceptance, Tolerance, Self-Support, Confrontation, Modification) over time, controlling for age and gender. All subscales demonstrated significant increases from baseline (T1) across post-retreat timepoints (T4–T7; ps < .002), with no notable effects of age or gender (ps > .08). This pattern reflects comprehensive enhancements across diverse facets of emotion regulation skills. Given the volume of estimates, detailed fixed effects are presented in Appendix (Table A1).

Figure 1 illustrates the mean trajectories of the nine ERSQ subscales from baseline (T1) to 12 months post-retreat (T7), with each line representing a subscale. Scores show a pronounced rise from T1 to T4 (2 weeks post-retreat), followed by stabilization or minor fluctuations through T7, underscoring sustained broad improvements in emotion regulation.

Figure 1. Mean Trajectories of ERSQ Subscales Over Time



Note. ERSQ = Emotion Regulation Skills Questionnaire. Subscales color-coded as: blue (Understanding), orange (Awareness), green (Clarity), red (Sensations), purple (Acceptance), yellow (Tolerance), cyan (Self-Support), pink (Confrontation), gray (Modification). Error bars denote standard errors. Timepoints: baseline (T1), 2 weeks (T4), 3 months (T5), 6 months (T6), and 12 months (T7) post-retreat. Lines connect connecting categories are visual aid only and do not represent continuous change (analysis treats time as categorical).

3.3. Defense Mechanisms (ODF)

Overall Defensive Functioning (ODF) scores were analyzed using a mixed-effects model, with results in Table 2. Compared to baseline (T1), significant increases were observed at all time points: T4 (0.20, SE = 0.02, $p < .001$), T5 (0.15, SE = 0.03, $p < .001$), T6 (0.11, SE = 0.03, $p < .001$), and T7 (0.10, SE = 0.03, $p = .005$). Age showed no significant effect (0.00, SE = 0.00, $p = .252$), nor did gender (-0.05, SE = 0.06, $p = .442$).

Table 2. Fixed Effects Estimates for Observational Defensive Function (ODF)

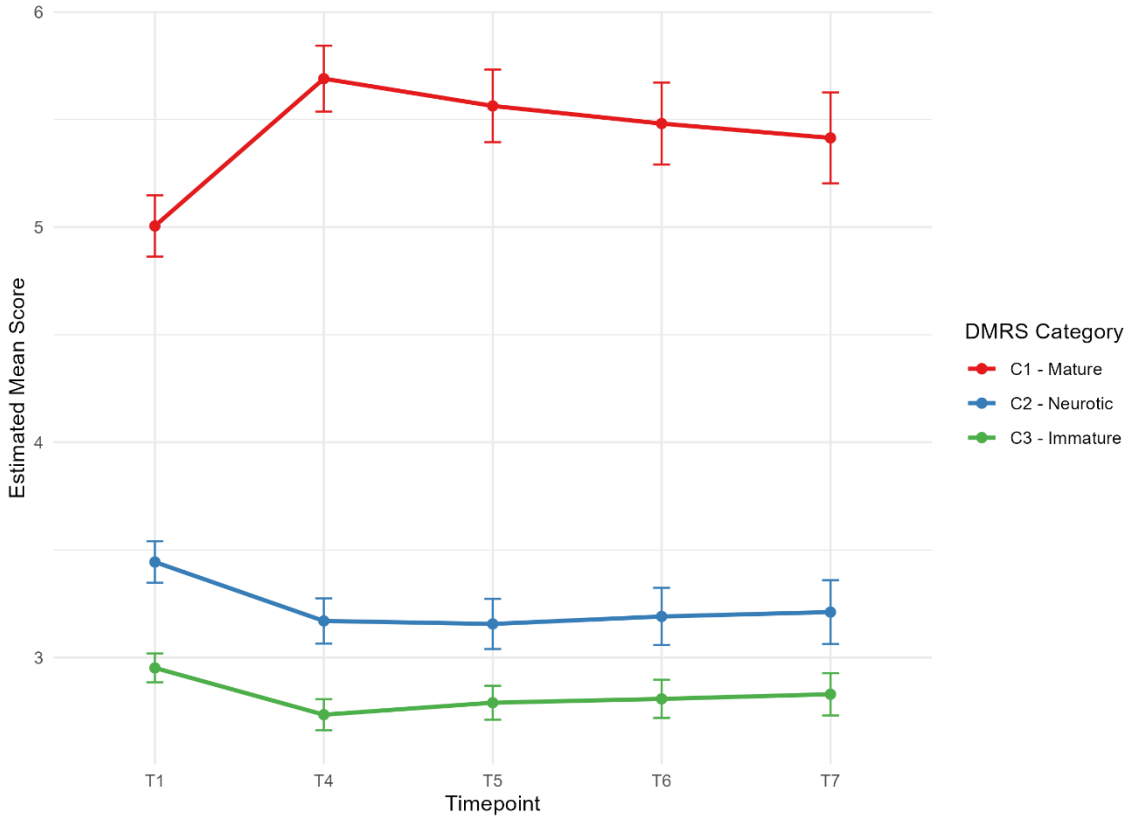
Variable	Estimate	SE	95% CI	t	p
Intercept	4.98	0.15	[4.69, 5.28]	32.98	< .001*
T4 vs T1	0.20	0.02	[0.15, 0.25]	8.45	< .001*
T5 vs T1	0.15	0.03	[0.10, 0.20]	5.72	< .001*
T6 vs T1	0.11	0.03	[0.05, 0.17]	3.72	< .001*
T7 vs T1	0.10	0.03	[0.03, 0.16]	2.84	0.005*
Age	0.00	0.00	[0.00, 0.01]	1.15	0.252
Gender	-0.05	0.06	[-0.18, 0.08]	-0.77	0.442

Note. ODF = Observational Defensive Function; SE = Standard Error; CI = Confidence Interval; Timepoints: T1 = baseline, T4 = 2 weeks, T5 = 3 months, T6 = 6 months and T7 = 12 months post-retreat. p < .001 indicates statistical significance at the .001 level.

3.3.1. DMRS Defense Categories

Mixed-effects models evaluated changes in the three DMRS categories (C1: Mature, C2: Neurotic, C3: Immature) over time, adjusting for age and gender. Results revealed significant increases in C1 from baseline (T1) across T4–T7 (ps < .001), reflecting enhanced mature defensive mechanisms, and significant decreases in C2 (neurotic) and C3 (immature) defences from T1 at all timepoints (ps ≤ .002 for C2, ps < .010 for C3). Age and gender had no significant impact (ps > .089). Given the detailed estimates, full results are provided in Appendix (Table A2).

Figure 2. Mean Trajectories of DMRS Categories Over Time



Note. DMRS = Defense Mechanism Rating Scales; C1 = Mature, C2 = Neurotic, C3 = Immature. Error bars denote standard errors. Timepoints: baseline (T1), 2 weeks (T4), 3 months (T5), 6 months (T6), and 12 months (T7) post-retreat. Lines connecting categories are visual aid only and do not represent continuous change (analysis treats time as categorical).

3.4. Experiential Factors (EBI, PIS-6, MEQ) and Associations with ERSQ and ODF.

An exploratory analysis examined the associations of experiential factors—MEQ, EBI, and PIS-6 (measured at T3)—with changes in main measures (ERSQ and ODF) from baseline (T1) to follow-ups (T4-7).

For ERSQ changes, MEQ showed significant positive associations at all timepoints but T6, with coefficients increasing over time: T4 showed a moderate association of 0.19 (95% CI [0.11, 0.28], SE = 0.04, $p < .001$), T5 increased to 0.21 (95% CI [0.09, 0.34], SE = 0.05, $p < .001$), T6 was 0.11 (95% CI [-0.04, 0.26], SE = 0.05, $p = .141$), and T7 at 0.28 (95% CI [0.12, 0.44], SE = 0.05, $p < .001$). EBI showed moderate and significant associations at T4 0.12

(95% CI [0.01, 0.24], SE = 0.05, p < .001), and T5 , 0.15 (95% CI [0.00, 0.30], SE = 0.05, p < .001), but not at T6 and T7. PIS-6 showed no significant association with ERSQ.

Table 3. Associations of Experiential Factors with ERSQ

Timepoint	Predictor	B	95% CI	SE	p
T4	MEQ	0.19	[0.11, 0.28]	0.04	< .001*
T4	EBI	0.12	[0.01, 0.24]	0.06	0.032*
T4	PIS-6	-0.01	[-0.12, 0.10]	0.06	0.811
T5	MEQ	0.21	[0.09, 0.34]	0.06	< .001*
T5	EBI	0.15	[0.00, 0.30]	0.08	0.045*
T5	PIS-6	-0.09	[-0.24, 0.06]	0.08	0.243
T6	MEQ	0.11	[-0.04, 0.26]	0.08	0.141
T6	EBI	0.13	[-0.07, 0.32]	0.10	0.195
T6	PIS-6	-0.10	[-0.31, 0.12]	0.11	0.366
T7	MEQ	0.28	[0.12, 0.44]	0.08	< .001*
T7	EBI	0.04	[-0.20, 0.29]	0.12	0.733
T7	PIS-6	-0.09	[-0.34, 0.17]	0.13	0.500

*Note. B = unstandardized regression coefficient; 95% CI = 95% confidence interval; SE = standard error. *p < .05.*

For ODF, MEQ showed a significant association at T7: 0.12 (95% CI [0.03, 0.21], SE = 0.04, p = 0.010) and PIS-6 at T4: 0.09 (95% CI [0.01, 0.16], SE = 0.04, p = 0.029. All other timepoints were non-significant.

Table 6. Associations of Experiential Factors with ODF

Timepoint	Predictor	B	95% CI	SE	p
T4	MEQ	0.04	[-0.01, 0.10]	0.03	0.127
T4	EBI	-0.05	[-0.13, 0.03]	0.04	0.207
T4	PIS-6	0.09	[0.01, 0.16]	0.04	0.029*
T5	MEQ	0.05	[-0.02, 0.12]	0.03	0.192
T5	EBI	0.02	[-0.07, 0.10]	0.04	0.697
T5	PIS-6	-0.01	[-0.10, 0.08]	0.04	0.813
T6	MEQ	-0.04	[-0.12, 0.04]	0.04	0.330
T6	EBI	0.01	[-0.10, 0.11]	0.05	0.913
T6	PIS-6	0.00	[-0.12, 0.11]	0.06	0.982
T7	MEQ	0.12	[0.03, 0.21]	0.04	0.010*
T7	EBI	-0.09	[-0.23, 0.05]	0.07	0.199
T7	PIS-6	0.03	[-0.11, 0.17]	0.07	0.681

*Note. B = unstandardized regression coefficient; 95% CI = 95% confidence interval; SE = standard error. *p < .05.*

3.5. Model Diagnostics

Residual plots and histograms for ERSQ and ODF models confirmed that assumptions of normality and homoscedasticity were met. Residuals for ERSQ ranged from -1.18 to 1.38 (M = 0.00), and for ODF from -0.84 to 0.61 (M = 0.00), supporting model reliability.

4. Discussion

This study investigated the impact of a non-clinical psilocybin retreat on emotion regulation skills (ERSQ) and defense mechanism utilization (ODF) among healthy adults,

using a longitudinal design with assessments at baseline (T1) and follow-ups to 12 months post-retreat (T7). Results revealed large, significant improvements in emotion regulation, with ERSQ scores rising from a baseline mean of 3.28 to an estimated 3.72 at two weeks post-retreat (T4, estimate = 0.44), sustaining at approximately 3.76 by 12 months (T7, estimate = 0.48). Comprehensive improvements across all ERSQ subscales suggest that psilocybin's effects facilitate a broad enhancement of emotional processing capabilities, rather than targeting specific aspects (such as acceptance, tolerance, and readiness to confront difficult emotions—skills that align with psychoeducation typically provided in psychedelic retreats).

Overall defensive functioning improved, as evidenced by moderate changes in ODF scores, which increased from 4.98 at T1 to 5.18 at T4 (estimate = 0.20), though gains tapered to 5.08 by T7 (estimate = 0.10). The increase in ODF was driven both by an increase in the use of mature defenses (C1) and decreases in neurotic (C2) and immature (C3) defenses. These shifts reflect a temporary move toward mature defenses (like sublimation or humor) over immature ones (like splitting or denial), rather than a mere overall reduction of use of defenses.

Mystical experiences (MEQ) showed significant associations with ERSQ (B = 0.19 at T4; B = 0.21 at T5 and, B = 0.28 at T7) but was non-significant at T6 and showed only one, negligible association with ODF (B = 0.12, 95% CI [0.03, 0.21], SE = 0.04, p = 0.010). Emotional breakthroughs (EBI) showed short-term associations with ERSQ (B = 0.12 at T4; B = 0.15 at T5) but none later or with ODF. Psychological insights (PIS-6) showed a negligible association with ODF at T4 (B = 0.09, SE = 0.04, p = .029) but none elsewhere or with ERSQ. These findings, which partially support hypotheses of enhanced emotion regulation and defense maturation predicted by experiential factors—particularly MEQ, with a limited role for EBI and none for PIS-6—are explored below in relation to theoretical frameworks, prior research, limitations, and implications for future work.

4.1. Interpretation of Findings

The observed changes in ERSQ and ODF scores following the psilocybin retreat invite cautious interpretation while acknowledging the study's non-experimental design limits causal inferences. For ERSQ, the increases from baseline to post-retreat timepoints, sustained through 12 months, suggest a strong link between retreat participation and reported enhancements in emotion regulation skills. Similarly, the elevations in ODF indicate a shift toward more mature defense mechanisms, though these gains appear to partially attenuate over time. These patterns are consistent with the notion that psilocybin experiences lead to improvements in emotional processing, but they do not demonstrate causation; alternative explanations, (as discussed in 4.3) cannot be excluded.

The divergent trajectories between ERSQ and ODF improvements merit examination. Inspection of the estimates revealed trends suggesting that ERSQ gains remained stable or slightly increased through T7, while ODF scores peaked at T4 before declining, though formal between-timepoint comparisons were not conducted. If these diverging trends are representative, they may potentially reflect i) distinct mechanisms of psychological change or ii) differences in capacities to sustain the change (i.e. integration). The first case is mirrored by the differing associations of experiential variables discussed next. The second case may reflect the different natures of the two types of psychological functioning, where the more explicit nature of emotion regulation may make it more amenable to deliberate integration practices while the implicit nature of defenses is more elusive and harder to improve unless supported by a therapist.

As for the experiential variables and emotion regulation, mystical experiences significantly predicted emotion regulation changes with moderate association strengths at all timepoints except for at 6 months (although non-significant, the association trended positive), with the strongest association at 12 months post retreat. Emotional breakthroughs predicted

emotion regulation changes at two weeks and 3 months post retreat but not at 6 and 12 months, while psychological insights did not significantly predict any changes. This may indicate that mystical experiences are more likely to lead to sustained changes in emotion regulation, while emotional breakthroughs are only impactful in short to medium term. For defenses, psychological insight did significantly predict changes at two-weeks post-retreat, and mystical experiences at 12 months post-retreat, but at no other timepoint. Although it is plausible that psychological insight may have short-term impact on defenses, and mystical experiences long term impact, we abstain from interpreting these associations as meaningfully representative given the multiple measurements that showed insignificant association for the same variables at different timepoints. If so, it appears that emotion regulation and defense mechanisms may be differentially impacted by mystical experiences and emotional breakthroughs, which itself provides reason for further investigation into the mechanisms of psilocybin induced psychological change.

4.2. Alignment With Existing Literature

These findings extend prior research on psilocybin's therapeutic potential, particularly in non-clinical contexts. The increases in emotion regulation skills echo clinical studies where psilocybin-assisted therapy (PAT) reduced depressive symptoms through enhanced emotional processing, such as in Carhart-Harris et al.'s (2016). Similarly, Griffiths et al. (2006) linked mystical experiences to enduring positive mood and behavior changes, paralleling the associations with emotion regulation seen here.

The limited role of emotional breakthroughs and lacking impact of psychological insight was unexpected given the hypotheses that emotional catharsis and insights could mediate changes (Roseman et al., 2019; Peill et al., 2022; Fischman, 2022). It contrasts with

studies like Roseman et al. (2019), where emotional breakthroughs increased wellbeing, and Peill et al. (2022), emphasizing insights in therapeutic outcomes.

This may reflect the non-clinical sample's baseline health, where emotional breakthroughs may be relatively more impactful for clinical populations combatting psychopathology or trauma, while mystical experiences are typically transformative for clinical and non-clinical populations alike (Alldredge et al., 2025). The non-significant role of psychological insight may be indicative of false insights (see FIBUS: False Insights and Beliefs Under pSychedelics, McGovern et al., 2024). Alongside the potential to catalyze actual insight, psychedelics may also increase susceptibility to false insights through processes like reduced constraints on belief updating, enhanced subjective certainty, and misattribution of meaning or truth to spurious thoughts or perceptions. This could possibly explain both the lacking association of psychological insight with any outcomes, and lacking association of breakthroughs with defenses and long-term emotion regulation outcomes.

Overall, the results support psilocybin's transdiagnostic potential but may highlight variability in non-clinical vs. clinical settings, and addresses gaps in longitudinal, naturalistic data.

Regarding theoretical models (REBUS and PiMS), although the study was not designed to test or confirm these models, the results align with REBUS and partially with PiMS. REBUS posits that psychedelics attenuate the precision of high-level priors in predictive coding hierarchies, potentially allowing for revisions to entrenched patterns like maladaptive emotion regulation strategies or immature defenses. If applicable here, the retreat experience could have been associated with a temporary relaxation of such priors, facilitating learning that manifest as higher ERSQ and ODF scores. In particular, increases in ERSQ subscales Awareness, Clarity and Sensation conceptually align with the upregulation of bottom-up information outlined by REBUS. The associations between mystical experiences and emotion

regulation improvements lend preliminary support to the PiMS model. A mystical experience is a canonical pivotal mental state, and the PiMS-model predicts that the presence of such states catalyzes (and therefore predict) profound and enduring changes in domains such as emotion and self-related processing (Brouwer & Carhart-Harris, 2021). The association between mystical experiences and outcomes over time, particularly at 12 months, suggests these pivotal states may contribute to a cascading reorganization process that continues to unfold post-experience, rather than producing only immediate effects. However, the lacking associations between long-term outcomes and emotional breakthrough partially weaken this line of reasoning.

4.3. Limitations

Several limitations must be considered when interpreting these results, particularly given the exploratory nature of the study.

First, the high attrition rate, with 149 missing responses for ERSQ and ODF at T7, may have influenced long-term estimates, potentially overestimating sustained effects among completers who were more motivated and/or experienced positive outcomes: positive outcomes or high functioning may increase response rate, while negative outcomes or factors like life stressors may contribute to dropout. Although attrition checks showed no systematic bias in baseline variables, confounding factors occurring post-retreat could not be controlled for.

Second, reliance on self-report measures introduces risks of response biases, including social desirability bias (responding in what is perceived as favorable for the researchers or norms), investment bias (responding more favorably due to personal investment in the experience) and biases stemming from having a positive attitude towards psychedelics. However, some of these biases may be mitigated by the long follow-up period, and the fact

that the outcome measures survey the participants' behavior in the preceding 1 week period, and do not reference psychedelics or the retreat per se.

Third, the study design lacked a control group, precluding causal attributions. Observed changes could stem from non-specific factors such as group support, psycho-education, expectation effects, or natural maturation rather than psilocybin-related effects per se. Concordantly, we abstain from using causal language for the experiential variables, even though there are theoretically conceptualized as mediators. However, the study's longitudinal design introduces a temporal dimension absent in cross-sectional designs, revealing associations that are not merely correlational, but also predictive.

Forth, the absence of randomization further limits inferences, as participants self-selected into the retreat and the study, potentially confounding results with pre-existing traits like openness to psychedelics or already being on a path of self-improvement.

Lastly, it is worth noting a complex problem specific to not only to studies of this design, but to studies on psychedelics in general. While standard medical paradigms typically attempt to isolate the pharmacological component (e.g. psilocybin) or intervention (e.g. PAT) from external factors (e.g. set, setting and matrix, Eisner, 1997), the hypothesized mechanisms of psychedelics complicate the picture: models such as REBUS and PiMS posit psychedelics as agents of plasticity that radically increase the influence of set and setting. For this reason, factors that may typically be considered confounders may instead be considered constitutive of the setting, and therefore the intervention. For example, the retreat's preparatory phase may have emphasized emotion regulation concepts such as acceptance, tolerance, and awareness, which are commonly referenced in preparation for psychedelic experiences. This may have primed participants to develop these competencies (or, being more familiar with related concepts, respond as if they have). On the other hand, the more subtle, implicit nature of defense mechanisms may lack this accessibility and therefore may

either be comparatively more susceptible to regression to the habitual norm or less susceptible to specific response biases. In either case, the unclear distinction between confounding and constitutive environmental factors may complicate interpretation of results and should be thoroughly considered in future research.

4.4. Directions for Future Research

The present findings, while limited by design constraints, point toward several promising directions for future work. Given the transdiagnostic importance of emotion regulation (ER) and defense mechanisms (DM), their improvement following psilocybin use represents a line of inquiry worthy of sustained and systematic exploration. Below, several avenues are outlined.

4.4.1. Further Research on Psilocybin's Impact on Emotion Regulation and Defensive Functioning.

Despite the established importance of emotion regulation and defense mechanisms in psychological functioning, their systematic investigation within psychedelic research remains underdeveloped. This study suggests these constructs may contribute understanding psilocybin's therapeutic mechanisms, particularly given ER's and DM's transdiagnostic relevance across depression, anxiety, trauma, and substance use disorders (Cludius et al., 2020; Babl et al. 2019). Future studies could pursue this line of research with more rigorous study design (e.g. comparative study with non-psilocybin retreats) and multiple types of measures (e.g. clinician-assessed structured interviews, neuroimaging or physiological markers such as heart-rate variability, or performance-based tasks). Future studies could also identify which ER components demonstrate greatest sensitivity to psilocybin— e.g. whether acceptance-based skills show more robust changes than modification strategies, or whether antecedent vs. response-based regulation strategies are more favored.

The examination of psychedelics impact on defense mechanisms may offer a bridge between contemporary neuroscience and psychodynamic theory. Psilocybin's documented effects on self-related processing—including default mode network disruption (Gattuso et al., 2023), ego dissolution experiences (Nour et al., 2016), and alterations in self-referential thinking align conceptually with psychodynamic notions of defensive reorganization. Integrating psychodynamic terminology and assessment methods could provide richer characterization of how psilocybin influences self-protective mechanisms (). For instance, investigating whether specific types of ego dissolution (anxious versus blissful) differentially impact movement along the defense hierarchy could illuminate mechanisms linking neural and psychological levels of analysis. Such interdisciplinary approaches may contribute to understanding how alterations in self-boundaries translate into lasting changes in defensive organization and emotional processing.

4.4.2. The Role of Integration in Sustaining Change.

The partial tapering of defensive maturity over time raises critical questions about consolidation mechanisms. Integration practices—whether group-based, psychodynamic, cognitive-behavioral, or mindfulness-oriented—require systematic experimental comparison to determine their differential effects on maintaining defensive gains. This research priority is particularly urgent given psychedelic science's nascent stage and the current absence of evidence-based integration protocols.

Longitudinal designs should track whether specific integration modalities differentially support mature defensive functioning or ER skill maintenance. Supposedly, psychodynamic approaches emphasizing might better sustain defensive reorganization, while mindfulness-based integration could preferentially maintain emotion regulation improvements. Additionally, examining whether booster sessions—either psychedelic or integration-

focused—prevent defensive regression could inform clinical implementation. The field's rapid expansion necessitates rigorous testing of integration assumptions before practices become entrenched without empirical support.

4.4.3. Set and Setting as Moderators.

Retreat contexts involve multiple factors beyond the substance itself—facilitator expertise, group dynamics, rituals, and natural environments—that may substantially influence whether psychedelic states yield adaptive change or destabilization. Future research should systematically isolate and examine these contextual variables as predictors of outcomes.

While controlled laboratory settings offer standardization advantages, exclusive reliance on clinical protocols risks overlooking therapeutic elements unique to naturalistic settings. Extra-clinical contexts, including retreats and indigenous ceremonial practices, may employ mechanisms absent from laboratory paradigms—communal support structures, extended preparation periods, nature immersion, or ritual frameworks that scaffold meaning-making. Comparative effectiveness research should directly contrast laboratory versus retreat outcomes while measuring proposed active ingredients.

Systematic investigation should identify which contextual factors enhance versus compromise safety and efficacy. Variables warranting examination include facilitator training backgrounds, group size and composition, preparation duration, integration structure, and environmental settings. Understanding these moderators would inform evidence-based guidelines for both clinical implementation and harm reduction in retreat contexts where regulatory oversight remains limited.

4.5. Conclusion

This study provides preliminary evidence that participation in a non-clinical psilocybin retreat is associated with long-term improvements in emotion regulation skills and modest shifts in defensive functioning. The association between mystical experiences and outcomes is consistent with aspects of the PiMS framework, suggesting that such experiences may play a role in sustaining adaptive change. However, the weaker associations for emotional breakthroughs and insights complicate this picture and highlight the need for more nuanced investigation.

The findings do not establish causality but align with theoretical predictions that psychedelics may open transient windows of psychological plasticity. At the same time, alternative explanations—such as expectancy, group support, or retreat structure—cannot be ruled out. The results should therefore be considered hypothesis-generating rather than conclusive.

In sum, this study adds to the growing body of naturalistic research suggesting that psilocybin retreats may foster adaptive emotional development in healthy adults. Yet the evidence remains preliminary. Progress in the field will depend on rigorous experimental designs, multi-method measurement, and direct tests of theoretical models. Only then can we determine with confidence the extent to which psilocybin itself, rather than the retreat context, accounts for the observed changes.

5. Acknowledgments

I would like to express my sincerest thanks to Joel Gruneau Brulin and Pehr Granqvist for providing feedback and mentorship throughout this project. Your guidance and encouragement have been invaluable. To my peers Gustav Martling, Anja Winter, Vendela Wallqvist and Einar Moback for you inspiring input and camaraderie in exploring this exciting field of research. To Michael Skragge and Frans Nordén for your assistance with analyses and R scripts. I also thank Nysnö for trust and collaboration in distributing the survey at their retreat enabling this study. And a special thank you to all the participants, without which the study would not have been possible. Finally, to my family and Raven- thank you for your endless patience, love, and encouragement. Your steadfast support carried me through this endeavor.

.

References

Agin-Liebes, G., Malone, T., Yalch, M. M., Mennenga, S. E., Ponté, K. L., Guss, J., Bossis, A. P., Grigsby, J., Fischer, S., & Ross, S. (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. https://doi.org/10.1177/0269881119897615

Aldao, A., & Nolen-Hoeksema, S. (2010). Specificity of cognitive emotion regulation strategies: A transdiagnostic examination. *Behaviour Research and Therapy, 48*(10), 974–983. https://doi.org/10.1016/j.brat.2010.06.002

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*(2), 217–237. https://doi.org/10.1016/j.cpr.2009.11.004

Alldredge, C. T., Vagner, M., Corlett, C., & Elkins, G. R. (2025). Clinical utility of mystical experiences: An overview and conceptual framework. *International Journal of Clinical and Experimental Hypnosis*. Advance online publication. https://pubmed.ncbi.nlm.nih.gov/40690713/

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.).

Andrews, G., Singh, M., & Bond, M. (1993). The Defense Style Questionnaire. *Journal of Nervous and Mental Disease, 181*(4), 246–256. https://doi.org/10.1097/00005053-199304000-00006

Babl, A., Grosse Holtforth, M., Perry, J. C., Schneider, N., Dommann, E., Heer, S., Stähli, A., Aeschbacher, N., & Eggel, S. (2019). Comparison and change of defense mechanisms over the course of psychotherapy in patients with depression or anxiety disorder: Evidence from a randomized controlled trial. *Journal of Affective Disorders, 252*, 212–220. https://doi.org/10.1016/j.jad.2019.04.021

Barlow, D. H., Farchione, T. J., Bullis, J. R., Gallagher, M. W., Murray-Latin, H., Sauer-Zavala, S., Bentley, K. H., Thompson-Hollands, J., Conklin, L. R., Boswell, J. F., Ametaj, A., Carl, J. R., Boettcher, H. T., & Cassiello-Robbins, C. (2017). The unified protocol for transdiagnostic treatment of emotional disorders compared with diagnosis-specific protocols for anxiety disorders: A randomized clinical trial. *JAMA Psychiatry, 74*(9), 875–884. https://doi.org/10.1001/jamapsychiatry.2017.2164

Barrett, F. S., Johnson, M. W., & Griffiths, R. R. (2015). Validation of the revised Mystical Experience Questionnaire in experimental sessions with psilocybin. *Journal of Psychopharmacology, 29*(11), 1182–1190. https://doi.org/10.1177/0269881115609019

Barrett, L. F., & Satpute, A. B. (2013). Large-scale brain networks in affective and social neuroscience: Towards an integrative functional architecture of the brain. *Current Opinion in Neurobiology, 23*(3), 361–372. https://doi.org/10.1016/j.conb.2012.12.012

Beliveau, V., Ganz, M., Feng, L., Ozenne, B., Højgaard, L., Fisher, P. M., Svarer, C., Greve, D. N., & Knudsen, G. M. (2017). A high-resolution in vivo atlas of the human brain's serotonin system. *The Journal of Neuroscience, 37*(1), 120–128. https://doi.org/10.1523/JNEUROSCI.2830-16.2016

Berking, M., Margraf, M., Ebert, D., Wupperman, P., Hofmann, S. G., & Junghanns, K. (2011). Deficits in emotion-regulation skills predict alcohol use during and after cognitive-behavioral therapy for alcohol dependence. *Journal of Consulting and Clinical Psychology, 79*(3), 307–318. https://doi.org/10.1037/a0023421

Berking, M., & Whitley, B. (2014). *Affect regulation training: A practitioners' manual*. Springer. https://doi.org/10.1007/978-1-4939-1022-9

Berking, M., Wupperman, P., Reichardt, A., Pejic, T., Dippel, A., & Znoj, H. (2008). Emotion-regulation skills as a treatment target in psychotherapy. *Behaviour Research and Therapy, 46*(11), 1230–1237. https://doi.org/10.1016/j.brat.2008.08.005

Berking, M., & Znoj, H. (2008). Entwicklung und Validierung eines Fragebogens zur standardisierten Selbsteinschätzung emotionaler Kompetenzen (SEK-27). *Zeitschrift für Psychiatrie, Psychologie und Psychotherapie, 56*(2), 141–153. https://doi.org/10.1024/1661-4747.56.2.141

Bogenschutz, M. P., Ross, S., Bhatt, S., Baron, T., Forcehimes, A. A., Laska, E., Mennenga, S. E., O'Donnell, K., Owens, L. T., Podrebarac, S., Rotrosen, J., Tonigan, J. S., & Worth, L. (2022). Percentage of heavy drinking days following psilocybin-assisted psychotherapy vs placebo in the treatment of adult patients with alcohol use disorder: A randomized clinical trial. *JAMA Psychiatry, 79*(10), 953–962. https://doi.org/10.1001/jamapsychiatry.2022.2096

Bonanno, G. A., & Burton, C. L. (2013). Regulatory flexibility: An individual differences perspective on coping and emotion regulation. *Perspectives on Psychological Science, 8*(6), 591–612. https://doi.org/10.1177/1745691613504116

Bond, M., & Perry, J. C. (2004). Long-term changes in defense styles with psychodynamic psychotherapy for depressive, anxiety, and personality disorders. *American Journal of Psychiatry, 161*(9), 1665–1671. https://doi.org/10.1176/appi.ajp.161.9.1665

Breuer, J., & Freud, S. (1955). *Studies on hysteria*. In J. Strachey (Ed. & Trans.), *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 2, pp. 1–335). Hogarth Press. (Original work published 1895)

Brouwer, A., & Carhart-Harris, R. L. (2021). Pivotal mental states. *Journal of Psychopharmacology, 35*(4), 319–352. https://doi.org/10.1177/0269881120959637

Buchborn, T., Lyons, T., & Knöpfel, T. (2023). The ego in psychedelic drug action – ego defenses, ego boundaries, and the therapeutic role of regression. *Frontiers in Neuroscience, 17*, Article 1232459. https://doi.org/10.3389/fnins.2023.1232459

Buckner, R. L., Andrews-Hanna, J. R., & Schacter, D. L. (2008). The brain's default network: Anatomy, function, and relevance to disease. *Annals of the New York Academy of Sciences, 1124*, 1–38. https://doi.org/10.1196/annals.1440.011

Calder, A. E., & Hasler, G. (2023). Towards an understanding of psychedelic-induced neuroplasticity. *Neuropsychopharmacology, 48*(1), 104–112. https://doi.org/10.1038/s41386-022-01389-z

Calnan, M., et al. (2025). Exploring the therapeutic effects of psychedelics administered to military veterans in naturalistic retreat settings. *Brain and Behavior, 15*(7), e70660. https://doi.org/10.1002/brb3.70660

Carbonaro, T. M., Bradstreet, M. P., Barrett, F. S., MacLean, K. A., Jesse, R., Johnson, M. W., & Griffiths, R. R. (2016). Survey study of challenging experiences after ingesting psilocybin mushrooms: Acute and enduring positive and negative consequences. *Journal of Psychopharmacology, 30*(12), 1268–1278. https://doi.org/10.1177/0269881116662634

Carhart-Harris, R. L., Bolstridge, M., Day, C. M. J., Rucker, J., Watts, R., Erritzoe, D. E., Kaelen, M., Giribaldi, B., Bloomfield, M., Pilling, S., Rickard, J. A., Forbes, B., Feilding, A., Taylor, D., Curran, H. V., & Nutt, D. J. (2018). Psilocybin with psychological support for treatment-resistant depression: Six-month follow-up. *Psychopharmacology, 235*(2), 399–408. https://doi.org/10.1007/s00213-017-4771-x

Carhart-Harris, R. L., & Friston, K. J. (2019). REBUS and the anarchic brain: Toward a unified model of the brain action of psychedelics. *Pharmacological Reviews, 71*(3), 316–344. https://doi.org/10.1124/pr.118.017160

Carhart-Harris, R. L., Giribaldi, B., Watts, R., Baker-Jones, M., Murphy-Beiner, A., Murphy, R., Martell, J., Blemings, A., Erritzoe, D., & Nutt, D. J. (2021). Trial of psilocybin versus escitalopram for depression. *New England Journal of Medicine, 384*(15), 1402–1411. https://doi.org/10.1056/NEJMoa2032994

Carhart-Harris, R. L., Leech, R., Hellyer, P. J., Shanahan, M., Feilding, A., Tagliazucchi, E., Chialvo, D. R., & Nutt, D. (2014). The entropic brain: A theory of conscious states informed by neuroimaging research with psychedelic drugs. *Frontiers in Human Neuroscience, 8*, Article 20. https://doi.org/10.3389/fnhum.2014.00020

Cavanna, F., Muller, S., de la Fuente, L. A., Zamberlan, F., Palmucci, M., Janeckova, L., Kuchar, M., Pallavicini, C., & Tagliazucchi, E. (2022). Microdosing with psilocybin

mushrooms: A double-blind placebo-controlled study. *Translational Psychiatry, 12*(1), Article 307. https://doi.org/10.1038/s41398-022-02039-0

Chambers, R., Gullone, E., & Allen, N. B. (2009). Mindful emotion regulation: An integrative review. *Clinical Psychology Review, 29*(6), 560–572. https://doi.org/10.1016/j.cpr.2009.06.005

Cisler, J. M., Olatunji, B. O., Feldner, M. T., & Forsyth, J. P. (2010). Emotion regulation and the anxiety disorders: An integrative review. *Journal of Psychopathology and Behavioral Assessment, 32*(1), 68–82. https://doi.org/10.1007/s10862-009-9161-1

Clark, A. (2013). Whatever next? Predictive brains, situated agents, and the future of cognitive science. *Behavioral and Brain Sciences, 36*(3), 181–204. https://doi.org/10.1017/S0140525X12000477

Cludius, B., Mennin, D. S., & Ehring, T. (2020). Emotion regulation as a transdiagnostic process. Emotion, 20(1), 37–42. https://doi.org/10.1037/emo0000646

Compas, B. E., Jaser, S. S., Bettis, A. H., Watson, K. H., Gruhn, M. A., Dunbar, J. P., Williams, E., & Thigpen, J. C. (2017). Coping, emotion regulation, and psychopathology in childhood and adolescence: A meta-analysis and narrative review. *Psychological Bulletin, 143*(9), 939–991. https://doi.org/10.1037/bul0000110

Cramer, P. (1998). Coping and defense mechanisms: What's the difference? *Journal of Personality, 66*(6), 919–946. https://doi.org/10.1111/1467-6494.00037

Cramer, P. (2015). Understanding defense mechanisms. *Psychodynamic Psychiatry, 43*(4), 523–552. https://doi.org/10.1521/pdps.2015.43.4.523

Davidson, K., & MacGregor, M. W. (1996). Reliability of an idiographic Q-sort measure of defense mechanisms. *Journal of Personality Assessment, 66*(3), 502–515. https://doi.org/10.1207/s15327752jpa6603_10

Davis, A. K., Barrett, F. S., May, D. G., Cosimano, M. P., Sepeda, N. D., Johnson, M. W., Finan, P. H., & Griffiths, R. R. (2021). Effects of psilocybin-assisted therapy on major depressive disorder: A randomized clinical trial. *JAMA Psychiatry, 78*(5), 481–489. https://doi.org/10.1001/jamapsychiatry.2020.3285

Di Giuseppe, M., Orrù, G., Gemignani, A., Ciacchini, R., Miniati, M., & Conversano, C. (2022). Mindfulness and Defense Mechanisms as Explicit and Implicit Emotion Regulation Strategies against Psychological Distress during Massive Catastrophic Events. *International Journal of Environmental Research and Public Health, 19*(19), Article 12690. https://doi.org/10.3390/ijerph191912690

Di Giuseppe, M., & Perry, J. C. (2021). The hierarchy of defense mechanisms: Assessing defensive functioning with the defense mechanisms rating scales Q-sort. *Frontiers in Psychology, 12*, Article 718440. https://doi.org/10.3389/fpsyg.2021.718440

Dittrich, A. (1998). The standardized psychometric assessment of altered states of consciousness (ASCs) in humans. *Pharmacopsychiatry, 31*(Suppl. 2), 80–84. https://doi.org/10.1055/s-2007-979351

Eisner B. (1997). Set, setting, and matrix. Journal of psychoactive drugs, 29(2), 213–216. https://doi.org/10.1080/02791072.1997.10400190

Erritzoe, D., Roseman, L., Nour, M. M., MacLean, K., Kaelen, M., Nutt, D. J., & Carhart-Harris, R. L. (2018). Effects of psilocybin therapy on personality structure. *Acta Psychiatrica Scandinavica, 138*(5), 368–378. https://doi.org/10.1111/acps.12904

Etkin, A., Büchel, C., & Gross, J. J. (2015). The neural bases of emotion regulation. *Nature Reviews Neuroscience, 16*(11), 693–700. https://doi.org/10.1038/nrn4044

Fischman, L. G. (2022). Seeing oneself through the eyes of another: A look at psychedelic insight. Neuropsychoanalysis, 24(2), 133–147. https://doi.org/10.1080/15294145.2022.2052163

Fischman, L. (2023). Psychedelic-assisted Psychotherapy in 3-D: Acceptance, Connectedness, and Defensiveness. Neuropsychoanalysis, 25(2), 217–236. https://doi.org/10.1080/15294145.2023.2255991

Freud, A. (1966). *The ego and the mechanisms of defence*. Hogarth Press. (Original work published 1936)

Freud, S. (1959). Inhibitions, symptoms and anxiety. In J. Strachey (Ed. & Trans.), *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 20, pp. 77–175). Hogarth Press. (Original work published 1926)

Freud, S. (1962). The neuro-psychoses of defence. In J. Strachey (Ed. & Trans.), *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 1, pp. 43–68). Hogarth Press. (Original work published 1894)

Friston, K. (2010). The free-energy principle: A unified brain theory? *Nature Reviews Neuroscience, 11*(2), 127–138. https://doi.org/10.1038/nrn2787

Garcia-Romeu, A., Griffiths, R. R., & Johnson, M. W. (2015). Psilocybin-occasioned mystical experiences in the treatment of tobacco addiction. *Current Drug Abuse Reviews, 7*(3), 157–164. https://doi.org/10.2174/1874473708666150107121331

Gattuso, J. J., Perkins, D., Ruffell, S., Lawrence, A. J., Hoyer, D., Jacobson, L. H., Timmermann, C., Castle, D., Rossell, S. L., Downey, L. A., Pagni, B. A., Galvão-Coelho, N. L., Nutt, D., & Sarris, J. (2023). Default Mode Network Modulation by Psychedelics: A Systematic Review. *The International Journal of Neuropsychopharmacology, 26*(3), 155–188. https://doi.org/10.1093/ijnp/pyac074

Goodwin, G. M., Aaronson, S. T., Alvarez, O., Arden, P. C., Baker, A., Bennett, J. C., Bird, C., Blom, R. E., Brennan, C., Brusch, D., Burke, L., Campbell-Coker, K., Carhart-Harris, R., Cattell, J., Daniel, A., DeBattista, C., Dunlop, B. W., Eisen, K., Feifel, D., ... Malievskaia, E. (2022). Single-dose psilocybin for a treatment-resistant episode of major depression. *New England Journal of Medicine, 387*(18), 1637–1648. https://doi.org/10.1056/NEJMoa2206443

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment, 26*(1), 41–54. https://doi.org/10.1023/B:JOBA.0000007455.08539.94

Griffiths, R. R., Johnson, M. W., Carducci, M. A., Umbricht, A., Richards, W. A., Richards, B. D., Cosimano, M. P., & Klinedinst, M. A. (2016). Psilocybin produces substantial and sustained decreases in depression and anxiety in patients with life-threatening cancer: A randomized double-blind trial. *Journal of Psychopharmacology, 30*(12), 1181–1197. https://doi.org/10.1177/0269881116675513

Grimm, O., Kraehenmann, R., Preller, K. H., Seifritz, E., & Vollenweider, F. X. (2018). Psilocybin modulates functional connectivity of the amygdala during emotional face discrimination. *European Neuropsychopharmacology, 28*(6), 691–700. https://doi.org/10.1016/j.euroneuro.2018.03.016

Grof, S. (1975). *Realms of the human unconscious: Observations from LSD research*. Viking Press.

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology, 74*(1), 224–237. https://doi.org/10.1037/0022-3514.74.1.224

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*(3), 271–299. https://doi.org/10.1037/1089-2680.2.3.271

Gross, J. J. (2015). Emotion regulation: Current status and future prospects. *Psychological Inquiry, 26*(1), 1–26. https://doi.org/10.1080/1047840X.2014.940781

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85*(2), 348–362. https://doi.org/10.1037/0022-3514.85.2.348

Haijen, E. C. H. M., Kaelen, M., Roseman, L., Timmermann, C., Kettner, H., Russ, S., Nutt, D., Daws, R. E., Hampshire, A., Lorenz, R., & Carhart-Harris, R. L. (2018). Predicting responses to psychedelics: A prospective study. *Frontiers in Pharmacology, 9*, Article 897. https://doi.org/10.3389/fphar.2018.00897

Hofmann, S. G., Asnaani, A., Vonk, I. J. J., Sawyer, A. T., & Fang, A. (2012). The efficacy of cognitive behavioral therapy: A review of meta-analyses. *Cognitive Therapy and Research, 36*(5), 427–440. https://doi.org/10.1007/s10608-012-9476-1

Hofmann, S. G., Carpenter, J. K., & Curtiss, J. (2016). Interpersonal emotion regulation questionnaire (IERQ): Scale development and psychometric characteristics. *Cognitive Therapy and Research, 40*(3), 341–356. https://doi.org/10.1007/s10608-016-9756-2

Hohwy, J. (2013). *The predictive mind*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199682737.001.0001

Hood, R. W., Jr. (1975). The construction and preliminary validation of a measure of reported mystical experience. *Journal for the Scientific Study of Religion, 14*(1), 29–41. https://doi.org/10.2307/1384454

James, W. (1902). *The varieties of religious experience: A study in human nature*. Longmans, Green.

Johnson, M. W., Garcia-Romeu, A., & Griffiths, R. R. (2017). Long-term follow-up of psilocybin-facilitated smoking cessation. *American Journal of Drug and Alcohol Abuse, 43*(1), 55–60. https://doi.org/10.3109/00952990.2016.1170135

Johnson, M. W., Richards, W. A., & Griffiths, R. R. (2008). Human hallucinogen research: Guidelines for safety. *Journal of Psychopharmacology, 22*(6), 603–620. https://doi.org/10.1177/0269881108093587

Joormann, J., & Stanton, C. H. (2016). Examining emotion regulation in depression: A review and future directions. *Behaviour Research and Therapy, 86*, 35–49. https://doi.org/10.1016/j.brat.2016.07.007

Kettner, H., Rosas, F. E., Timmermann, C., Kärtner, L., Carhart-Harris, R. L., & Roseman, L. (2021). Psychedelic communitas: Intersubjective experience during psychedelic group sessions predicts enduring changes in psychological wellbeing and social connectedness. *Frontiers in Pharmacology, 12*, Article 623985. https://doi.org/10.3389/fphar.2021.623985

Kiraga, M. K., Kuypers, K. P. C., Uthaug, M. V., Ramaekers, J. G., & Mason, N. L. (2022). Decreases in State and Trait Anxiety Post-psilocybin: A Naturalistic, Observational Study Among Retreat Attendees. *Frontiers in Psychiatry, 13*, Article 883869. https://doi.org/10.3389/fpsyt.2022.883869

Ko, K., Knight, G., Rucker, J. J., & Cleare, A. J. (2022). Psychedelic therapy for depressive symptoms: A systematic review and meta-analysis. *Journal of Affective Disorders, 315*, 194–199. https://doi.org/10.1016/j.jad.2022.07.043

Ko, K., Knight, G., Rucker, J. J., & Cleare, A. J. (2022). The psychological processes of classic psychedelics in the treatment of depression: A systematic review protocol. *Systematic Reviews, 11*(1), Article 83. https://doi.org/10.1186/s13643-022-01930-7

Kometer, M., Schmidt, A., Bachmann, R., Studerus, E., Seifritz, E., & Vollenweider, F. X. (2012). Psilocybin biases facial recognition, goal-directed behavior, and mood state toward positive relative to negative emotions through different serotonergic subreceptors. *Biological Psychiatry, 72*(11), 898–906. https://doi.org/10.1016/j.biopsych.2012.04.005

Kraehenmann, R., Preller, K. H., Scheidegger, M., Pokorny, T., Bosch, O. G., Seifritz, E., & Vollenweider, F. X. (2015). Psilocybin-induced decrease in amygdala reactivity correlates with enhanced positive mood in healthy volunteers. *Biological Psychiatry, 78*(8), 572–581. https://doi.org/10.1016/j.biopsych.2014.04.010

Kramer, U. (2010). Coping and defence mechanisms: What's the difference? - Second act. *Psychology and Psychotherapy: Theory, Research and Practice, 83*(2), 207–221. https://doi.org/10.1348/147608309X475989

Lebedev, A. V., Lövdén, M., Rosenthal, G., Feilding, A., Nutt, D. J., & Carhart-Harris, R. L. (2015). Finding the self by losing the self: Neural correlates of ego-dissolution under psilocybin. *Human Brain Mapping, 36*(8), 3137–3153. https://doi.org/10.1002/hbm.22833

Letheby, C., & Gerrans, P. (2017). Self unbound: Ego dissolution in psychedelic experience. *Neuroscience of Consciousness, 2017*(1), Article nix016. https://doi.org/10.1093/nc/nix016

Linehan, M. M., Comtois, K. A., Murray, A. M., Brown, M. Z., Gallop, R. J., Heard, H. L., Korslund, K. E., Tutek, D. A., Reynolds, S. K., & Lindenboim, N. (2006). Two-year randomized controlled trial and follow-up of dialectical behavior therapy vs therapy by experts for suicidal behaviors and borderline personality disorder. *Archives of General Psychiatry, 63*(7), 757–766. https://doi.org/10.1001/archpsyc.63.7.757

Ly, C., Greb, A. C., Cameron, L. P., Wong, J. M., Barragan, E. V., Wilson, P. C., Burbach, K. F., Soltanzadeh Zarandi, S., Sood, A., Paddy, M. R., Duim, W. C., Dennis, M. Y., McAllister, A. K., Ori-McKenney, K. M., Gray, J. A., & Olson, D. E. (2018).

Psychedelics promote structural and functional neural plasticity. *Cell Reports, 23*(11), 3170–3182. https://doi.org/10.1016/j.celrep.2018.05.022

Lyons, T., & Carhart-Harris, R. L. (2018a). More realistic forecasting of future life events after psilocybin for treatment-resistant depression. *Frontiers in Psychology, 9*, Article 1721. https://doi.org/10.3389/fpsyg.2018.01721

Lyons, T., & Carhart-Harris, R. L. (2018b). Increased nature relatedness and decreased authoritarian political views after psilocybin for treatment-resistant depression. *Journal of Psychopharmacology, 32*(7), 811–819. https://doi.org/10.1177/0269881117748902

Ma, D., Cao, J., Wei, J., & Jiang, J. (2024). Immature defense mechanisms mediate the relationship between negative life events and depressive symptoms. *Frontiers in Psychiatry, 14*, Article 1341288. https://doi.org/10.3389/fpsyt.2023.1341288

MacLean, K. A., Johnson, M. W., & Griffiths, R. R. (2011). Psilocybin occasioned mystical-type experiences: Immediate and persisting dose-related effects. *Psychopharmacology, 218*(4), 649–665. https://doi.org/10.1007/s00213-011-2358-5

Malone, J. C., Cohen, S., Liu, S. R., Vaillant, G. E., & Waldinger, R. J. (2013). Adaptive midlife defense mechanisms and late-life health. *Personality and Individual Differences, 55*(2), 85–89. https://doi.org/10.1016/j.paid.2013.01.025

Margulies, D. S., Ghosh, S. S., Goulas, A., Falkiewicz, M., Huntenburg, J. M., Langs, G., Bezgin, G., Eickhoff, S. B., Castellanos, F. X., Petrides, M., Jefferies, E., & Smallwood, J. (2016). Situating the default-mode network along a principal gradient of macroscale cortical organization. *Proceedings of the National Academy of Sciences of the United States of America, 113*(44), 12574–12579. https://doi.org/10.1073/pnas.1608282113

Marks, M. (2023). Microdosing psychedelics under local, state, and federal law. *Boston University Law Review, 103*(6), 1631–1682. https://www.bu.edu/bulawreview/files/2023/10/MARKS.pdf

Mathai, D. S., Roberts, D. E., Nayak, S. M., Sepeda, N. D., Lehrner, A., Johnson, M. W., Lowe, M. X., Jackson, H., & Garcia-Romeu, A. (2025). Shame, Guilt and Psychedelic Experience: Results from a Prospective, Longitudinal Survey of Real-World Psilocybin Use. *Journal of Psychoactive Drugs*. Advance online publication. https://doi.org/10.1080/02791072.2025.2461997

McGovern, H. T., Grimmer, H. J., Doss, M. K., Hutchinson, B. T., Timmermann, C., Lyon, A., Corlett, P. R., & Laukkonen, R. E. (2024). An integrated theory of false insights and beliefs under psychedelics. Communications Psychology, 2(1), 69. https://doi.org/10.1038/s44271-024-00120-6

Mesulam, M. M. (1998). From sensation to cognition. *Brain, 121*(Pt 6), 1013–1052. https://doi.org/10.1093/brain/121.6.1013

Millière, R. (2017). Looking for the self: Phenomenology, neurophysiology and philosophical significance of drug-induced ego dissolution. *Frontiers in Human Neuroscience, 11*, Article 245. https://doi.org/10.3389/fnhum.2017.00245

Moreno, F. A., Wiegand, C. B., Taitano, E. K., & Delgado, P. L. (2006). Safety, tolerability, and efficacy of psilocybin in 9 patients with obsessive-compulsive disorder. *Journal of Clinical Psychiatry, 67*(11), 1735–1740. https://doi.org/10.4088/JCP.v67n1110

Naragon-Gainey, K., McMahon, T. P., & Chacko, T. P. (2017). The structure of common emotion regulation strategies: A meta-analytic examination. *Psychological Bulletin, 143*(4), 384–427. https://doi.org/10.1037/bul0000093

Nayak, S. M., Jackson, H., Sepeda, N. D., Mathai, D. S., So, S., Yahn, A. C., Lowe, M., Hamilton, A. J., & Garcia-Romeu, A. (2023). Naturalistic psilocybin use is associated with persisting improvements in mental health and wellbeing: Results from a prospective, longitudinal survey. *Frontiers in Psychiatry, 14*, Article 1199642. https://doi.org/10.3389/fpsyt.2023.1199642

Nichols, D. E. (2016). Psychedelics. *Pharmacological Reviews, 68*(2), 264–355. https://doi.org/10.1124/pr.115.011478

Nichols, D. E. (2020). Psilocybin: From ancient magic to modern medicine. *The Journal of Antibiotics, 73*(10), 679–686. https://doi.org/10.1038/s41429-020-0311-8

Nour, M. M., Evans, L., Nutt, D., & Carhart-Harris, R. L. (2016). Ego-dissolution and psychedelics: Validation of the Ego-Dissolution Inventory (EDI). *Frontiers in Human Neuroscience, 10*, Article 269. https://doi.org/10.3389/fnhum.2016.00269

Pahnke, W. N. (1963). *Drugs and mysticism* [Unpublished doctoral dissertation]. Harvard University.

Passie, T., Guss, J., & Krähenmann, R. (2022). Lower-dose psycholytic therapy - A neglected approach. *Frontiers in Psychiatry, 13*, Article 1020505. https://doi.org/10.3389/fpsyt.2022.1020505

Peck, S. K., Shao, S., Gruen, T., Yang, K., Babakanian, A., Trim, J., Finn, D. M., & Kaye, W. H. (2023). Psilocybin therapy for females with anorexia nervosa: A phase 1, open-label feasibility study. *Nature Medicine, 29*(8), 1947–1953. https://doi.org/10.1038/s41591-023-02455-9

Peill, J. M., Trinci, K., Kettner, H., Mertens, L. J., Roseman, L., Timmermann, C., Rosas, F. E., Lyons, N., Allen, G., Erritzoe, D., Nutt, D., & Carhart-Harris, R. (2022). Validation of the Psychological Insight Scale: A new scale to assess psychological insight following a psychedelic experience. *Journal of Psychopharmacology, 36*(1), 81–94. https://doi.org/10.1177/02698811211066709

Perry, J. C. (1990). *Defense Mechanism Rating Scales* (5th ed.). Author.

Perry, J. C., & Bond, M. (2012). Change in defense mechanisms during long-term dynamic psychotherapy and five-year outcome. *American Journal of Psychiatry, 169*(9), 916–925. https://doi.org/10.1176/appi.ajp.2012.11091403

Pokorny, T., Preller, K. H., Kometer, M., Dziobek, I., & Vollenweider, F. X. (2017). Effect of psilocybin on empathy and moral decision-making. *International Journal of Neuropsychopharmacology, 20*(9), 747–757. https://doi.org/10.1093/ijnp/pyx047

Preller, K. H., Jungwirth, J., Dziobek, I., Vollenweider, F. X., von Rotz, R., Pokorny, T., Seifritz, E., & Quednow, B. B. (2024). Psilocybin increases emotional empathy in patients with major depression. *Molecular Psychiatry, 30*(6), 2665–2672. https://doi.org/10.1038/s41380-024-02875-0

Prout, T. A., Di Giuseppe, M., Zilcha-Mano, S., Perry, J. C., & Conversano, C. (2022). Psychometric properties of the defense mechanisms rating scales-self-report-30 (DMRS-SR-

30): Internal consistency, validity, and factor structure. *Journal of Personality Assessment, 104*(1), 92–103. https://doi.org/10.1080/00223891.2021.2019053

Rice, T. R., & Hoffman, L. (2014). Defense mechanisms and implicit emotion regulation: A comparison of a psychodynamic construct with one from contemporary neuroscience. *Journal of the American Psychoanalytic Association, 62*(4), 693–708. https://doi.org/10.1177/0003065114546746

Roseman, L., Demetriou, L., Wall, M. B., Nutt, D. J., & Carhart-Harris, R. L. (2018). Increased amygdala responses to emotional faces after psilocybin for treatment-resistant depression. *Neuropharmacology, 142*, 263–269. https://doi.org/10.1016/j.neuropharm.2017.12.041

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. https://doi.org/10.1177/0269881119855974

Roseman, L., Nutt, D. J., & Carhart-Harris, R. L. (2018). Quality of acute psychedelic experience predicts therapeutic efficacy of psilocybin for treatment-resistant depression. *Frontiers in Pharmacology, 8*, Article 974. https://doi.org/10.3389/fphar.2017.00974

Ross, S., Bossis, A., Guss, J., Agin-Liebes, G., Malone, T., Cohen, B., Mennenga, S. E., Belser, A., Kalliontzi, K., Babb, J., Su, Z., Corby, P., & Schmidt, B. L. (2016). Rapid and sustained symptom reduction following psilocybin treatment for anxiety and depression in patients with life-threatening cancer: A randomized controlled trial. *Journal of Psychopharmacology, 30*(12), 1165–1180. https://doi.org/10.1177/0269881116675512

Sheppes, G., Scheibe, S., Suri, G., Radu, P., Blechert, J., & Gross, J. J. (2014). Emotion regulation choice: A conceptual framework and supporting evidence. *Journal of Experimental Psychology: General, 143*(1), 163–181. https://doi.org/10.1037/a0030831

Sheppes, G., Suri, G., & Gross, J. J. (2015). Emotion regulation and psychopathology. *Annual Review of Clinical Psychology, 11*, 379–405. https://doi.org/10.1146/annurev-clinpsy-032814-112739

Skodol, A. E., & Perry, J. C. (1993). Should an axis for defense mechanisms be included in DSM-IV? *Comprehensive Psychiatry, 34*(2), 108–119. https://doi.org/10.1016/0010-440X(93)90056-R

Smigielski, L., Kometer, M., Scheidegger, M., Krähenmann, R., Huber, T., & Vollenweider, F. X. (2019). Psilocybin-assisted mindfulness training modulates self-consciousness and brain default mode network connectivity with lasting effects. *NeuroImage, 196*, 207–215. https://pubmed.ncbi.nlm.nih.gov/30965131/

Stace, W. T. (1960). *Mysticism and philosophy*. J. B. Lippincott.

Stroud, J. B., Freeman, T. P., Leech, R., Hindocha, C., Lawn, W., Nutt, D. J., Curran, H. V., & Carhart-Harris, R. L. (2018). Psilocybin with psychological support improves emotional face recognition in treatment-resistant depression. *Psychopharmacology, 235*(2), 459–466. https://doi.org/10.1007/s00213-017-4754-y

Studerus, E., Gamma, A., & Vollenweider, F. X. (2010). Psychometric evaluation of the altered states of consciousness rating scale (OAV). *PLoS ONE, 5*(8), Article e12412. https://doi.org/10.1371/journal.pone.0012412

Vaillant, G. E. (1971). Theoretical hierarchy of adaptive ego mechanisms: A 30-year follow-up of 30 men selected for psychological health. *Archives of General Psychiatry, 24*(2), 107–118. https://doi.org/10.1001/archpsyc.1971.01750080011003

Vaillant, G. E. (1976). Natural history of male psychological health: V. The relation of choice of ego mechanisms of defense to adult adjustment. *Archives of General Psychiatry, 33*(5), 535–545. https://doi.org/10.1001/archpsyc.1976.01770050003001

Vaillant, G. E. (1992). *Ego mechanisms of defense: A guide for clinicians and researchers*. American Psychiatric Press.

Vollenweider, F. X., & Preller, K. H. (2020). Psychedelic drugs: Neurobiology and potential for treatment of psychiatric disorders. *Nature Reviews Neuroscience, 21*(11), 611–624. https://doi.org/10.1038/s41583-020-0367-2

Vujanovic, A. A., Bonn-Miller, M. O., Potter, C. M., Marshall, E. C., & Zvolensky, M. J. (2011). An evaluation of the relation between distress tolerance and posttraumatic stress within a trauma-exposed sample. *Journal of Psychopathology and Behavioral Assessment, 33*(1), 129–135. https://doi.org/10.1007/s10862-010-9209-2

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. https://doi.org/10.1177/0022167817709585

Wolff, M., Evens, R., Mertens, L. J., Koslowski, M., Betzler, F., Gründer, G., & Jungaberle, H. (2020). Learning to let go: A cognitive-behavioral model of how psychedelic

therapy promotes acceptance. *Frontiers in Psychiatry, 11*, Article 5. https://doi.org/10.3389/fpsyt.2020.00005

Yılmaz, M., et al. (2024). Initial validation of the Turkish version of the defense mechanisms rating scales self-report-30 (DMRS-SR-30). Frontiers in Psychology, 15, 1432170. https://doi.org/10.3389/fpsyg.2024.1432170

Zaki, J., & Williams, W. C. (2013). Interpersonal emotion regulation. *Emotion, 13*(5), 803–810. https://doi.org/10.1037/a0033839

Zeman, J., Klimes-Dougan, B., Cassano, M., & Adrian, M. (2007). Measurement issues in emotion research with children and adolescents: A focus on emotional competence. *Clinical Psychology: Science and Practice, 14*(4), 377–391. https://doi.org/10.1111/j.1468-2850.2007.00098.x

Appendix

Table A1. ERSQ Subscales Fixed Effects

term	estimate	conf.low	conf.high	SE	t	p.value	Subscale
Intercept	3.25	2.79	3.71	0.23	13.96	< .001	Understanding
T4	0.43	0.32	0.54	0.06	7.71	< .001	Understanding
T5	0.43	0.30	0.55	0.06	6.70	< .001	Understanding
T6	0.41	0.26	0.55	0.07	5.54	< .001	Understanding
T7	0.47	0.31	0.63	0.08	5.72	< .001	Understanding
age	0.01	0.00	0.02	0.00	1.63	0.104	Understanding
female	0.17	-0.02	0.37	0.10	1.75	0.081	Understanding
Intercept	3.41	2.95	3.87	0.23	14.74	< .001	Awareness
T4	0.52	0.41	0.63	0.06	9.28	< .001	Awareness
T5	0.43	0.31	0.56	0.06	6.73	< .001	Awareness
T6	0.40	0.25	0.55	0.07	5.38	< .001	Awareness
T7	0.43	0.26	0.59	0.08	5.14	< .001	Awareness
age	0.00	-0.01	0.01	0.00	0.81	0.417	Awareness
female	0.11	-0.08	0.30	0.10	1.11	0.267	Awareness
Intercept	3.20	2.72	3.68	0.24	13.08	< .001	Clarity
T4	0.42	0.30	0.54	0.06	6.99	< .001	Clarity
T5	0.39	0.25	0.53	0.07	5.65	< .001	Clarity
T6	0.38	0.23	0.54	0.08	4.85	< .001	Clarity
T7	0.38	0.21	0.56	0.09	4.29	< .001	Clarity
age	0.01	0.00	0.02	0.00	1.65	0.101	Clarity
female	0.17	-0.03	0.38	0.10	1.70	0.092	Clarity
Intercept	3.32	2.77	3.86	0.28	12.01	< .001	Sensations
T4	0.36	0.24	0.48	0.06	5.86	< .001	Sensations
T5	0.28	0.14	0.42	0.07	4.03	< .001	Sensations
T6	0.25	0.10	0.41	0.08	3.16	0.002	Sensations

term	estimate	conf.low	conf.high	SE	t	p.value	Subscale
T7	0.32	0.14	0.50	0.09	3.52	< .001	Sensations
age	0.00	-0.01	0.01	0.01	0.38	0.701	Sensations
female	0.18	-0.05	0.41	0.12	1.53	0.127	Sensations
Intercept	3.17	2.65	3.68	0.26	12.14	< .001	Acceptance
T4	0.59	0.46	0.72	0.06	9.17	< .001	Acceptance
T5	0.53	0.38	0.67	0.07	7.18	< .001	Acceptance
T6	0.44	0.27	0.61	0.08	5.18	< .001	Acceptance
T7	0.60	0.42	0.79	0.10	6.33	< .001	Acceptance
age	0.01	0.00	0.02	0.00	1.39	0.165	Acceptance
female	-0.03	-0.25	0.18	0.11	-0.31	0.754	Acceptance
Intercept	3.46	2.95	3.98	0.26	13.27	< .001	Tolerance
T4	0.51	0.38	0.64	0.07	7.70	< .001	Tolerance
T5	0.45	0.30	0.60	0.08	5.88	< .001	Tolerance
T6	0.40	0.23	0.57	0.09	4.54	< .001	Tolerance
T7	0.56	0.37	0.76	0.10	5.72	< .001	Tolerance
age	0.00	-0.01	0.01	0.00	0.76	0.449	Tolerance
female	-0.03	-0.25	0.18	0.11	-0.31	0.757	Tolerance
Intercept	3.33	2.85	3.80	0.24	13.85	< .001	Self_support
T4	0.44	0.31	0.56	0.06	6.93	< .001	Self_support
T5	0.48	0.33	0.62	0.07	6.63	< .001	Self support
T6	0.42	0.26	0.59	0.08	5.13	< .001	Self support
T7	0.57	0.39	0.75	0.09	6.16	< .001	Self_support
age	0.00	-0.01	0.01	0.00	0.36	0.718	Self_support

term	estimate	conf.low	conf.high	SE	t	p.value	Subscale
female	0.10	-0.10	0.29	0.10	0.95	0.345	Self_support
Intercept	3.30	2.82	3.78	0.25	13.46	< .001	Confront
T4	0.31	0.18	0.43	0.06	4.90	< .001	Confront
T5	0.44	0.30	0.58	0.07	6.19	< .001	Confront
T6	0.33	0.17	0.49	0.08	4.05	< .001	Confront
T7	0.45	0.27	0.63	0.09	4.85	< .001	Confront
age	0.01	0.00	0.01	0.00	1.22	0.223	Confront
female	0.14	-0.06	0.35	0.10	1.40	0.164	Confront
Intercept	3.11	2.58	3.64	0.27	11.54	< .001	Modification
T4	0.39	0.26	0.52	0.07	5.95	< .001	Modification
T5	0.49	0.34	0.64	0.08	6.49	< .001	Modification
T6	0.48	0.31	0.65	0.09	5.56	< .001	Modification
T7	0.51	0.32	0.70	0.10	5.24	< .001	Modification
age	0.00	-0.01	0.01	0.01	0.40	0.688	Modification
female	-0.02	-0.24	0.21	0.11	-0.14	0.890	Modification

Table A2. DMRS Categories Fixed Effects

term	estimate	conf.low	conf.high	SE	t	p	Category
Intercept	4.58	3.99	5.17	0.30	15.39	< .001	C1
T4	0.68	0.54	0.82	0.07	9.61	< .001	C1
T5	0.56	0.40	0.71	0.08	7.02	< .001	C1
T6	0.48	0.30	0.66	0.09	5.19	< .001	C1
T7	0.41	0.21	0.61	0.10	3.99	< .001	C1
Age	0.01	0.00	0.02	0.01	1.54	0.125	C1
Gender	-0.02	-0.27	0.22	0.13	-0.19	0.849	C1
Intercept	3.43	3.04	3.82	0.20	17.34	< .001	C2
T4	-0.27	-0.38	-0.17	0.05	-5.30	< .001	C2
T5	-0.29	-0.40	-0.17	0.06	-5.00	< .001	C2
T6	-0.25	-0.38	-0.12	0.07	-3.81	< .001	C2
T7	-0.23	-0.38	-0.09	0.07	-3.13	0.002	C2
Age	0.00	-0.01	0.01	0.00	0.20	0.839	C2
Gender	-0.04	-0.21	0.12	0.08	-0.50	0.619	C2
Intercept	3.22	2.94	3.50	0.14	22.92	< .001	C3
T4	-0.22	-0.28	-0.15	0.03	-6.61	< .001	C3
T5	-0.16	-0.23	-0.09	0.04	-4.41	< .001	C3
T6	-0.14	-0.23	-0.06	0.04	-3.40	< .001	C3
T7	-0.12	-0.22	-0.03	0.05	-2.58	0.010	C3
Age	0.00	-0.01	0.00	0.00	-1.71	0.089	C3
Gender	-0.08	-0.20	0.04	0.06	-1.37	0.173	C3