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Research Article

Aquahenosis: a non-pharmacological altered state of consciousness induced by floatation-REST in individuals with anxiety and depression

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Abstract

Floatation-REST (Reduced Environmental Stimulation Therapy) systematically alters the balance of sensory signals reaching the brain by combining neutral buoyancy, thermal and proprioceptive neutrality, attenuation of exteroceptive stimulation, and enhancement of cardiorespiratory signaling. Here we examined whether this non-pharmacological sensory perturbation induces altered states of consciousness and whether specific experiential dimensions are statistically related to changes in affect. In a secondary analysis of a randomized controlled feasibility trial, 75 treatment-seeking adults with anxiety and depression were assigned to six sessions of Floatation-REST with prescribed scheduling, Floatation-REST with preferred scheduling and duration, or a zero-gravity chair comparison condition. Altered states of consciousness were assessed using the 5-Dimensional Altered States of Consciousness Rating Scale, alongside measures of interoceptive awareness and affect. Compared to the chair condition, Floatation-REST was associated with increased interoceptive awareness of cardiorespiratory sensations and an altered state of consciousness characterized by Oceanic Boundlessness, Disembodiment, and Experience of Unity—a pattern we refer to as "*aquahenosis*". Effects were strongest among participants who selected longer and more flexible float sessions. Experiential profiles selectively overlapped with those reported for psilocybin and ketamine along boundary-dissolution dimensions. These findings identify Floatation-REST as a tractable, non-pharmacological method for inducing specific altered states of consciousness and highlight Oceanic Boundlessness as an important mediator of the float-induced changes in positive affect.

Keywords States of Consciousness, Embodiment, Altered States

Highlights

- Floatation-REST induced aquahenosis: an altered state of consciousness marked by interoceptive awareness and self-boundary dissolution.
- Oceanic Boundlessness, Disembodiment, Experience of Unity, and Spiritual Experience were elevated relative to a chair control.
- Floatation-REST enhanced Body Listening and Emotional Awareness and increased cardiorespiratory sensation intensity.
- Floatation-REST phenomenology overlapped with ketamine and low-dose psilocybin on boundary-dissolution dimensions.

Introduction

Non-ordinary states of consciousness—also referred to as altered states of consciousness (ASCs)—have been argued to have the capacity to fundamentally alter how humans experience the world and themselves, often by promoting the updating of maladaptive beliefs and upregulating well-being in clinical and non-clinical populations (Timmermann et al. 2023, Carhart-Harris and Friston 2019). While psychedelics have garnered considerable attention for their capacity

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to induce ASCs with demonstrable therapeutic potential (e.g. Barber and Aaronson 2022), there are currently some significant methodological and practical constraints that preclude their widespread clinical application and dissemination, including blinding and expectancy effects (Soliman et al. 2024, Huneke et al. 2025, Orsini et al. 2026), limited generalizability to routine clinical settings (Hosein et al. 2025), mechanistic ambiguity (van Elk and Yaden 2022, Mertens et al. 2026) and high rate of adverse events (Hinkle et al. 2024). Controlled therapeutic settings have markedly reduced the incidence of adverse events during psychedelic experiences, yet considerable complications—including dysphoria (colloquially termed "bad trips") and lasting or persistent visual hallucinations or perceptual distortions (sometimes referred to as "hallucinogen-persisting perception disorder")—warrant careful consideration and screening (Schlag et al. 2022). Adverse experiences with psychedelics can also be compounded by potential for false insights and even strengthening of maladaptive beliefs (McGovern et al. 2024, Safron et al. 2025), while pharmacological contraindications may systematically exclude certain populations, including individuals with high risk for psychosis, those on complex medication regimens [e.g. not simply antidepressants (see Tap et al. 2025)], or individuals with risk of cardiovascular complications, from both research participation and therapeutic access (O'Donnell et al. 2019, *cf.* Tap et al. 2025). These clinical limitations intersect with substantial regulatory barriers, as most psychedelics currently retain federal Schedule I classification.

From a consciousness science perspective, these constraints highlight a broader methodological gap: most experimentally tractable altered states are pharmacologically induced, confounding changes in conscious experience with receptor-specific, expectancy-driven, and systemic drug effects. This limits our ability to isolate how alterations in sensory precision, bodily self-models, and environmental context shape conscious experience itself. Identifying non-pharmacological paradigms capable of reliably inducing altered states therefore represents both a clinical and a theoretical opportunity. The challenges associated with the routine utilization of psychedelic substances in standard clinical settings further highlight the value and potential utility of non-pharmacological alternatives capable of reliably inducing ASCs with a lower potential for negative outcomes. Potential avenues are heterogeneous in nature, including cultivated practices, such as certain forms of meditation (Dahl et al. 2015, Potash et al. 2025), hypnosis (Timmermann et al. 2023), and breathwork (Havenith et al. 2025), external sensory manipulations, such as stroboscopic stimulation (Bartossek et al. 2021, Johnson et al. 2024) and immersive technology in virtual reality and reflective chambers (Simonian et al. 2025, Suzuki et al. 2023, Wildman and Stockly 2021), and experiences that arise spontaneously, such as spiritual awakenings (Corneille and Luke 2021), chills-inducing aesthetic experiences (Christov-Moore et al. 2024), and lucid dreaming (Mutz and Javadi 2017).

One promising strategy is to perturb consciousness not through neurochemical manipulation, but through systematic alteration of the sensory and bodily inputs that constrain self-experience. For example, one historical approach with prior precedent in contemplative traditions utilizes sustained exposure to darkness (aka 'dark retreats') for consciousness exploration (Colin 2025). A more sophisticated contemporary instantiation of this approach involves Floatation-REST (Reduced Environmental Stimulation Therapy), which systematically minimizes sensory and bodily input through precise calibration of water temperature to thermal neutrality, attenuation of gravitational sensation *via* saltwater buoyancy, and elimination of external visual and auditory stimulation. Floatation environments achieve a sizable degree of external sensory isolation that facilitates considerable alterations in perceptual experience (Norlander et al. 2000).

Recent work has suggested the possibility that Floatation-REST may be capable of inducing clinically relevant ASCs. For example, a study by Hruby et al. (2024) using a within-subject crossover design in 50 healthy individuals found that Floatation-REST reliably produced aspects of ASCs such as time distortion and dissolution of body boundaries, with the latter being a significant mediator of reductions in state anxiety relative to the control condition (lying in a dark and quiet room). While Floatation-REST has been found to enhance interoceptive awareness of cardiorespiratory sensations (Feinstein et al. 2018a, Khalsa et al. 2020), a sensory capacity commonly deteriorated in affective and anxiety disorders (Khalsa et al. 2018, Saltafossi et al. 2025), no studies have examined whether this intervention induces clinically-relevant ASCs in psychiatric patient populations.

To investigate whether Floatation-REST provides a non-pharmacological route to specific, theoretically meaningful ASCs, particularly those involving changes in self-boundaries, we conducted a secondary analysis of our previously published randomized controlled trial in individuals diagnosed with anxiety and/or depression (Garland et al. 2024). We evaluated data on ASCs using a standard self-report measure, the 5-Dimensional Altered States of Consciousness Rating Scale (5D-ASC; Dittrich 1998), commonly employed in psychedelic research, alongside measures of interoceptive awareness and affective symptoms. In this exploratory study, we sought to determine: (i) whether Floatation-REST would induce ASCs comparable to those elicited by psychedelic compounds, and (ii) whether observed changes in phenomenology and interoception mediated changes in affective states. Here, phenomenology is treated as an intermediate explanatory level linking controlled sensory perturbations to affective outcomes, rather than as a purely epiphenomenal byproduct.

Methods

Participants

Recruitment/remuneration

Participants were treatment-seeking adults with anxiety and depression recruited through the Laureate Institute for Brain Research's (LIBR) T1000 and Center of Biomedical Research Excellence (CoBRE) databases (Victor et al. 2018). Recruitment took place between February 2019 and October 2021, with a 4-month pause during the COVID-19 global pandemic starting in March 2020. A total of 1715 individuals were screened for the original study, and 192 met inclusion criteria. A total of 168 (87.5%) were contacted for participation and 82 participants initially consented. Of those who consented, 75 participants were randomized to one of the three experimental conditions. Five participants were excluded for not starting the intervention. The final sample comprised 57 participants who completed all six Floatation-REST sessions (see Table 1 for demographic characteristics).

Eligibility (inclusion/exclusion criteria)

Participants were required to have clinically elevated levels of anxiety (Overall Anxiety Severity and Impairment Scale; OASIS $\geq$ 6) and anxiety sensitivity (Anxiety Sensitivity Index-3; ASI-3 $\geq$ 24). (These cutoffs were reduced from the original thresholds (OASIS $\geq$ 8; ASI-3 $\geq$ 29) in September 2020, with funding agency approval, to enhance recruitment during the COVID-19 pandemic.) Additional inclusion

Table 1 Participant characteristics by group at study intervention entry for participants who completed all six Floatation-REST sessions ($n = 57$).

	Condition		
	Chair-REST ($n = 17$)	**Pool-REST ($n = 19$)**	**Pool-REST Preferred ($n = 21$)**
Demographics			
Sex			
Male, n (%)	5 (29%)	5 (26%)	5 (24%)
Female, n (%)	12 (71%)	14 (74%)	16 (76%)
Age M (SD)	36.4 (13.6)	31.01 (10.2)	35.5 (9.2)
Race/Ethnicity, n (%)[a]			
White	16 (94%)	17 (89%)	16 (76%)
Black/African American	2 (11%)	3 (16%)	4 (19%)
Am. Indian/Alaskan Native	4 (23%)	4 (21%)	4 (19%)
Asian/Pacific Islander	0 (0%)	0 (0%)	0 (0%)
Hispanic	1 (5%)	2 (10%)	1 (4%)
Unspecified	0 (0%)	0 (0%)	1 (4%)
Years of Education	15.3 (1.7)	15.1 (1.7)	15.7 (1.7)
BMI	29.6 (7.8)	28.6 (5.3)	28.9 (6.9)
Psychiatric Medication[b]	0.7 (1.0)	0.26 (0.6)	1.2 (1.4)
Psychiatric Diagnosis n (%)[c]			
Major Depressive Diagnosis	16 (94%)	18 (94%)	21 (100%)
Generalized Anxiety Disorder	6 (35%)	15 (78%)	10 (47%)
Social Anxiety Disorder	6 (35%)	10 (52%)	5 (23%)
Posttraumatic Stress Disorder	4 (23%)	6 (31%)	6 (28%)
Panic Disorder	1 (5%)	5 (26%)	7 (33%)
Self-report Measures M (SD)[d]			
OASIS Anxiety	9.8 (2.5)	9.6 (2.4)	9.8 (2.4)
ASI-3 Anxiety Sensitivity	38.6 (14.09)	42 (8.8)	41.5 (12.5)
Patient Health Questionnaire-9 (PHQ-9) Depression	11.3 (4.9)	12.2 (4.9)	13.05 (4.4)

[a]Categories were not mutually exclusive; participants could choose more than one race/ethnicity category. [b]Numbers reflect the mean number of prescribed medications taken by each participant measured at screening. [c]Diagnosis determined by the Mini International Neuropsychiatric Inventory (MINI) version 7.0, clinician-administered interview. Only comorbid diagnoses with >10% across the sample are listed. Percentages will be >100% as the current study allowed for comorbid diagnoses. [d]No significant group differences on self-report measures at screening.

criteria were: age 18–60 years, either no prior Floatation-REST experience or at least 1 year since their last session. Participants taking psychiatric medications or engaged in psychotherapy were required to have been on a stable medication regimen or in consistent treatment for at least 8 weeks. Participants prescribed benzodiazepines or opioids on an as-needed basis were required to abstain from use for at least 24 h prior to each float session. Individuals who used these medications daily were excluded from the study. Other exclusion criteria included discomfort being in water; any skin conditions or open wounds that could worsen if exposed to salt water; neurological disorders (e.g. epilepsy) or other medical conditions that could interfere with protocol; comorbid bipolar disorder, schizophrenia spectrum, or other psychotic disorders; comorbid eating disorders; current moderate to severe substance use disorder; active suicidality with plan or intent; actively enrolled in inpatient psychiatric treatment; or pregnancy. Drug and alcohol use were assessed prior to each float *via* urine and breathalyzer screening; positive results were exclusionary.

Ethics

All study procedures were approved by the Western Institutional Review Board (Protocol #20150528) and were performed in accordance with the Declaration of Helsinki. Participants provided their written informed consent prior to participation and were financially compensated for their study involvement. Additionally, the primary hypotheses of the parent study were pre-registered on ClinicalTrials.gov (NCT03899090).

Materials

Trait Measures. The Anxiety Sensitivity Index-3 Revised (ASI-3R; Garland 2023) was administered at baseline, mid-intervention (after the third float) and post-intervention (after the sixth float).

State and phenomenology measures

Acute Affect and Anxiety. The State-Trait Anxiety Inventory—State Subscale (STAI-S; Spielberger et al. 1983) and Positive and Negative Affect Schedule (PANAS; Watson et al. 1988) were completed immediately before and after each of the six Floatation-REST sessions to assess acute changes in anxiety and affect.

Interoceptive Awareness. The Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al. 2012), adapted to assess self-reported interoceptive awareness during the float experience (i.e. state sensitive; MAIA-S) was administered after the first, fourth, and sixth REST sessions. Custom post-float questions about the intensity and pleasantness of three visceral sensations (breath, heartbeat, and stomach/digestive system) were asked after each float session (Feinstein et al. 2018a, Garland et al. 2024). The three intensity questions asked: “How intensely did you feel your [heartbeat, breath, or stomach/digestive system] while floating?” using a visual analog scale ranging from 0 (Not at all/None) to 100 (Extremely/The most I have ever felt). The three pleasantness questions asked: “How did your [heartbeat, breath, or stomach/digestive system] feel while floating?” using a 100-point bipolar scale ranging from −50 (Extremely Unpleasant) to +50 (Extremely Pleasant), with the slider starting in the middle of the scale at 0 (Neutral).

Altered States of Consciousness. The 5D-ASC (Dittrich 1998) captures self-reported experiential states commonly associated with non-ordinary states of consciousness. It includes 94 items rated on visual analog scales and yields scores across five core dimensions: Oceanic Boundlessness (OB), Anxious Ego Dissolution, Visionary Restructuralization, Auditory Alterations, and Reduction of Vigilance. Due to the substantial item number and secondary nature of this investigation, the scale was only administered once following the sixth and final Floatation-REST session, after participants had completed their exposure to the intervention. Because the 5D-ASC was administered after the final session, responses reflect participants' cumulative or representative float experiences rather than session-specific state fluctuations. In addition to the original five-dimensional model, the scale was also scored using the 11-factor (11-ASC) framework (Studerus et al. 2010), which reorganizes the same item responses into 11 factors, including Spiritual Experience, Disembodiment, Insightfulness, and Blissful State, allowing for a more nuanced characterization of the Floatation-REST experience.

Clinician-Rated Symptom Scales. Clinician-rated symptom scales included the Hamilton Anxiety Rating Scale (HAM-A; Hamilton 1959) and the Montgomery–Åsberg Depression Rating Scale (MADRS; Montgomery and Åsberg 1979), both administered by a trained clinician at baseline and post-intervention (after the sixth float). The HAM-A assessed present symptoms of anxiety over the past week, including both psychic and somatic components. The MADRS evaluated the severity of depression symptoms, focusing on features of depression such as sadness, pessimism, and suicidality. Both scales are sensitive to clinical change and are widely used in treatment studies to monitor symptom progression over time.

Positive Side Effects. A custom measure was collected after each float to measure a variety of positive experiences. This Side Effects Checklist was included as an alternative measure to capture positive experiences, many of which significantly varied between Pool-REST groups (Garland et al. 2024).

Procedure

Using a randomized parallel design, participants were assigned to one of three study conditions after completing the consent form, eligibility screening, and baseline measures. In each condition, participants completed 11 study visits. The study timeline is outlined in Fig. 1 (reproduced from Garland et al. 2024). Participants completed self-report assessments at baseline and post-intervention visits in person. During each experimental visit (Visits #3–8), participants also completed acute symptom and experience measures, before and after engaging in their assigned REST condition.

Experimental conditions

Pool-REST (Prescribed). In the Pool-REST conditions, participants effortlessly floated without clothing in an 11-inch pool of water saturated with Epsom salt located in an environment designed to attenuate exteroceptive sensory input including visual, auditory, olfactory, gustatory, thermal, tactile, vestibular, gravitational and proprioceptive input. Participants completed six 1-h float sessions over 6 weeks at the LIBR facility in lightproof, soundproof float rooms. Each circular pool (Floataway Inc., Norfolk, United Kingdom; 2.44 m diameter, 0.28 m depth) was filled with >800 kg of Epsom salt, producing a supersaturated solution (specific gravity ~ 1.26) maintained at skin temperature (∼35°C). Participants chose between an open or enclosed pool to support comfort. For further details, see Feinstein et al. (2018a).

Pool-REST Preferred. This condition was identical to Pool-REST; however, it involved increased flexibility of both duration and frequency. Participants completed six sessions in either the open or enclosed pool but were allowed to choose their session length (up to 2 h) and frequency. Participants could choose to float whenever they preferred over a 12-week period, with the only requirement that they needed to wait at least 24 h between sessions.

Chair-REST ("control"). Participants reclined in a zero gravity chair (PC510, Classic Power, Series 2, Human Touch Inc., Long Beach, CA) at the LIBR facility. In this active comparison condition, participants engaged in six weekly 1-h sessions. This condition was created to closely match the Pool-REST conditions in session structure and duration in a room with reduced light and sound, with similar instructions, albeit with less complete attenuation of sound and light than in pool conditions. Unlike the pool conditions, the ambient room temperature (∼23.3°C) and lack of pool environment required participants to remain clothed.

Data Analysis

Dependent variables (DVs). DVs were self-report and clinician-administered scales for depression/affective valence (PANAS, MADRS) and anxiety (HAM-A, STAI-S, ASI-3R). For each of these scales, "difference scores" (post-pre/baseline) were calculated by subtracting the mean of the six pre-float scores from the mean of the six post-float scores (for PANAS: Positive and Negative Affect dimensions and STAI-S) or subtracting baseline from post-intervention (MADRS, HAM-A, ASI-3R). As an alternative to PANAS, we created a measure of positive side effects by averaging participants' ratings of 15 positive side effects collected after each session (see Supplementary Table 1 for schedule of measure administration).

Independent variables (IVs). Initial analyses examined three groups—Pool-REST (Prescribed), Pool-REST Preferred, and Chair-REST—as a between-subjects factor. Given that preliminary findings indicated numerical advantages for both Pool-REST conditions, mediation analyses combined both Pool-REST conditions into a single Floatation-REST group. Subsequent analyses adopted a binary contrast (Pool-REST Preferred versus Chair-REST) to reflect how future Floatation-REST studies would likely be conducted.

Mediator variables. The two types of mediators tested were experiential and interoceptive. The choice of these mediators was informed by prior links between phenomenology and psychedelic outcomes, and interoception and affective disorders. Experiential mediator variables were from dimensions and subscales of the 5D-ASC, completed after each participant's sixth REST session. Interoceptive awareness mediators were from: (i) subscales of the MAIA-S averaged across each participant's first, fourth, and sixth float session; and (ii) the custom post-float questionnaire assessing the pleasantness and intensity of interoceptive sensations, averaged across the six sessions (see Supplementary Figure 1). Given that mediator variables were assessed retrospectively (after the intervention), these mediation models should be interpreted as identifying correlates of symptom change rather than definitive causal pathways.

Covariates. Age (numeric) and sex (binary) were tested as possible covariates. Final model selection was determined by comparing information criteria (AIC, BIC) and R^2. The model including only age provided the best fit and was used for all subsequent mediation analyses.

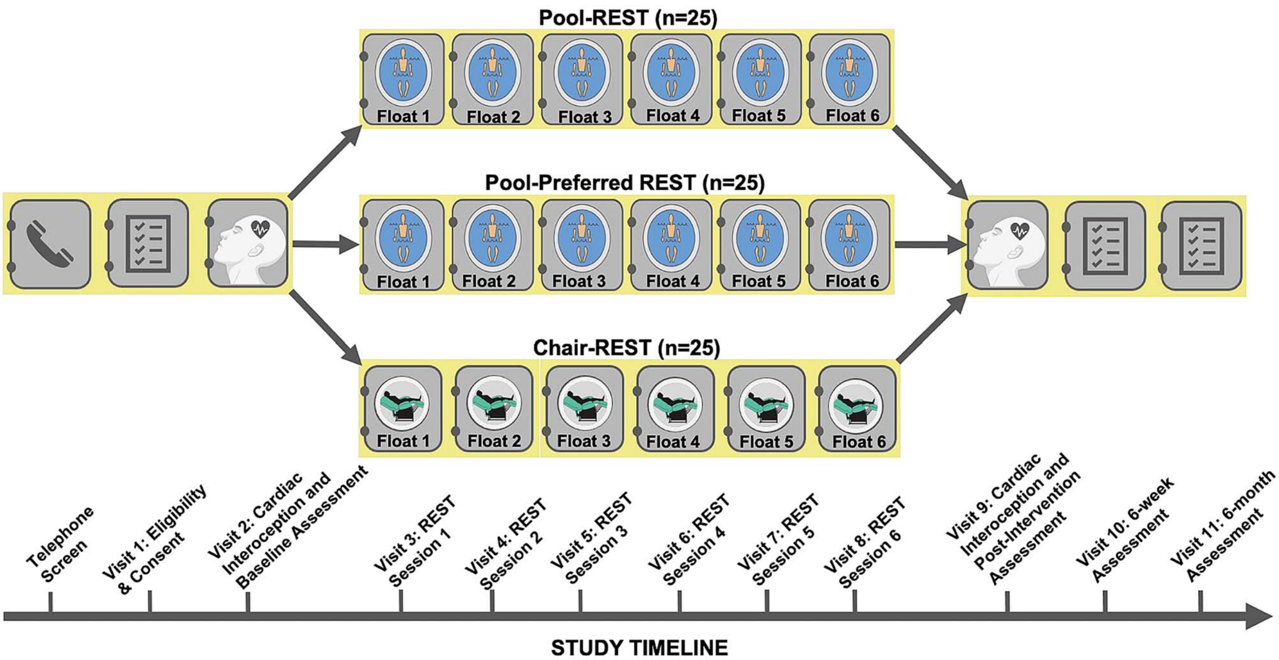

Figure 1 Study visits timeline (reproduced from Garland et al. 2024).

Analytical approach. Mediation analyses were used to test whether experiential or interoceptive variables statistically accounted for observed treatment-related changes in affect. Given the exploratory and secondary nature of this investigation, these models were designed to identify candidate experiential pathways rather than establish definitive causal mechanisms. To address temporal ambiguity, we additionally tested reversed models in which phenomenological variables were treated as outcomes. Our sequential analysis strategy involved: (i) testing between-groups differences in phenomenology and interoception; (ii) qualitatively and quantitatively comparing phenomenology between floating and psychedelics; (iii) examining mediation pathways through structural equation modeling; and (iv) conducting follow-up analyses (e.g. on subscales of significant mediators) to identify the most specific mechanisms and pathways.

Comparison Strategy for ASC Data. We conducted qualitative comparisons with psilocybin using mean values derived from the dose–response equations reported by Hirschfeld and Schmidt (2021) in healthy study participants. As these equations provided only mean estimates without variance parameters, formal inferential testing was precluded. We therefore augmented our analysis with raw data from the Altered States Database (Prugger et al. 2022), identifying 27 dose arms from 19 psilocybin studies ($n = 503$) containing suitable dose–response data and compatible assessment instruments, stratified by dose intensity (see Supplementary Materials).

Statistical tests

1) **Group comparisons.** One-way Analysis of Variance (ANOVA) with Tukey's Honest Significant Differences (HSD) *post hoc* tests were conducted for all continuous DVs (including composite scores). When assumptions of normality (Shapiro–Wilk Test) or homogeneity of variances (Levene's Test) were violated, Welch's ANOVA and Games–Howell *post hoc* tests were used. Kruskal–Wallis tests were used for ordinal DVs (single-item positive side effects ratings). Independent samples t-tests examined binary group comparisons. Welch's t-tests were used to compare pharmacological versus non-pharmacological ASC data. Effect sizes (generalized eta-squared (η^2G) for ANOVAs, and Cohen's d for pairwise comparisons) were reported for all comparisons. For all means (M) reported in text, 95% confidence intervals (CIs) were provided.
2) **Structural equation modeling (SEM).** SEM was conducted comparing Floatation-REST groups (Pool-REST and Pool-REST Preferred) versus Chair-REST, as preliminary analyses demonstrated comparable therapeutic effects across both Floatation-REST conditions relative to the control. This pooling approach provided a more precise estimate of overall Floatation-REST effects while focusing on the contrast of primary theoretical interest. SEM was used for all mediation analyses. Supplementary sensitivity analyses compared Pool-REST Preferred and Chair-REST conditions only.

i. *Immediate effects models* tested mediators and immediate outcome variables iteratively. Follow-up tests were performed with individual subscale components. We also tested reversed mediation models where the proposed mediators (experiential and interoceptive) were treated as DVs and the proposed outcomes were treated as mediators. This flipped approach was important given that mediator variables were collected post-float, which could introduce temporal ambiguity in our proposed mechanistic hypothesis.
ii. *Model Specifications.* Maximum likelihood estimation with bias-corrected and accelerated bootstrap resampling (5000 replications) was applied to create robust, non-parametric CIs for indirect effects (Efron and Tibshirani 1994). Effect sizes were reported as standardized path coefficients (β), R^2, and

proportion mediated for significant indirect effects (indirect effect/total effect) when appropriate.

Multiple comparisons corrections. Due to iterative testing across many subscales and DVs, we applied a False Discovery Rate (FDR) correction ($q = 0.05$) with the Benjamini–Hochberg method for all statistical tests (Benjamini and Hochberg 1995). For ANOVAs, FDR correction was applied within each family of related comparisons: across main effects, across ASC subscale comparisons, and across interoceptive awareness measures. The *post hoc* tests within the "Main Effects" ANOVAs were already corrected for multiple comparisons as part of the specific procedures (e.g. Tukey's HSD, Games–Howell), so FDR correction was not applied. For mediation analyses, FDR correction was applied to the indirect effect within families defined by mediator (phenomenology versus validated interoception subscales versus exploratory interoception measures) and outcome (affect, anxiety, depression) types, resulting in nine total families ranging from 2 to 18 comparisons.

Missing data management. The dataset contained some missing values. Data were not collected when participants withdrew (scheduling conflicts, nonresponse, transportation issues, illness, or low tolerance), with withdrawal rates of 16% in Pool-REST Preferred, 20% in Pool-REST, and 32% in Chair-REST after the six sessions (Garland et al. 2024). Forty participants completed all six Floatation-REST sessions and 17 completed all six Chair-REST sessions (Fig. 2).

Little's Missing Completely at Random (MCAR; Little, 1988) test yielded $P = 1.0$, supporting the MCAR assumption and indicating that missingness was unrelated to observed and unobserved values.

For ANOVAs, we used available-case averaging, including participants with at least one float per measure. This approach maximized data inclusion and demonstrated robustness as nearly identical findings were obtained when the same ANOVAs were rerun with the limited sample ($n = 57$) and the full sample ($n = 70$) with imputed values. For analyses involving the ASC Rating Scale, we restricted the sample to the 57 participants who completed this measure.

Data Analysis Software and Tools. Basic comparisons (e.g., t-tests, ANOVAs) were conducted in R and mediation analyses were conducted in R's *lavaan* (Rosseel 2012). R's *ggplot2* (Wickham 2016) and *gt* (Iannone et al. 2025) were used for data visualization. Missing data patterns were assessed using Python's *pyampute* (Schouten et al. 2018).

Results

Group comparisons

Phenomenological outcomes

Floatation-REST was associated with significant phenomenological alterations across multiple 5D-ASC dimensions. OB showed the most pronounced differences, with a large effect size ($F(2, 35.3) = 9.57$, $pFDR = 0.002$, $\eta^2_G = 0.259$), with both Floatation-REST groups (particularly the Pool-REST Preferred group) significantly outperforming the control group (Pool-REST Preferred versus Chair-REST: $\Delta M = 22.53$ [95% CI: 9.18, 35.88], $P < .001$; Pool-REST versus Chair-REST: $\Delta M = 12.74$ [95% CI: 2.73, 22.76], $P = .010$; Pool-REST Preferred versus Pool-REST: $\Delta M = -9.79$ [95% CI: −22.75, 3.17], $P > .05$) (Fig. 3, Supplementary Table 2).

Anxious Ego Dissolution ($F(2, 31.6) = 7.82$, $pFDR = 0.004$, $\eta^2_G = 0.139$) and Auditory Alterations ($F(2, 34.6) = 4.83$, $pFDR = 0.024$, $\eta^2_G = 0.144$) also displayed significant between-group differences with medium effect sizes (Table 2).

At a more granular phenomenological resolution using the 11-ASC, three subscales within the OB dimension differed significantly between groups: Disembodiment ($F(2, 34.1) = 22.78$, $pFDR < 0.001$, $\eta^2_G = 0.347$), Experience of Unity ($F(2, 35.9) = 6.71$, $pFDR = 0.012$, $\eta^2_G = 0.186$), and Spiritual Experience ($F(2, 33.8) = 5.13$, $pFDR = 0.025$, $\eta^2_G = 0.180$), suggesting Pool-REST participants experienced enhanced alterations in bodily awareness and spatial orientation alongside greater dissolution of self-environment boundaries (Table 3). The Impaired Control and Cognition ($F(2, 29.9) = 12.36$, $pFDR < 0.001$, $\eta^2_G = 0.188$) and Complex Imagery ($F(2, 34.1) = 6.20$, $pFDR = 0.014$, $\eta^2_G = 0.126$) subscales also differed significantly between groups, with the biggest differences occurring between the Pool-REST Preferred and Chair-REST groups (Supplementary Table 2).

Interoception measures

Significant group differences emerged for two MAIA-S subscales: Body Listening ($F(2, 35.8) = 7.00$, $pFDR = 0.010$, $\eta^2_G = .188$) and Emotional Awareness ($F(2, 54) = 7.15$, $pFDR = 0.008$, $\eta^2_G = .209$; Table 4). For Body Listening, both Floatation-REST groups significantly outperformed the control (Pool-REST Preferred versus Chair-REST: $\Delta M = 1.32$ [95% CI: 0.393, 2.247], $P = .003$; Pool-REST versus Chair-REST: $\Delta M = 1.13$ [95% CI: 0.274, 1.991], $P = .007$) but did not differ from each other (Supplementary Table 2). The same was true for Emotional Awareness (Pool-REST Preferred versus Chair-REST: $\Delta M = 1.00$ [95% CI: 0.167, 1.830], $P = .015$; Pool-REST versus Chair-REST: $\Delta M = 0.99$ [95% CI: 0.170, 1.801], $P = .015$).

Large group differences were observed for interoceptive intensity ratings, consistent with Feinstein et al. (2018a). Both Floatation-REST groups reported significantly higher intensity than control on Breath Intensity ($F(2, 54) = 11.88$, $pFDR < 0.001$, $\eta^2_G = 0.306$; Pool-REST Preferred versus Chair-REST: $\Delta M = 23.67$ [95% CI: 9.76, 37.59], $P < .001$; Pool-REST versus Chair-REST: $\Delta M = 23.39$ [95% CI: 8.97, 37.81], $P < .001$) and Heartbeat Intensity ($F(2, 54) = 11.60$, $pFDR < 0.001$, $\eta^2_G = .300$; Pool-REST Preferred versus Chair-REST: $\Delta M = 29.20$ [95% CI: 14.17, 44.22], $P < .001$; Pool-REST versus Chair-REST: $\Delta M = 29.24$ [95% CI: 13.30, 45.19], $P < .001$). All other interoceptive measures were non-significant (all $pFDR > 0.05$), with Self-Regulation approaching significance ($pFDR = 0.054$).

Comparing altered states in Floatation-REST versus psychoactive drugs

To determine whether Floatation-REST induces experiential features that overlap with specific dimensions of psychedelic-induced altered states, rather than to establish equivalence between states, we conducted qualitative and quantitative comparisons using the 5D/11-ASC framework, drawing upon data from a prior meta-analysis that compiled results from 43 experimental studies in healthy individuals, including psilocybin ($n = 327$) and ketamine ($n = 162$) (Studerus et al. 2010). Mean percentages of the theoretical maximum for each subscale under psilocybin and ketamine were extracted from Fig. 4 of Studerus et al. (2010) using WebPlotDigitizer (Rohatgi), following the approach of Prugger et al. (2022).

A visualization of phenomenological profiles revealed distinct patterns across Floatation-REST, Chair-REST, and two psychoactive drugs, psilocybin and ketamine. The two pool conditions (light and dark blue) displayed substantial overlap with ketamine (orange) and psilocybin (black) across multiple subscales, particularly Disembodiment,

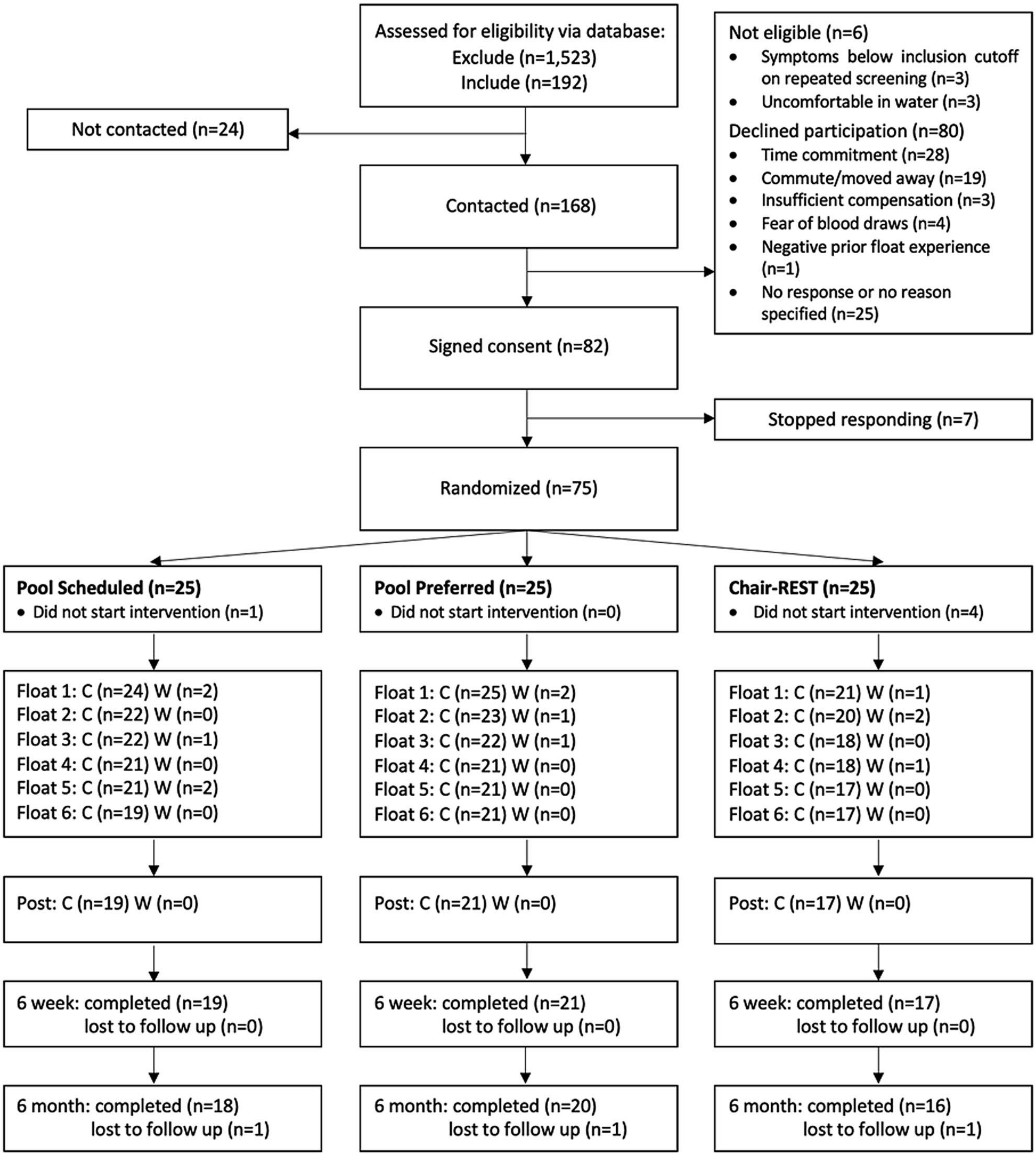

Figure 2 CONSORT diagram (reproduced from Garland et al. 2024).

Table 2 ANOVAs of 5D-ASC subscales.

Subscale	Test	Estimate (*F*)	df1	df2	*P*	Generalized eta	FDR *P*
Oceanic Boundlessness	**Welch ANOVA**	**9.57**	**2**	**35.3**	**<.001**	**0.259**	**.002**
Anxious Ego Dissolution	**Welch ANOVA**	**7.82**	**2**	**31.6**	**.002**	**0.139**	**.004**
Visionary Restructuralization	Welch ANOVA	3.39	2	35.4	.045	0.116	.056
Auditory Alterations	**Welch ANOVA**	**4.83**	**2**	**34.6**	**.014**	**0.144**	**.024**
Reduction of Vigilance	One-way ANOVA	1.79	2	54.0	.177	0.062	.177

Table 3 ANOVAs of 11-ASC subscales. All Welch's ANOVAs.

Subscale	Estimate (*F*)	df1	df2	*P*	Generalized eta	FDR *P*
Experience of Unity	**6.71**	**2**	**35.9**	**.003**	**0.186**	**.012**
Spiritual Experience	**5.13**	**2**	**33.8**	**.011**	**0.180**	**.025**
Blissful State	2.66	2	35.8	.084	0.093	.132
Insightfulness	3.53	2	35.4	.040	0.149	.074
Disembodiment	**22.78**	**2**	**34.1**	**<.001**	**0.347**	**<.001**
Impaired Control and Cognition	**12.36**	**2**	**29.9**	**<.001**	**0.188**	**<.001**
Anxiety	1.94	2	32.8	.160	0.032	.176
Complex Imagery	**6.20**	**2**	**34.1**	**.005**	**0.126**	**.014**
Elementary Imagery	2.18	2	35.4	.128	0.079	.156
Audio-Visual Synesthesia	0.29	2	35.9	.747	0.013	.747
Changed Meaning of Percepts	2.38	2	35.0	.107	0.079	.147

Table 4 ANOVAs of Interoception subscales from the MAIA-S and Custom post-float questions.

Subscale	Test	Estimate (*F*)	df1	df2	*P*	Generalized eta	FDR *P*
Self-Regulation	One-way ANOVA	4.25	2	54.0	.019	0.136	.054
Body Listening	**Welch ANOVA**	**7.00**	**2**	**35.8**	**.003**	**0.188**	**.010**
Noticing	Welch ANOVA	1.85	2	35.3	.172	0.059	.302
Not Distracting	Welch ANOVA	0.82	2	36.0	.447	0.026	.481
Not Worrying	Welch ANOVA	0.86	2	34.4	.430	0.028	.481
Attention Regulation	One-way ANOVA	2.89	2	54.0	.064	0.097	.150
Emotional Awareness	**One-way ANOVA**	**7.15**	**2**	**54.0**	**.002**	**0.209**	**.008**
Trusting	Welch ANOVA	2.50	2	35.1	.097	0.076	.194
Breath Intensity	**One-way ANOVA**	**11.88**	**2**	**54.0**	**<.001**	**0.306**	**<.001**
Heartbeat Intensity	**One-way ANOVA**	**11.60**	**2**	**54.0**	**<.001**	**0.300**	**<.001**
Stomach/Digestive Intensity	Welch ANOVA	1.36	2	35.5	.269	0.045	.418
Breath Pleasantness	Welch ANOVA	1.13	2	34.7	.334	0.032	.468
Heartbeat Pleasantness	Welch ANOVA	0.83	2	34.6	.445	0.024	.481
Stomach/Digestive Pleasantness	Welch ANOVA	0.07	2	33.4	.929	0.002	.929

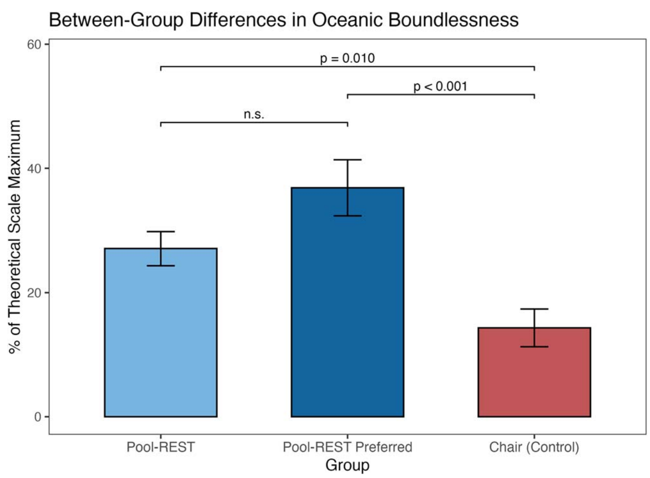

Figure 3 Comparison of OB (5D-ASC) across REST conditions. Error bars represent standard error of the mean and *P*-values reflect *post hoc* Games-Howell comparisons.

Experience of Unity, and Blissful State (Fig. 4). Both pharmacological conditions were characterized by marked perceptual alterations—Elementary and Complex Imagery, Changed Meaning of Percepts, and Audio-Visual Synesthesia—especially for psilocybin. Notably, overlap was most pronounced for OB dimensions (Disembodiment, Experience of Unity, Blissful State), whereas perceptual and imagery-related dimensions remained largely distinct. Additionally, the Pool-REST Preferred group exhibited higher scores on the Spiritual Experience subscale than ketamine or psilocybin. The Chair-REST control condition (red) produced minimal ASCs.

Utilizing the dose-dependent psilocybin data described previously, we conducted qualitative and quantitative phenomenological comparisons with Floatation-REST. Welch's t-tests indicated that Floatation-REST did not significantly differ from low-dose psilocybin in subscales such as Experience of Unity (Pool-REST versus psilocybin low mg, $P = .992$), Disembodiment (Pool-REST Preferred versus psilocybin low mg, $P = .948$), Bliss ($P = .920$), and several others (Anxiety, Insightfulness, Impaired Control and Cognition; Fig. 5, Supplementary Table 3). In contrast, subscales like Elementary Imagery, Complex Imagery, Changed Meaning of Percepts, and Audio-Visual Synesthesia more frequently showed significant differences between high doses of psilocybin and Floatation-REST (Fig. 5, Supplementary Table 3).

Exploratory mediation of the effects of Floatation-REST

We observed improvements in pre- to post-intervention measures of mood (PANAS), depression (MADRS), and anxiety (HAM-A, STAI-S, ASI-3R) across all three groups (all $P < .001$; see Supplementary Table 4). Due to the lack of significant between-group differences in clinical

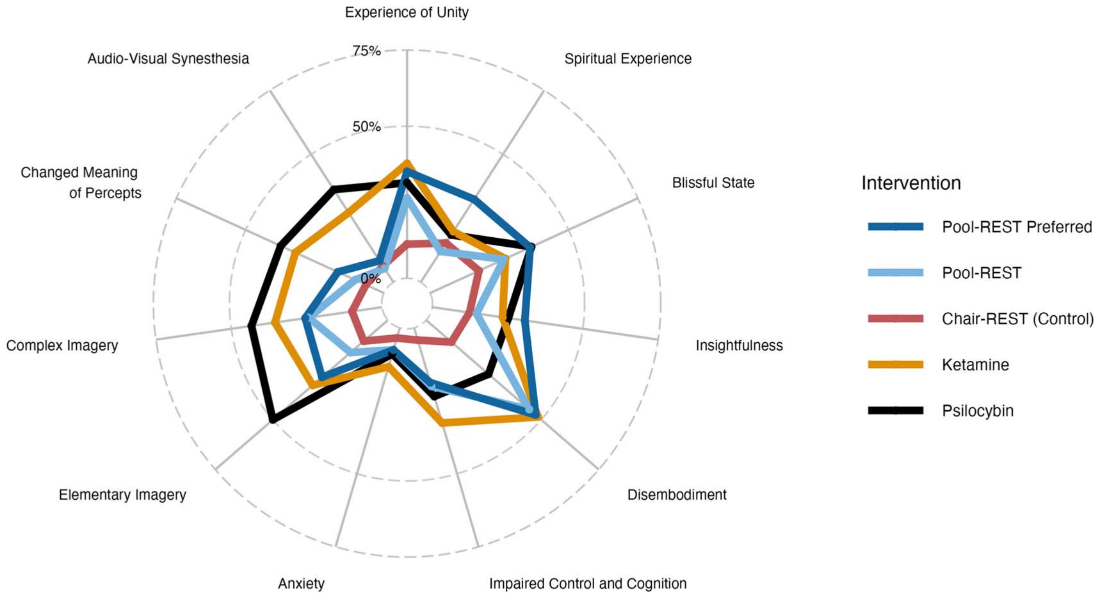

Figure 4 Radar plot of subscale scores from the ASC rating scale (11-ASC), comparing the phenomenology of Floatation-REST in individuals with anxiety and depression versus pharmacologic interventions drawn from studies of healthy individuals (Studerus et al., 2010). Values expressed as percentages of the theoretical maximum.

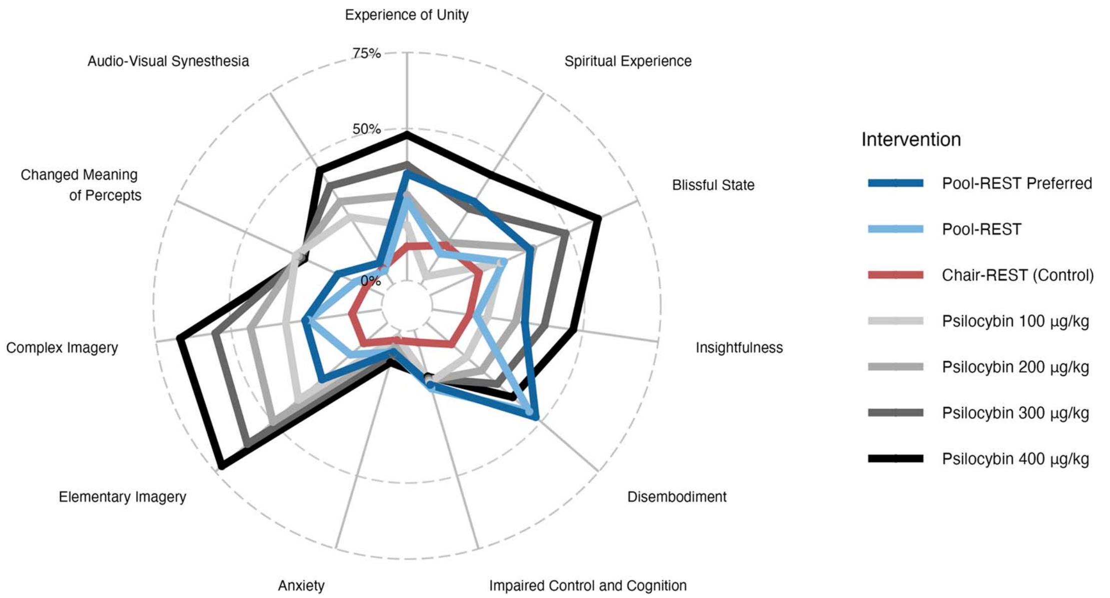

Figure 5 Radar plot of subscale scores from the ASC rating scale (11-ASC), comparing the phenomenology of Floatation-REST in individuals with anxiety and depression versus different doses of psilocybin (100, 200, 300, and 400 μg/kg) in 193 healthy individuals (from Hirschfeld and Schmidt 2021; see Supplemental Materials for more information). Values expressed as percentages of the theoretical maximum.

variables (see Supplementary Table 5), the mediation tests were conducted *a priori* ("by design") as opposed to a posteriori ("for explanation") (Fairchild and McDaniel 2017). In exploratory mediation analyses (see Supplemental Analyses for more information), one experiential mediator, OB, emerged as a significant mediator of Positive Affect (PANAS; indirect effect (ab) unstandardized = 2.633, 95% CI [1.020, 4.719], indirect effect (ab) standardized = 0.223, $pFDR = 0.024$, $R^2 = 0.219$) and depression (MADRS; indirect effect (ab) unstandardized = −3.415, 95% CI [−6.527, −1.235], indirect effect (ab) standardized = −0.188, $pFDR = 0.014$, $R^2 = 0.138$) following FDR correction.

In these models, the Pool-REST groups exhibited markedly higher OB scores than Chair-REST (a = 18.527, 95% CI [9.58, 24.46], $\beta = 0.472$, $P < .001$), which in turn were associated with greater increases in Positive Affect (b = 0.142, 95% CI [0.067, 0.213], $\beta = 0.473$, $P < .001$) and greater decreases in depression (b = −0.184, 95% CI [−0.347, −0.054], $\beta = -0.399$, $P < .001$). For the Positive Affect model, the total effect was not significant (c = 2.504, 95% CI [−1.245, 5.246], $P = .115$), and the direct effect was near zero (c′ = −0.129, $P = .940$, 95% CI [−4.064, 2.771]), suggesting that, relative to Chair-REST, the Pool-REST Preferred and Pool-REST conditions enhanced Positive Affect (PANAS) indirectly by increasing feelings of OB (see Fig. 6). Notably, these two models

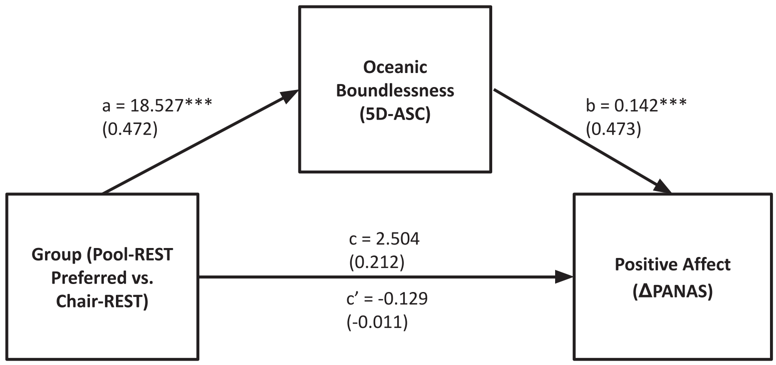

Figure 6 Significant mediation of changes in PANAS positive affect by OB during Floatation-REST. The mediation model survived FDR correction, with unstandardized (and standardized) path coefficients. Significance levels: * $P < .05$, ** $P < .01$, *** $P < .001$.

demonstrated high explained variance compared to other models ($R^2 = 0.219$ and 0.138, respectively), with bootstrapped 95% CIs for the indirect effects excluding zero in the Pool-REST Preferred versus Chair-REST comparison at follow-up (Supplementary Table 6).

Across all other mediation models ($n = 64$; see Supplementary Table 6), no mediator–outcome pair remained statistically significant following FDR correction. Several mediators—Body Listening and Self-Regulation (MAIA-S), as well as Breath and Heart Intensity—approached statistical significance in relation to Positive Affect. Follow-up models testing the 11-ASC subscales of Oceanic Boundlessness are reported in Supplementary Table 7, and sensitivity analyses restricted to Pool-REST Preferred vs. Chair-REST are reported in Supplementary Table 8. Flipped mediator–outcome models yielded no significant indirect effects (Supplementary Table 9).

Discussion

The present findings can be understood across three analytically distinct levels: (i) environmental induction conditions (sensory attenuation, buoyancy, thermal neutrality), (ii) phenomenological state descriptors (e.g. OB, Disembodiment, Experience of Unity), and (iii) putative mechanisms linking these states to affective change. While the present study directly measures the first two levels, mediation analyses suggest—but do not prove—that specific phenomenological dimensions statistically account for affective improvements. We refer to this reproducible pattern of altered experience as *aquahenosis* (oneness with water): a non-pharmacologically induced non-ordinary state of consciousness characterized by interoceptive enhancement, positively-valenced dissolution of self-world boundaries, altered bodily self-location or disembodiment, and reduced exteroceptive salience.

Experiential distinctions and autonomy

Participants in the Pool-REST Preferred condition, wherein participants controlled the session timing and duration, demonstrated the highest OB scores, with particularly elevated Disembodiment and Experience of Unity subscale scores. This pattern suggests that longer float sessions (e.g. 75 min on average) may elicit self-transcendent experiences more strongly than shorter durations. Following Yaden et al. (2017), we define self-transcendent experiences as states characterized by a temporary loss of salience of the self and a corresponding increase in feelings of connectedness. These states range in intensity, from mild boundary softening to complete ego dissolution. It is also possible that increases in perceived control in this condition (i.e. due to scheduling flexibility) reduce defensive psychological barriers, facilitating surrender to the consciousness alterations that Floatation-REST enables. This interpretation aligns with self-determination theory (Ryan and Deci 2000) and research demonstrating that patient treatment preferences enhance therapeutic outcomes (Swift and Callahan 2009).

The Disembodiment items (“I felt as if I no longer had a body”; “I had the impression I was out of my body”) and Experience of Unity items (“Everything seemed to unify into a oneness”; “I felt one with my surroundings”) capture dissolution of ordinary self-world boundaries—experiences particularly afforded by the float pool’s ability to match the temperature of the air and water to the temperature of the skin, which can blur the boundary of self and environment. These represent positive, expansive ego dissolution.

However, Floatation-REST also induced negatively-valenced phenomenology, with significantly greater Anxious Ego Dissolution and Auditory Alterations on the 5D-ASC in the Floatation-REST groups, as well as elevated Complex Imagery and Impaired Control and Cognition on the 11-ASC. Yet contrary to findings from the psychedelics literature where Anxious Ego Dissolution significantly mediates negative outcomes (Roseman et al. 2018), Anxious Ego Dissolution showed no significant mediation effects across all outcome measures in the present study (all Ps $> .05$; see Supplementary Table 6 and 10). Floatation-REST thus appears to primarily facilitate an “oceanic” rather than “anxious” dissolution. This was a difference that made a difference: OB—particularly Experience of Unity and Blissful State—mediated positive affective change (see Supplementary Table 7), as well as positive side effects (Supplementary Tables 10 and 11), whereas Anxious Ego Dissolution did not. This valence asymmetry is mechanistically plausible: by attenuating gravitational load and matching water temperature to skin, Floatation-REST may help to remove the very sensory cues that demarcate body from environment, scaffolding dissolution as an “extension” of self rather than its threatening loss. Consistent with established phenomenological distinctions, derealization and depersonalization vary substantially in affective tone and experiential structure and are not inherently pathological (Fort et al. 2025, Costines and Schmidt 2026).

Enhanced interoceptive awareness in Floatation-REST

Floatation-REST was associated with marked self-reported interoceptive awareness enhancements compared to Chair-REST, with significant group differences for several MAIA subscales, Body Listening (“I listened for information from my body about my emotional state”), Emotional Awareness (“I noticed how my body changed when I felt happy/joyful"), as well as visual analog ratings of Breath Intensity, and Heartbeat Intensity. The increased intensity of cardiorespiratory sensations during Floatation-REST replicates our prior research (Feinstein et al. 2018a, Khalsa et al. 2020). We propose that Floatation-REST increases the salience of interoceptive signals while simultaneously relaxing exteroceptive and proprioceptive constraints, creating conditions under which self-models become more labile. In this context, dissolution of self-world boundaries may be experienced as expansive rather than threatening, consistent with the selective mediation of OB rather than Anxious Ego Dissolution. Body dissolution may be further facilitated by thermosensory modulation (i.e. heating the water and air to skin temperature) (Salvato and Crucianelli 2025), creating a unique embodied state (Hruby et al. 2024) where the boundaries of the external body dissolve. This enhancement of interoceptive sensation may explain why both Body Listening and Emotional Awareness were heightened in the float environment. These two facets of interoceptive awareness are critically important for emotion regulation (Lazzarelli et al. 2024) and future studies will need to determine whether these effects extend beyond the float experience.

One aspect of these findings warrants comment: heightened interoceptive intensity and heightened body dissolution seem contradictory, requiring opposite shifts in bodily awareness. We propose they are linked rather than opposed—attending closely to bodily signals familiarizes them, so they generate less prediction error and, with it, less salience, until the felt boundary fades (see Becattini et al. 2026, for a predictive-processing account in body-scan meditation). Floatation may amplify this trajectory: skin-matched water and the near-absence of gravity first expand the body's felt extent, then leave fewer boundary-defining signals for sustained attention to attenuate, while also modulating autonomic tone (Feinstein et al. 2018a, Flux et al. 2022). Our questionnaires, however, capture the session as a whole and likely average transient oscillations between interoceptive focus, boundary dissolution, and shifting valence into single retrospective scores. Methods that track temporal trajectories, such as Temporal Experience Tracing (Jachs et al. 2022), are needed to test this directly.

Phenomenological comparability with psychedelics

The relevance of these comparisons lies not in clinical substitution, but in identifying modality-invariant dimensions of altered consciousness. Visual comparison of 5D-ASC data revealed several phenomenological similarities between Floatation-REST and both psilocybin and ketamine, particularly for Experience of Unity and Disembodiment. Notably, these were the same dimensions that differentiated Floatation-REST from the control condition. Experiential convergence is particularly significant given emerging evidence that mystical-type experiences account for a majority of meaningful therapeutic evidence (e.g. depression and anxiety in life-threatening cancer; Griffiths et al. 2016) and positive behavioral changes (e.g. smoking cessation; Garcia-Romeu et al. 2014) following a psychedelic experience. It is worth pointing out that OB has been found to be a primary predictor of therapeutic success in psychedelic therapy, accounting for up to 59% of variance in clinical outcomes (Ko et al. 2022, Romeo et al. 2025). The observed similarity between floating and ketamine is consistent with a recent paper that used natural language processing to show that textual reports of ketamine and Floatation-REST experiences exhibited overlapping thematic profiles, such as personal growth and self-dissolution (Dikovskaya et al. 2025). This suggests Floatation-REST provides access to specific non-ordinary states traditionally associated with psychedelic compounds, potentially democratizing these therapeutic states by eliminating pharmacological, legal, and cultural barriers.

While psilocybin and ketamine induced perceptual alterations including elementary imagery, audio-visual synesthesia and changed meaning of percepts, Floatation-REST produced minimal scores on these dimensions, perhaps due to the absence of exteroceptive stimulation. Instead, Floatation-REST selectively induced boundary-dissolution aspects of psychedelic phenomenology (Hruby et al. 2024). This selective induction may explain Floatation-REST's favorable safety profile.

During psychedelic experiences, adverse effects like headaches and increased anxiety can be quite common, in some cases affecting over three-quarters of participants (Goodwin et al. 2022, Simonsson et al. 2024). In contrast, adverse effects during Floatation-REST are rare, with multiple studies demonstrating minimal risk and an overall strong safety profile (Feinstein et al. 2018b, Garland et al. 2024, Khalsa et al. 2020). By reliably producing self-transcendent states that drive therapeutic change in the context of minimal perceptual alterations, Floatation-REST may offer a considerably safer route toward achieving certain types of ASCs.

Mediation of acute effects

Mediation analyses revealed that OB mediated the benefits of Floatation-REST for Positive Affect (PANAS) and depression (MADRS) such that Floatation-REST, relative to Chair-REST, increased feelings of OB which was associated with increased Positive Affect and decreased depression scores. Because phenomenology was assessed retrospectively, these mediation models should be interpreted as identifying experiential correlates of treatment response rather than definitive causal intermediaries. OB also mediated other positive experiential outcomes (Supplementary Tables 10 and 11), particularly the composite score of 15 positive side effects, with specific effects on Refreshment, Relaxation, and Pain Free Existence. These results suggest that positively-valenced aspects of derealization, rather than anxiety-producing qualities captured by Anxious Ego Dissolution (Preller and Vollenweider 2018), drive Floatation-REST's therapeutic outcomes. These findings align with Hruby et al. (2024), who identified body boundary-dissolution, a common theme of OB, as the primary mediator of Floatation-REST's anxiolytic effects. They also correspond with neuroimaging evidence showing reduced resting-state functional connectivity in the posterior default mode network and somatosensory cortices during Floatation-REST (Al Zoubi et al. 2021). This convergent phenomenological, behavioral, and neural evidence supports a modality-invariant model wherein consciousness-altering interventions, whether induced intrinsically, pharmacologically, or technologically, achieve therapeutic effects through self-transcendent experiences, most likely through reorganization of self-related processing. The induction of positively-valenced OB may help explain why Floatation-REST is well tolerated across clinical populations. This profile raises the possibility that Floatation-REST could function either as an alternative pathway to self-transcendent states for individuals contraindicated for psychedelic therapy, or as a preparatory context that familiarizes individuals with boundary-dissolution experiences prior to pharmacological interventions.

Conclusion

The historical trajectory of sensory deprivation tanks presents a compelling full-circle narrative: float tanks, originally developed by

Lilly (1956) to explore whether consciousness could persist without external stimulation, demonstrated from their inception the capacity to induce profound altered states without pharmacological intervention. This potential for non-pharmacological altered states takes on new significance given the ongoing debate about whether subjective phenomenological experiences are necessary for psychedelic therapy's clinical benefits (Hashimoto 2025). Some researchers argue that direct pharmacological mechanisms alone may be sufficient, pointing to the development of novel 5-HT2A receptor agonists with reduced psychedelic propensities (Kaplan et al. 2022), theoretical frameworks suggesting subjective effects may be unnecessary for therapeutic outcomes (Olson 2021), and case reports of antidepressant responses to psilocybin in the absence of typical psychedelic effects (Rosenblat et al. 2023). However, the preponderance of evidence increasingly suggests that conscious phenomenological experiences, particularly OB and mystical-type experiences, are not merely epiphenomena but essential components of therapeutic outcomes, with studies demonstrating that the depth and quality of subjective experiences explain large swaths of variance in clinical improvements and functional brain changes (Roseman et al. 2018, Carhart-Harris et al., 2017).

Floatation-REST represents a viable non-pharmacological pathway to specific consciousness alterations traditionally associated with psychedelic compounds, while maintaining superior safety and accessibility profiles. Though Floatation-REST does not replicate the full phenomenological spectrum of psychedelics (particularly visual and perceptual alterations), it reliably induces critical experiential dimensions including OB, Experience of Unity, and Disembodiment. These findings contribute substantive evidence demonstrating that Floatation-REST provides a non-pharmacological route toward inducing therapeutically-relevant ASCs.

Beyond its clinical implications, this work positions Floatation-REST as a tractable, non-pharmacological model for studying ASCs. By selectively inducing boundary-dissolution experiences through controlled sensory perturbation, Floatation-REST offers a unique window into how bodily self-models and interoceptive awareness shape conscious experience. These findings contribute to a growing view that self-transcendent states represent a dimension of human consciousness with relevance across neuroscience, psychiatry, and contemplative science.

Limitations

Several limitations warrant consideration. First, the modest sample size limited statistical power and precluded more complex models, including serial mediation analyses that could clarify causal cascades linking interoceptive awareness, phenomenology, and clinical outcomes. Second, ASCs were assessed only after the final float session, introducing temporal ambiguity regarding whether reported phenomenology reflects cumulative experience, peak effects, or session-specific states. This limits inferences about how phenomenological changes evolve across sessions or track symptom trajectories. Third, comparisons with psychedelic-induced altered states should be interpreted cautiously given heterogeneity in source studies, differences between healthy and clinical samples, data constraints within existing altered-states databases, and the use of visual, qualitative comparisons (i.e. radar plots) rather than direct statistical comparisons; future work with participant-level data could enable direct statistical testing. Notably, the finding that spiritual experience scores in Pool-REST preferred exceeded those in psychedelics is limited by two factors: participants did not undergo both conditions, and the psilocybin data are stratified by dose. At higher doses (e.g. 400 μg/kg), spiritual experience scores surpassed those observed in Pool-REST preferred sessions, suggesting the inversion may be partly attributable to collapsing across dose. Together, these limitations underscore the exploratory nature of the present findings and motivate larger, longitudinal, and mechanistically targeted studies.

Future directions

Several directions for future research emerge from these findings. Within-subject crossover designs directly comparing Floatation-REST and psychedelic interventions would provide a more rigorous test of whether non-pharmacological sensory perturbations can induce altered states comparable in magnitude and structure to pharmacologically induced experiences. Longitudinal assessment of phenomenology across float sessions would further clarify how altered states evolve over time, identify critical windows for therapeutic or experiential shifts, and enable formal testing of dose–response relationships.

Larger-scale studies will be needed to test serial mediation models examining how changes in interoceptive awareness give rise to specific phenomenological states that, in turn, support affective or clinical improvements. Characterizing individual difference factors—such as absorption, openness to experience, or baseline interoceptive accuracy—may further enable personalized matching to consciousness-altering interventions and help predict whether ego dissolution is experienced as anxious or oceanic.

The selective convergence between Floatation-REST and psychedelic phenomenology, particularly along the dimension of OB, suggests opportunities to study Floatation-REST as a preparatory or adjunctive intervention for psychedelic-assisted therapy. Such approaches could reduce anxiety surrounding altered states, enhance receptivity to self-transcendent experiences, or potentially allow lower pharmacological doses while preserving therapeutic mechanisms.

Future work should also examine whether educational and contemplative scaffolding around the float experience (particularly intention-setting before sessions and structured integration afterward) can modulate the valence of any ego-dissolution phenomenology that emerges and, in turn, the magnitude of downstream therapeutic effects. Such pre- and post-session framing is increasingly central to psychedelic-assisted therapy (Carhart-Harris et al. 2018, Watts and Luoma 2020), and analogous evidence from contemplative training (Dahl et al. 2015) suggests that interpretive frameworks shape whether self-deconstructive states are experienced as expansive or threatening.

From a broader neuroscience of consciousness perspective, Floatation-REST offers a safe, legal, and experimentally tractable model for investigating how controlled sensory environments reshape bodily self-models and conscious experience. Future work integrating neuroimaging, computational modeling, and economic analyses of scalability may help position Floatation-REST within a broader ecosystem of consciousness-altering interventions, clarifying when and how non-pharmacological approaches can complement or substitute pharmacological ones.

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Supplementary data

Supplementary data are available at *Neuroscience of Consciousness* online.

Conflict of interest

J.F. receives funding from the Bial Foundation and consulting fees from IAMA Therapeutics, both unrelated to this project. S.K. has performed scientific consulting for Janssen Pharmaceuticals, previously served on a data monitoring committee for Engrail Pharmaceuticals, and is a member of several executive boards (uncompensated): the International Society for Contemplative Research and the Float Research Collective.

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Data availability

The data may be made available upon request to the corresponding author. The analysis code used in this study is publicly available at GitHub: https://github.com/Institute-for-Advanced-Consciousness/Float.

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