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ORIGINAL RESEARCH PAPER

Perceptions of psychedelic personality change, determinants of use, setting and drug moderation: Toward a holistic model

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ABSTRACT

Background: Studies have shown evidence for long-term effects of psychedelics on personality, but comprehensive models of psychedelic-mediated personality changes have yet to be explored. *Aims:* The present study aims to investigate (1) perceptions of personality change in the general population, (2) moderators of perceived personality change including setting and drug type, and (3) whether personality predisposes individuals to use psychedelics. *Method:* Paid participants with experience using psychedelic ($N = 218$), non-users with interest in using psychedelics ($N = 104$), and non-users without interest in using psychedelic ($N = 104$) completed an online survey following recruitment from Amazon Mechanical Turk. Psychedelic users were asked to complete written open-ended accounts of perceived personality changes that they attribute to their most intense psychedelic experience. Thematic and factor analyses were undertaken to identify themes of perceived psychedelic change and their organizational structure. *Results/Outcomes:* Thematic analyses resulted in 52 unique personality change themes, and exploratory factor analyses yielded eight thematic factors (Unitive Spiritual, Gratitude Absorption, Purpose Freedom, Compassion Understanding, Emotional Stability, Openness Perspective, Connection to Self, and Neuroticism Caution). Interest in psychedelic use among non-users was associated with higher openness and neuroticism. Psychedelic users tended to be more open and extraverted, and less neurotic than non-users, and interested non-users tended to be higher in openness than uninterested non-users. *Conclusion/Interpretation:* The present results inform a tentative model of how personality leads to psychedelic use, how psychedelic use leads to changes in personality, and how setting and drug moderate different types of changes in personality. Research and clinical implications are discussed, including (1) hypotheses for future prospective and experimental research, (2) the value of creating multi-faceted, holistic measures that reflect the diversity and organizational structure of possible psychedelic changes, and (3) the value of allowing such evidence to guide novel psychedelic-assisted therapeutics.

KEYWORDS

psychedelics, psilocybin, LSD, personality, self, personality change, nature-relatedness

INTRODUCTION

The last twenty years of research on psychedelics has observed long-term effects on mental health (e.g., Carhart-Harris et al., 2018; Gukasyan et al., 2022), personality (Erritzoe et al., 2018; Netzband, Ruffell, Linton, Tsang, & Wolff, 2020; B. M. Weiss, Miller, Carter, & Keith Campbell, 2021; Weiss et al., 2023), and philosophical beliefs (Nayak, Singh, Yaden, &

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Griffiths, 2022; Timmermann et al., 2021). Most previous studies have examined these effects using pre-selected outcome measures or have conducted qualitative studies examining areas and processes of change proximal to specific mental health disorders such as depression (Belser et al., 2017; Watts, Day, Krzanowski, Nutt, & Carhart-Harris, 2017). These approaches have been richly informative, but there still exists no overall model of psychedelic change that integrates disparate aspects of changes in the self, spanning personality, mental health, spirituality, cognition, and belief. One preliminary step for deriving such a unified model involves examining open-ended personal accounts of *perceived* psychedelic-induced change without an a priori bias toward particular types of change. Using this method, the present study aims to generate a model of psychedelic change that is inclusive of the diversity of trait changes individuals in the general population attribute to their psychedelic experiences. Although this method runs the risk of registering false perceptions of change or misattributions to psychedelic experience, we believe, as a preliminary step, it is likely to capture a comprehensive variety of actual psychedelic-induced changes whose veridicality future prospective and experimental tests can adjudicate.

An additional purpose of the present study is to investigate whether certain traits predispose or promote the inclination to use psychedelics. Such information would inform the existence of positive or negative feedback loops whereby certain personality traits promote psychedelic use, which may in turn reduce or promote these traits.

Evidence of actual change in personality

A moderately-sized literature of cross-sectional and prospective findings offers preliminary, albeit mixed, evidence that psychedelic compounds accompany meaningful changes in personality (Bouso, Dos Santos, Alcázar-Córcoles, & Hallak, 2018). Cross-sectional studies comparing lifetime users of psychedelic compounds and healthy controls have indicated that lifetime users exhibit lower Temperament and Character Inventory (TCI) (Cloninger, Svrakic, & Przybeck, 1993) **Harm Avoidance**, characterized by dispositions toward worry, fear of uncertainty, shyness, and fatigability (Bouso et al., 2012, 2015; Grob et al., 1996; Schneider Jr et al., 2015), higher TCI **Novelty Seeking**, characterized by responsiveness to potential rewards and punishments and exploration of unfamiliar situations (Révész et al., 2021), higher TCI **Reward Dependence**, characterized by tendencies to respond to signals of reward including social approval, support, and sentiment (Bouso et al., 2012), lower TCI **Cooperativeness**, characterized by agreeable relations with others (Révész et al., 2021), higher TCI **Self-Transcendence**, characterized by spirituality and consciousness of being part of something greater than the individual self (Bouso et al., 2015; Jiménez-Garrido et al., 2020; Révész et al., 2021; Schneider Jr et al., 2015), and higher **FFM Openness**, characterized by intellectual curiosity, aesthetic sensitivity, and imagination (Barbosa et al., 2016; Nour & Carhart-Harris, 2017). Cross-sectional findings, however, limit interpretation as significant differences found between users of psychedelic compounds and non-users may be attributable to stable, preexisting personality traits that predispose use rather than psychedelic-induced change.

Despite containing mixed results, prospective research may provide strongest evidence for pre-post decreases in Neuroticism or TCI Harm Avoidance (Barbosa, Cazorla, Giglio, & Strassman, 2009; Erritzoe et al., 2018; Fernández et al., 2014; Kiraga et al., 2021; Netzband et al., 2020; B. Weiss, V. Nygart, et al., 2021; B. M. Weiss, Miller, et al., 2021). Of the sixteen studies that have endeavored to prospectively investigate personality change, 44% have observed decreased Neuroticism, and this finding has been observed in the context of studies containing randomization and placebo-control (Erritzoe et al., 2018), comparisons to a control group (Netzband et al., 2020), and peer-ratings (B. M. Weiss, Miller, et al., 2021). Similar evidentiary support exists for Openness which has shown increases in 44% of studies (Carhart-Harris et al., 2016; Erritzoe et al., 2018; Griffiths et al., 2018; MacLean, Johnson, & Griffiths, 2011; Madsen et al., 2020; Weiss et al., 2023; B. Weiss, J. D. Miller, et al., 2021). More *inconsistently* replicated increases have been found for Extraversion or TCI Self-directedness (19% of studies) (Erritzoe et al., 2018; Fernández et al., 2014; Weiss et al., 2023; B. M. Weiss, Miller, et al., 2021), Agreeableness (25%) (Carhart-Harris et al., 2016; Netzband et al., 2020; B. Weiss, V. Nygart, et al., 2021; Weiss et al., 2023; B. M. Weiss, Miller, et al., 2021), and Conscientiousness (19%) (Barrett, Doss, Sepeda, Pekar, & Griffiths, 2020; Schmid & Liechti, 2018; B. M. Weiss, Miller, et al., 2021).

In summary, the strongest evidence for personality change following psychedelic use is for decreased neuroticism and related traits, and an increase in openness and related traits, but there is a great deal of variability in research design and participant samples.

Qualitative evidence of psychedelic personality change

Qualitative work is useful for revealing contents of changes processes that are not yet recognized and instantiated in quantitative measures. Qualitative designs are important for fields like psychedelic science, whose models are not yet well defined, as they promote exploration into inner experiences and meanings that can be more narrowly examined in subsequent quantitative work. For example, the Five-Factor Model of personality (FFM, Costa & McCrae, 2008) possesses impressive internal consistency, retest reliability, replicability, and descriptive power, which constitute valuable properties for the measurement of psychedelic-induced personality changes. However, it remains possible that its factor structure meaningfully diverges from the factor structure of psychedelic-induced trait changes, and that it excludes traits with high germaneness to psychedelic change, e.g., spiritual or meta-cognitive traits (Lace, Evans, Merz, & Handal, 2020; Lemos & Oñate, 2018).[1]

[1]While acknowledging that these additional traits are likely to fit within its factor structure, examining them saliently may be helpful in the context of psychedelic therapeutics.

Qualitative research on classic psychedelics constitutes a fairly small body of literature, consisting of examinations of interviews of participants in non-Western treatment (Loizaga-Velder & Verres, 2014; Presser-Velder, 2013) and ceremonial (Kavenská & Simonová, 2015; Shanon, 2002) settings, written reports of psychedelic experience found on online forums (Bersani et al., 2014; Kjellgren & Soussan, 2011), as well as phenomenological and content analyses of subjective experience in recreational (Shaw, Rea, Lachowsky, & Roth, 2022) and clinical treatment settings (Belser et al., 2017; Gasser, Kirchner, & Passie, 2015; Griffiths et al., 2008, 2011; Turton, Nutt, & Carhart-Harris, 2014; Watts et al., 2017), covering a variety of compounds including psilocybin (Turton et al., 2014), Lysergic acid (LSD) (Gasser et al., 2015), ayahuasca (Loizaga-Velder & Verres, 2014), 25C-NBOMe (Bersani et al., 2014), and 4-HO-MET (Kjellgren & Soussan, 2011).

A systematic review of qualitative findings is beyond the remit of the present work. However, it bears briefly presenting accounts of psychedelic-attributed changes including (1) feelings of connectedness (Belser et al., 2017; Kjellgren & Soussan, 2011; Watts et al., 2017); (2) relational embeddedness, i.e., the salience and importance of relationships, and forgiveness of longstanding resentments (Belser et al., 2017; Bersani et al., 2014; Kavenská & Simonová, 2015); (3) orientation to authentic values, life priorities, and identity (Belser et al., 2017; Kavenská & Simonová, 2015; Shaw et al., 2022; Watts et al., 2017); (4) present-focused awareness (Kjellgren & Soussan, 2011); (5) lateral cognition, whereby "habitual ways of thinking, feeling, and behaving [are] made visible and questioned from an observed and distanced perspective" (p. 216, Kjellgren & Soussan, 2011); (6) progression from acute emotional struggle (e.g., self-hatred) to surrender and "letting go," (Belser et al., 2017; Kavenská & Simonová, 2015; Presser-Velder, 2013; Shaw et al., 2022); (7) awareness of self-deceptions and denials around the consequences of maladaptive behavior (Loizaga-Velder & Verres, 2014); and (8) self-efficacy and "redemption" narratives, opening up resources for problem-solving and coping (Loizaga-Velder & Verres, 2014; Presser-Velder, 2013).

Improving upon research methods

When researching the effects of psychedelic use, it is additionally important to improve upon certain contemporary practices. Most studies examining psychedelics in the general population are vulnerable to three types of sample bias: (1) disproportionate recruitment of individuals on psychedelic internet forums who may have stronger positive expectancies of change, (2) lack of compensation for participation, producing volunteer bias (or systematic exclusion of subsets of the general population who require extrinsic monetary compensation for participation), and (3) high levels of attrition (e.g., ~50–80%, Haijen et al., 2018), raising concern that individuals who drop out may disproportionately experience negative or less positive outcomes. Although the important contributions of previous research cannot be overstated, applying more rigorous methods remains important.

Present study

The present study investigates perceptions of personality change using cross-sectional qualitative data from over 200 sets of open-responses. Despite being vulnerable to retrospective bias and placebo response, such an approach surveys a large number of individuals with which to gain a more adequate understanding of personality changes that *may* occur in relation to psychedelic use. Our working premise is that accounts of perceived change are likely to be inclusive of, but not perfectly overlapping with, actual changes. That is, a substantive false-positive error rate is expected, but we regard the present study as a necessary preliminary step before conducting future prospective and experimental work to validate our findings.

Our first aim was to (a) document an unconstrained, i.e., non-a-priori, set of psychologically salient perceived changes attributed to psychedelic experiences; and (b) quantify associations between change themes.

Our second aim was to examine the role of setting and drug type in influencing perceptions of change. Specifically, we examined associations between change themes and settings, and calculated the rate of reports of change themes and settings by drug type.

Our third aim was to examine which personality traits may predispose psychedelic use. First, we compared FFM personality scores between three groups, namely (1) individuals with previous psychedelic experience, (2) individuals without psychedelic experience and no interest in using psychedelics, and (3) individuals without psychedelic experience and some level of interest in psychedelic use. Second, we examined whether personality was associated with interest in psychedelic use among non-users. Such information may be useful in guiding future clinicians in assessing which patients may be more or less interested in psychedelic interventions.

Consistent with previous work (e.g., Révész et al., 2021; Schneider, Ottoni, Carvalho, Elisabetsky, & Lara, 2015), lifetime users of psychedelic compounds were hypothesized to exhibit higher scores on FFM Openness than both non-user groups; and interest in psychedelic use was hypothesized to correlate with higher Openness among non-users. Hypotheses were preregistered at https://aspredicted.org/zy4bk.pdf.

These aims are understood to work in tandem to inform a *tentative* model of how personality may lead to psychedelic use, how psychedelic use may lead to changes in personality, and how setting and drug may moderate different types of changes in personality.

METHODS

Participants and procedure

Five-hundred-fifty-seven United States residents were recruited from Amazon's Mechanical Turk (MTurk). MTurk workers are generally thought to provide data of equal or higher quality than other sample types (Chandler & Shapiro, 2016; Miller, Crowe, Weiss, Maples-Keller, & Lynam, 2017). A screener survey was first administered in which

demographics were assessed. To reduce the likelihood of disproportionately selecting psychedelic enthusiasts, the study was advertised on MTurk without reference to psychedelic use, and, to avoid deception, an initial screener assured participants that they would be directed to a subsequent paid task opportunity regardless of their previous use status. According to their previous psychedelic use and interest in using psychedelics, participants were directed to one of three surveys: (1) a survey for individuals with previous psychedelic experience, (2) a survey for individuals without previous psychedelic experience and no interest in using psychedelics in the future, and (3) a survey for individuals without previous psychedelic experience but some interest in using psychedelics in the future. Participants were compensated $0.25 for completing the screener survey, and $2.00 for completing the subsequent survey. This research was approved by the University of Georgia Institutional Review Board.

These data were collected between March and October, 2018 which arguably predates heightened media coverage of psychedelics, e.g., the so-called 'Pollan effect.' As a consequence, we consider these accounts of psychedelic change less vulnerable to positive expectancy and placebo response than more recent data collection projects.

Figure 1 Flow Diagram shows enrollment, exclusion, and analysis numbers. Of the total recruited sample, 78 were excluded due to invariant responding to more than 85% of IPIP NEO items (n = 17), invalid responding based on Elemental Psychopathy Assessment validity scales (n = 23), inconsistency in responding about previous use of psychedelics (n = 61), and/or insufficient time responding (i.e., <1 SD below mean survey completion time; n = 11). Of the 271 remaining subjects in the use sample, an additional 53 were excluded due to withdrawing from the survey before completing open-ended questions (n = 37) and reporting previous use with a substance other than a 5-HT-2A receptor agonist (n = 16).

Following these exclusions, the *uninterested non-user sample* was comprised of 104 subjects (72 females and 32 males; *mean* age = 41.8 [*SD* = 13.3]; 76% White, 12% Black, 12% Asian, and 8% Hispanic), the *interested non-user sample* was comprised of 104 subjects (65 females and 39 males; *mean* age = 34.0 [*SD* = 10.2]; 81% White, 8% Black, 12% Asian, and 9% Hispanic), and the *user sample* was comprised of 218 subjects (118 females, 99 males. 1 non-binary; *mean* age = 36.0 [*SD* = 10.9]; 86% White, 6% Black, 6% Asian, and 10% Hispanic). Sample size was planned such that there would be at least 100 subjects in each of the non-use categories, and at least 200 subjects in the use category. Sample size in the use category was determined in order to obtain 80% statistical power to detect a small correlation of r = 0.20 or higher. Table 1 presents a brief summary of this information and the sample's drug use history.

Independent samples t-test analyses were conducted to test for differences between validly responding subjects in the use sample who did and did not complete open-ended questions. Participants who completed open-ended questions exhibited either negligibly or modestly elevated levels of FFM personality traits (i.e., *IPIP-NEO Neuroticism*, d = 0.08; *IPIP-NEO Extraversion*, d =0 .05; *IPIP-NEO Openness*, d = 0.16; *IPIP-NEO Agreeableness*, d = 0.00; *IPIP-NEO Conscientiousness*, d = 0.07).

Measures

Measures administered to all samples

Five-factor model of personality. A 60-item set of the International Personality Item Pool (IPIP-NEO-60; Maples-Keller et al., 2019) was used to index subjects' dispositional FFM personality traits. The IPIP-NEO-60 consists of five 12-item FFM domain subscales, and 30 2-item FFM facet subscales, and has been demonstrated to show good reliability, convergent, and criterion validity when compared to

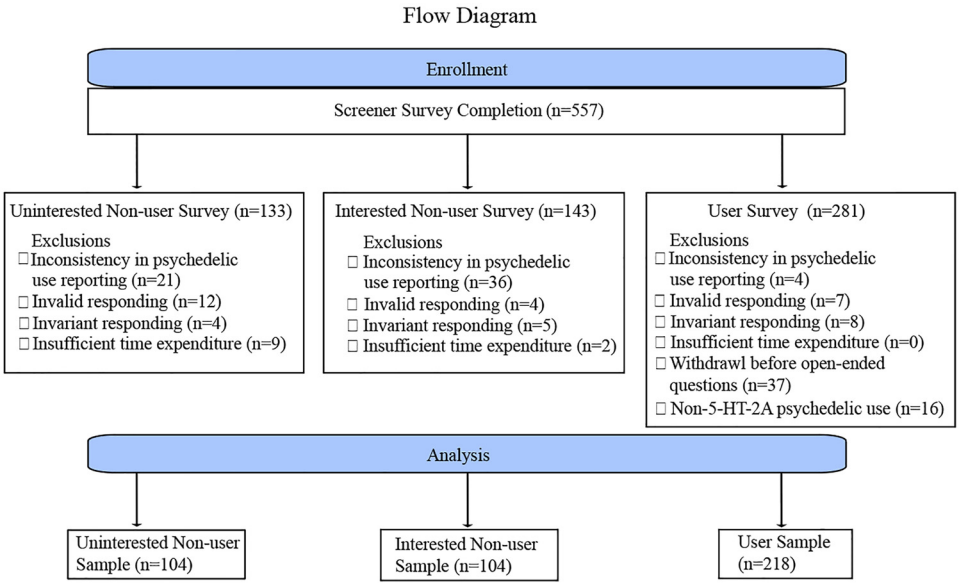

Fig. 1. Flow diagram

Table 1. Sample demographics and use history

		Sample			
		Total Sample	Users	Interested Non-users	Uninterested Non-users
N		426	218	104	104
Sex	Male	170 (40%)	99 (45%)	39 (38%)	32 (31%)
	Female	255 (60%)	118 (54%)	65 (63%)	72 (69%)
Race	Caucasian	350 (82%)	187 (86%)	84 (81%)	79 (76%)
	Not Caucasian	76 (18%)	31 (14%)	20 (19%)	25 (24%)
Ethnicity	Hispanic	39 (9%)	22 (10%)	9 (9%)	8 (8%)
	Not Hispanic	386 (91%)	195 (89%)	95 (91%)	96 (92%)
Drug Experience	LSD		104 (48%)		
	Psilocybin		70 (32%)		
	DMT		11 (5%)		
	Mescaline		5 (2%)		
	Polydrug		6 (3%)		
	Ayahuasca		4 (2%)		
	5-HT-2A research chemicals		3 (1%)		
Drug History	LSD		174 (80%)		
	Psilocybin		154 (71%)		
	MDMA		38 (17%)		
	DMT		29 (13%)		
	Mescaline		28 (13%)		
	Ayahuasca		5 (2%)		
	5-HT-2A research chemicals		12 (6%)		

Note. N represents the sum total number of participants who responded.
LSD = Lysergic acid diethylamide; DMT = Dimethyltryptamine; Polydrug refers to combinations of drugs that include 5-HT-2A agonists. For Drug Experience and Drug History, participants could be counted in multiple drug categories.

the Revised NEO Personality Inventory (NEO PI-R) (Costa & McCrae, 2008; Maples-Keller et al., 2019). For FFM domains, Cronbach alphas ranged from 0.77 (*Openness*) to 0.89 (*Neuroticism*) for the use sample, 0.76 (*Openness*) to 0.89 (*Neuroticism*) for the non-use/interest sample; and 0.76 (*Openness*) to 0.89 (*Neuroticism*) for the non-use/no-interest sample. The *Intellect* and *Openness* aspect subscales from the Big Five Aspects Scale (DeYoung, Quilty, & Peterson, 2007) were also used to enhance coverage of subjects' dispositional Openness, especially in view of suboptimal internal consistency of FFM Openness domain scales. The *Intellect* and *Openness* aspect subscales consist of 10 items each, and they have shown good reliability and convergent validity in previous research (DeYoung et al., 2007). Cronbach alphas were 0.87 (*Intellect*) and 0.85 (*Openness*) for the use sample; 0.88 (*Intellect*) and 0.85 (*Openness*) for the not-taken/interest sample; and 0.92 (*Intellect*) and 0.87 (*Openness*) for the not-taken/no-interest sample.

Interest in psychedelic use. Users and non-users were asked about their level of interest in using psychedelics. Non-users were asked to rate their level of interest in having a psychedelic experience for the first time. Users were asked to retrospectively rate their level of interest in having a psychedelic experience when they *first took* a psychedelic compound. Response options included "Definitely interested" (5), "I was very interested" (4), "I was interested" (3), "I was somewhat interested" (2), "Minimal to no interest" (1).

Invalid responding. Two 8-item validity scales from the Elemental Psychopathy Assessment (Lynam et al., 2011) were used to detect invalid responding in subjects. These scales included the Infrequency scale (e.g., "Frequently forget my middle name") and the Unlikely Virtue scale (e.g., "I have lied to someone at least once in my life"). In line with guidelines for use (Lynam et al., 2011), subjects that endorsed more than three Infrequency scale items and more than four Unlikely Virtue scale items were eliminated.

Measures administered to the use sample only

Open-ended responses. Participants were asked to answer a series of open-ended questions. After filling out the IPIP-NEO self-report scale, participants were asked to describe aspects of their "most intense psychedelic experience." They were encouraged to share "full and honest… account[s]" and were thanked for their effort. Participants were asked four questions examined in the present study: (1) Describe the setting of their experience in a sentence or two (of note, participants also described their initial mindset ahead of their psychedelic experience and psychological aspects of their experience, but these responses were not used in the present study). (2) Describe how they felt their experience influenced their life afterwards. (3) Describe how they felt their experience influenced their personality afterwards. After completing quantitative scales measuring acute affective and mystical-type experience and appraisals of personality change, (4) participants were additionally asked to write a

paragraph detailing how the experience changed aspects of their personality. Question (2) was asked to capture perceived dispositional trait change more broadly. Despite some redundancy, questions (3) and (4) were both asked to capture appraisals of personality change that were both free of bias toward FFM personality content (i.e., 3) and reflective of such content (i.e., 4, as question 4 responses followed and therefore could have been influenced by FFM personality change items that immediately preceded them). Data were available for 202 participants. The Table 1 Drug Experience section indicates the composition of drugs associated with participants' "most intense psychedelic experience."

Qualitative methodology

Settings of participants' most intense psychedelic experience. The first author read through participants' open-ended responses to question 1, and identified frequently reported settings. The list of settings was condensed (e.g., Beach and Cabin condensed into Nature) and expanded (e.g., Companion divided into Friend, Romantic partner) based on two criteria: if (a) at least 20 subjects reported a particular setting; and (b) empirical findings were suggestive of a particular setting's prevalence among psychedelic users (e.g., listening to music).

The resulting list contained 11 settings: Being alone, with one or more companions, with a romantic partner, in a residence, in one's own residence, in another's residence, in nature, in a public setting (i.e., in a place where unfamiliar people are around), at a festival or concert, at a party (i.e., including holiday and otherwise special occasions), and listening to music.

Two undergraduate students separately identified the presence or absence of each setting among responses for each subject using coding guidelines. Inter-rater reliability (using Pearson *r*) ranged from 0.45 (being with one or more companions) to 0.94 (being in a residence) and was above 0.70 in nine of eleven cases. Inter-rater reliability was low in two cases (i.e., being with one or more companions, being in a public setting). To ameliorate coding errors, open-ended responses for which raters disagreed were examined by the first author, and setting codes were corrected. Data were available for 202 participants.

Coding of dispositional trait change. Thematic analysis (Braun & Clarke, 2006; Castleberry & Nolen, 2018) was employed to distill the open-ended responses to questions (2), (3), and (4) into themes pertaining to psychedelic-induced dispositional trait change. The analysis is considered to be *theoretical* because the data were coded to examine a quite specific research question. The analysis is considered *semantic* because themes were identified based on the explicit meanings of the data. The steps of thematic analysis first involved the first author reading through the open-ended responses and generating a list of thematic codes. The first author generally created themes at an intermediate level of the thematic hierarchy, with some exceptions. For example, broader themes (e.g., *Emotional stability*) were created where narrower themes were difficult to identify; and narrower themes (e.g., *Touchstone experience*, *Author*) were created where the first author wished to highlight novel constructs. When a new theme was created, the first author coded each participants' responses again. A series of binary variables for each theme resulted (containing 0 or 1). An additional variable ("None") was created to index participants who denied psychedelic-induced dispositional trait change. Data were available for 202 participants.

Analytic plan

Thematic and exploratory factor analysis. First, thematic analyses were employed to identify qualitative themes of dispositional trait change (i.e., change themes) among open-ended responses of psychedelic users. Second, exploratory factor analyses (EFA) were conducted to derive the latent hierarchical structure of qualitative themes.

Relationships between themes, settings, and drug type. First, correlations between settings and change themes were calculated. Given the large number of analyses and the preliminary nature of these results, inferential statistics were not calculated, and effect sizes were principally evaluated. Second, descriptive frequencies of change theme and setting endorsement were calculated by drug type.

Personality determinants of psychedelic use. First, to examine differences in personality based on enacted psychedelic use, mean-level differences were examined between three groups (users, interested non-users, and uninterested non-users) in terms of FFM personality domains and aspects. Regression models were conducted in which each personality variable was regressed onto a binary group variable containing two of the three samples, with Age included as a covariate due to its significant association with Sample. Descriptive mean and standard deviation values of personality facets are provided in Supplementary Table S1.

Second, to examine the association between personality and interest in using psychedelic compounds, correlations between FFM variables and interest in using psychedelic compounds were calculated.

Statistical significance was evaluated at a threshold of $p < 0.05$ for hypothesized analyses. Evaluations of statistical significance for the other 26 analyses were corrected for multiple comparisons using a Bonferroni correction, resulting in a significance threshold of $p < 0.002$.

Supplementary analysis. Three sets of supplementary analyses were additionally conducted. *p*-values are provided, but no adjustments for multiple comparisons were implemented, making supplementary results vulnerable to Type I error. See Supplementary Materials I for information on the measures used for these analyses.

First, to examine whether participants perceived psychedelic-attributed changes in FFM personality, one-sample *t*-tests of mean-level personality change items were conducted (Supplementary Table S2).

Second, to examine the degree to which acute factors and settings potentiated (or limited) perceived changes in personality, correlations between personality change items and acute experiences including mystical-type phenomena, acute positive and negative affect, and settings were calculated (Supplementary Tables S3 and S4).

Third, correlations between measured variables for each subsample are provided in Supplementary Tables S5 and S6.

RESULTS

Thematic and exploratory factor analysis

Fifty-two trait change themes were identified during the thematic analysis of open-response data. These themes were next subjected to exploratory factor analysis (EFA). Data were excluded for participants who reported no change within open-ended responses ($N = 141$; principal axis factoring with an oblimin rotation); as such, the resulting factor structure characterized only individuals who reported non-zero trait change. We first employed the Parallel Analysis (PA) method of Horn (1965) and the Minimum Average Partial (MAP) method of Velicer (1976) to identify the optimal number of factors. The PA method suggested that up to nine factors could be extracted. The Velicer Very Simple Structure (VSS) method achieved a maximum (0.42) with nine factors. However, inspection of the scree plot and theme loadings led to the selection of an eight-factor solution. The eight factors explained 31% of the variance and possessed eigenvalues as follows: 2.61, 2.24, 2.08, 2.05, 1.97, 1.84, 1.59, and 1.50. The eight-factor solution loadings are presented in Table 2.

In this section, we will describe the eight factors that emerged, labeled **Unitive Spiritual**, **Gratitude Absorption**, **Purpose Freedom**, **Compassion Understanding**, **Emotional Stability**, **Open-mindedness**, **Connection to Self**, and **Neuroticism Caution**. Only themes that loaded onto factors at $\lambda > 0.30$ were designated to each factor. To delineate the structure of these factors, a network map was created reflecting univariate Pearson correlations between themes (Fig. 2). Only edges between themes were represented on the map whose correlations bore a small effect size or larger (i.e., corresponding to $r > 0.21$). The thickness of each edge is proportional to the effect size of the correlation between two themes, and the size of the circle is proportional to the number of participants endorsing each theme.

To guide understanding of the themes and factors, Tables 3 and 4 present definitions of the factors and themes, respectively. In addition, relevant open-ended responses are provided below, but an expanded list of relevant responses by thematic factor is provided in Supplementary Materials II. For curious readers, Supplementary Tables S7 to S14 contain correlations between themes within each factor.

Unitive Spiritual. The **Unitive Spiritual** factor consisted of themes *Connection to the world*, *Letting go of small concerns*, *Mystical*, *Spiritual*, *Metaphysical*, and *Shamanic*. The former five themes were significantly intercorrelated with each other ($r > 0.25$, $p < 0.005$), suggesting factor coherence. The themes *Spiritual*, *Metaphysical*, and *Mystical* exhibited the highest loadings onto the broad factor ($\lambda = 0.66, 0.76, 0.79$ respectively). The frequency of coded responses for all themes within the **Unitive Spiritual** factor ranged from 4 (*Shamanic*, 2% of total sample, 5% of participants expressing a theme within the factor) to 24 (*Connection to the world*, 12% total sample, 31% of factor). The number of unique participants endorsing at least one of the **Unitive Spiritual** themes was $N = 78$, 39% of total coded responses.

Three characteristics of this factor were notable. First, a substantive proportion of respondents (14%) reported shifts in their metaphysical assumptions regarding the fundamental nature of reality. Respondents variously described worldviews containing elements of idealism (i.e., mental phenomena including ideas, thoughts, and consciousness being fundamental rather than physical matter) (Hegel, 1977; Pinkard, 2002), divine providence/intelligent design (i.e., a divine agentic power governs the affairs of the world and the structure of reality) (Polkinghorne, 1994), and mysticism (i.e., sacred unity of all things) (Stace, 1960; Underhill, 2002):

> "I feel like, mentally, I'm on a higher plane of existence. Trivial matters that might have irked me in the past don't bother me at all. Everything is relative. Nothing lasts – nothing in this world at least. I want to continue to chase those feelings of interconnectedness and unity - that's all I'm focused on. Inclusion and meaning. Everything else is unacceptable."

Second, participants who reported enhancements in spirituality (*Spiritual*) also tended to report heightened connectedness (*Connection to the world*). This correlation suggests that perceived spiritual changes emanating from psychedelic experience may arise from enhanced connectedness. Consistent with the central role of connectedness in many world religions (e.g., Hinduism, Buddhism), the present results may also reflect the ontological nature of spirituality as, e.g., involving a *relationship* to the sacred and big picture reality (Smith, 1958):

> "I did have more of a sense of being connected to everything and perhaps I was a little more humble, realizing that I was a very small part in such a big and complex world."

> "I'm more apt to just accept things as they come both from other people and myself… I became much more spiritual and much more connected. I'm more understanding."

Third, *Letting go of small concerns* surprisingly loaded onto **Unitive Spiritual** more strongly than **Emotional Stability** ($\lambda = 0.45$ versus 0.26), which reflects decreased stress and negative emotionality. The theme's factor loading was suggestive that participants' reports of "letting go" may be particular to psychedelic-inspired spirituality, with *Letting go of small concerns* connoting an attentional shift away from "small concerns" toward more 'meaningful' objects of contemplation. The localization of *Letting go of small concerns* within this factor may also be indicative of relations

Table 2. Factor loadings of qualitative themes

Themes	US	GA	PR	CU	ES	OP	CS	NC
Mystical	**0.79**	−0.04	−0.03	0.01	0.06	−0.07	0.01	0.02
Metaphysical	**0.76**	−0.01	0.07	−0.10	−0.15	0.03	0.08	−0.05
Spiritual	**0.66**	−0.10	−0.03	0.13	0.01	−0.05	0.00	−0.08
Letting go of small concerns	**0.45**	−0.05	0.04	0.09	0.26	0.01	−0.06	0.06
Connection to the world	**0.38**	0.05	0.05	0.33	0.15	0.19	0.01	0.06
Shamanic	**0.31**	0.00	−0.07	0.09	−0.17	−0.05	−0.09	−0.09
Savor beauty	−0.08	**0.89**	0.02	−0.01	0.03	−0.05	0.01	0.00
Gratitude appreciation	−0.01	**0.80**	−0.02	0.00	−0.11	−0.02	−0.01	−0.09
Nature relatedness	0.12	**0.45**	−0.04	0.15	0.30	0.14	−0.09	0.10
Aesthetic openness	−0.02	**0.44**	0.02	−0.06	0.08	0.03	0.01	0.04
Observant of surroundings	0.15	**0.36**	0.07	0.00	0.14	0.07	0.09	0.11
Author	−0.03	0.00	**0.84**	0.01	−0.04	−0.05	−0.01	−0.02
Authenticity	0.08	−0.01	**0.55**	−0.07	0.00	−0.09	−0.11	−0.08
Nonconformity	0.18	0.04	**0.51**	−0.11	−0.02	0.10	−0.09	0.11
Conscientiousness	−0.13	−0.07	**0.45**	0.18	0.03	0.05	0.30	−0.04
Goals/purpose	−0.10	0.09	**0.42**	0.10	0.06	0.04	0.12	−0.01
Freedom	0.20	0.01	**0.41**	−0.14	0.05	0.23	−0.11	0.02
Reduced react/anger/antagonism	0.06	0.01	−0.06	**0.61**	−0.03	0.11	0.03	−0.01
Reduced judgement	−0.01	−0.12	0.16	**0.54**	−0.02	0.09	0.04	−0.01
Compass/affect empathy	0.10	0.07	−0.11	**0.50**	−0.18	−0.24	0.05	−0.18
Warmth/friend/sociality	−0.08	0.10	−0.06	**0.50**	0.18	−0.01	0.00	0.22
Connection to others	0.19	0.00	−0.02	**0.39**	0.17	−0.12	−0.05	0.01
Self-trust/accept/love	−0.12	−0.14	0.28	**0.32**	0.14	−0.19	0.22	−0.12
Emotional stability	−0.03	−0.01	−0.03	0.04	**0.82**	0.00	0.01	−0.05
Peace/calm	0.03	0.03	0.04	−0.06	**0.63**	0.04	0.03	−0.02
Mental health	−0.03	−0.20	−0.11	−0.10	**0.44**	−0.22	0.03	−0.21
Resilience/coping/psych flexibility	0.03	0.05	0.02	−0.17	**0.30**	−0.11	0.03	−0.04
Open-minded	−0.07	−0.06	0.01	0.00	−0.11	**0.58**	0.13	−0.10
New perspective	−0.15	−0.07	−0.15	−0.05	−0.01	**0.50**	−0.01	−0.11
Epistemic openness	−0.15	−0.11	−0.03	0.12	−0.02	**0.41**	0.03	−0.08
Openness to new experience	0.06	−0.02	−0.04	−0.02	0.09	**0.38**	−0.09	−0.08
Small ego	−0.02	−0.11	0.16	0.05	0.12	**0.37**	−0.11	0.03
Truth/meaning/understanding	0.16	0.00	−0.04	0.25	0.05	**0.36**	0.00	−0.07
Introspective	0.06	−0.05	−0.04	0.06	0.01	0.03	**0.70**	0.05
Connected to self	0.04	0.00	0.02	−0.10	0.01	−0.02	**0.51**	0.05
Touchstone experience	0.02	0.17	−0.02	−0.13	0.13	−0.11	**0.42**	−0.12
Intellect/philosophical	0.10	0.09	−0.07	0.00	−0.05	0.19	**0.41**	0.01
Closed to psychedelics	−0.04	−0.07	−0.04	0.03	−0.06	−0.07	0.04	**0.62**
Cautious	−0.02	−0.01	0.00	−0.03	−0.10	−0.05	0.04	**0.57**
Introversion	−0.06	−0.08	−0.05	0.01	−0.05	−0.10	0.01	**0.50**
Neuroticism/anxiety/depression	−0.07	−0.14	−0.04	−0.06	−0.09	−0.11	−0.02	**0.34**
Pers-taking/cog empathy	0.27	0.04	−0.10	0.09	−0.29	0.08	0.19	−0.05
Creativity	0.20	0.17	−0.10	−0.03	0.07	0.14	0.17	−0.03
Happiness/positivity/enthusiasm	0.02	0.08	−0.05	−0.12	0.07	0.00	0.21	0.02
Reappraisal	−0.01	−0.11	−0.10	−0.02	0.02	0.21	0.14	−0.11
Psychosis	−0.01	−0.10	−0.01	−0.03	0.07	−0.09	−0.02	0.17
Clarity of thought	−0.02	−0.01	0.00	−0.14	0.10	0.17	0.10	−0.05
Hope	−0.03	−0.05	−0.10	0.02	0.09	−0.18	0.07	−0.17
Humans as insignificant	−0.04	−0.05	−0.02	0.12	0.00	0.22	−0.14	−0.02
Assertive/outgoing	−0.09	−0.07	0.00	0.05	−0.02	−0.20	0.00	−0.18
Vigor	−0.09	−0.01	−0.02	0.21	−0.08	−0.10	−0.11	−0.09
Communion bonding	−0.13	0.00	−0.03	0.25	−0.05	0.08	−0.21	−0.09

Note. Bolded loadings indicate themes designated to each factor. Only themes for which $\lambda > 0.30$ were designated; US = Unitive Spiritual; GA = Gratitude Absorption; PF = Purpose Freedom; CU = Compassion Understanding; ES = Emotional Stability; OP = Openness Perspective; CS = Connection to Self; NC = Neuroticism Caution.

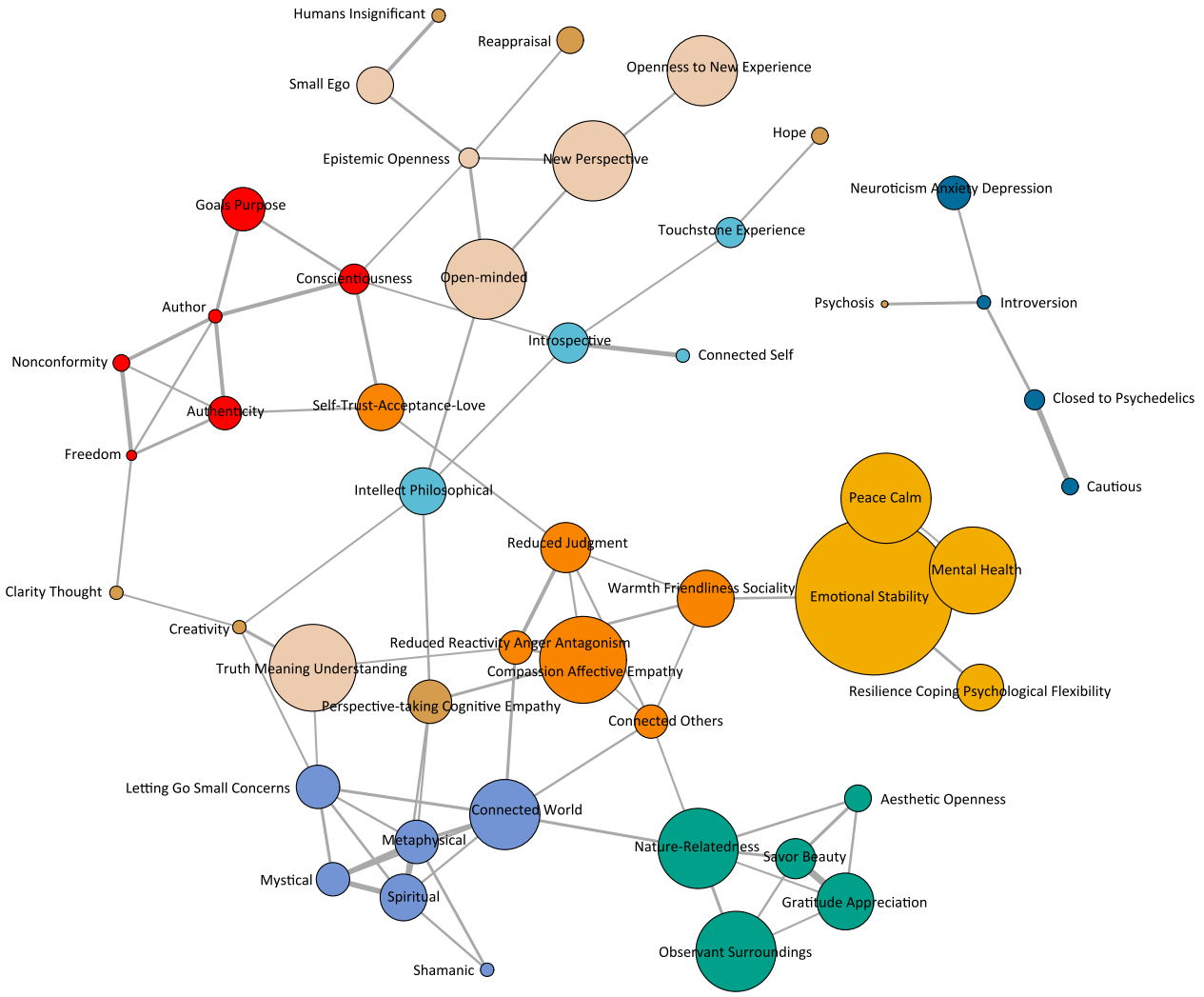

Fig. 2. Network map of qualitative themes from open-ended responses. Eight broad factors emerged: Unitive Spiritual (purple), Gratitude Absorption (green), Purpose Freedom (red), Compassion Understanding (orange), Emotional Stability (yellow), Openness Perspective (beige), Connection to Self (cyan), and Neuroticism Caution (blue). The brown themes did not load onto coherent factors

between spirituality and mental health, such that modulating one's attention to objects of concern bears therapeutic effects. Future research can meaningfully explore whether (1) this attentional shift toward more meaningful objects is itself spiritual (i.e., search for the sacred) (Eliade, 1959), (2) the more meaningful objects themselves possess spiritual content, or if (3) "letting go" follows from heightened spirituality but is not inherently spiritual.

Gratitude Absorption. The **Gratitude Absorption** factor consisted of themes *Savor beauty*, *Gratitude appreciation*, *Nature-relatedness*, *Aesthetic openness*, and *Observant of surroundings*. These five themes were generally intercorrelated ($r > 0.24$, $p < 0.005$) (exception: *Observant of surroundings* and *Aesthetic openness*), indicating coherence within this factor overall. The themes *Savor beauty* ($\lambda = 0.89$) and *Gratitude appreciation* ($\lambda = 0.80$) exhibited the highest loadings onto the broad factor, suggesting that they may reflect the factor's core. The frequency of coded responses for all themes within the **Gratitude Absorption** factor ranged from 8 (*Aesthetic openness*, 4% total sample, 9% of factor) to 26 (*Nature-relatedness*, 13% total sample, 29% of factor). The number of unique participants endorsing at least one of the **Gratitude Absorption** themes was $N = 90$, 45% of total coded responses.

Three characteristics of this factor were notable. First, **Gratitude Absorption** was unique among factors in reflecting perceptions of cognitive changes in momentary attention and intentionality. Participants reported a tendency and volitional desire to apply heightened cognitive awareness to natural settings and everyday objects previously perceived to be mundane:

> "I felt like I experienced something special that I would never forget and it made me more aware. It was like there was this whole other world or realm of consciousness that I was unaware existed and now I knew. It made me more open-minded and observant of the things around me."

Table 3. Qualitative factors and definitions

Factor	Associated themes	Definition	Ppts reported/% endorsed
Unitive Spiritual (US)	Mystical, Metaphysical, Spiritual, Letting go of small concerns, Connection to the world, Shamanic	Contains themes reflecting spiritual, mystical, and metaphysical changes in one's perspective on the world.	78/39%
Gratitude Absorption (GA)	Savor beauty, Gratitude appreciation, Nature-relatedness, Aesthetic openness, Observant of surroundings	Contains themes reflecting observational changes in the processing of environmental information.	90/45%
Purpose Freedom (PF)	Author, Authenticity, Nonconformity, Conscientiousness, Goals/purpose, Freedom	Contains themes reflecting patterns of actionable behaviors derived from self-understanding and perceived agency.	45/22%
Compassion Understanding (CU)	Reduced reactivity/anger/antagonism, Reduced judgement, Compassion/affective empathy, Warmth/friendliness/sociality, Connection to others, Self-trust/acceptance/love	Contains themes reflecting changes in prosociality and reduced judgementalness expressed towards self and others.	92/46%
Emotional Stability (ES)	Emotional stability, Peace/calm, Mental health, Resilience/coping/psychological flexibility	Contains themes reflecting psychedelic-attributed enhancements in mental health and reductions in negative affectivity.	120/59%
Openness Perspective (OP)	Open-minded, New perspective, Epistemic openness, Openness to new experience, Small ego, Truth/meaning/understanding	Contains themes involving shifts toward new open-minded perspectives on self, others, and the world.	98/49%
Connection to Self (CS)	Introspective, Connected to self, Touchstone experience, Intellect/philosophical	Contains themes reflecting increased introspective self-inquiry.	43/21%
Neuroticism Caution (NC)	Closed to psychedelics, Cautious, Introversion, Neuroticism/anxiety/depression	Contains themes reflecting psychedelic-attributed increase in negative psychological experiences.	28/14%

Note. US = Unitive Spiritual; GA = Gratitude Absorption; PF = Purpose Freedom; CU = Compassion Understanding; ES = Emotional Stability; OP = Openness Perspective; CS = Connection to Self; NC = Neuroticism Caution.

> "It was intense. I think that's a good word for it. It changed me forever, and this sounds weird, but I couldn't look at trees the same way again. I'm connected to trees now. You can judge me for that statement, that's okay, but I am. There's something very spiritual about being connected to nature."

Such changes in attention may represent states of heightened mindfulness involving moment-to-moment awareness of the surrounding environment (Shapiro, Carlson, Astin, & Freedman, 2006).

Second, the factor reflects generally positive sentiment toward one's self, relationships, and circumstances. This is expressed with gratitude, appreciation, and an aesthetic sensibility:

> "It made me feel like I should appreciate God's gifts more. I saw the beauty in things that I previously never noticed."

One particularly notable object of attention and positive sentiment was the natural environment, with 13% of the total sample reporting an enhanced positive connection with nature:

> "I love a good rainstorm to this day even though it has been over 30 years ago. I also love trees and nature in general. I have always felt that trees experience feelings and I can communicate with them in some way."

Third, this factor showed substantive conceptual convergence with *absorption*, a personality trait instantiated in the Tellegen absorption scale (Tellegen & Atkinson, 1974) that describes an individual's tendency to become engrossed in outer (e.g., sensory experiences) and inner (e.g., imagined) phenomena. Experiences of absorption tend to involve an experiential (versus instrumental) mindset and may converge with hypnotic states of involuntary and effortless attention (Lifshitz, van Elk, & Luhrmann, 2019).

Purpose Freedom. The **Purpose Freedom** factor consisted of themes *Author*, *Authenticity*, *Nonconformity*, *Conscientiousness*, *Goals/purpose*, and *Freedom*. The four themes of *Author*, *Authenticity*, *Nonconformity*, and *Freedom* were intercorrelated ($r > 0.27$, $p < 0.005$) indicating factor coherence. *Author*, *Authenticity*, and *Nonconformity* exhibited the highest loadings onto the broad factor ($\lambda = 0.84, 0.55, 0.51$ respectively). The frequency of coded responses for all themes within the **Purpose Freedom** factor ranged from 3 (*Freedom*, 1% total sample, 7% of factor) to 13 (*Goals/purpose*, 6% total sample,

Table 4. Qualitative themes and definitions

Theme	*Definition*	*Ppts reported/% endorsed*
Connection to the world (US)	Expressed capacity for feelings of interconnectedness with the global environment.	24/12% (total); 31% (factor)
Spiritual (US)	Expressed increased identification as "spiritual," greater interest in spiritual and religious ideas and dialogue, and adoption of spiritual worldviews (e.g., all is one). Most broad theme within Unitive Spiritual factor.	14/7% (total); 18% (factor)
Letting go of small concerns (US)	Expressed a reduced engagement with anxiety-contributing concerns, not allowing concerns to unduly affect oneself. Responses were indicative of an ability to let go of unproductive stress.	13/6% (total); 17% (factor)
Metaphysical (US)	Expressed a new ontology about the nature of reality that deviates from scientific materialism and/or physicalism (e.g., panpsychism, idealism, intelligent design). Presence of other phenomena sitting outside of a materialist worldview (e.g., vibration, spirits). Responses reflected engagement with information beyond ordinary perceptual experience.	13/6% (total); 17% (factor)
Mystical (US)	Expressed subjective experiences of mystical phenomena including sacredness, unity, awe, or consciousness.	10/5% (total); 13% (factor)
Shamanic (US)	Expressed subjective experiences containing communication with phenomena including spirits, higher powers, higher intelligence, and other realms. Responses reflected an attribution of agency to identified phenomena.	4/2% (total); 5% (factor)
Nature-relatedness (GA)	Expressed a desire to be in natural surroundings and respect for the natural world. Responses reflected greater attentional awareness of nature. Similar to Nisbet et al.'s (2009) Nature-relatedness-Experience factor.	26/13% (total); 29% (factor)
Observant of surroundings (GA)	Expressed increased awareness and consciousness of one's external environment. Responses reflected greater appreciation and increased cognitive attention to the external environment (e.g., intentional "slowing down" to facilitate increased attention).	25/12% (total); 28% (factor)
Gratitude appreciation (GA)	Expressed gratitude for small, everyday aspects of life. Responses were indicative of expanded appreciation for an increased proportion of one's life.	18/9% (total); 20% (factor)
Savor beauty (GA)	Expressed regard for the beauty of life and previously mundane elements of one's environment. Greater attentional awareness paid to beautiful elements in life.	13/6% (total); 14% (factor)
Aesthetic openness (GA)	Expressed increased appreciation for art, music, aesthetics, and beauty.	8/4% (total); 9% (factor)
Goals/purpose (PF)	Expressed attitude of confidently approaching goals with a sense of direction. Responses were indicative of having a strong rationale for pursuing identified goals in life.	13/6% (total); 29% (factor)
Authenticity (PF)	Expressed greater capacity for knowing and expressing oneself authentically.	10/5% (total); 22% (factor)
Conscientiousness (PF)	Expressed greater industriousness, attention to detail, and organization. Responses were indicative of greater deliberation with respect to life decisions, reduced overall impulsivity, and noted ability to engage in self-control.	10/5% (total); 22% (factor)
Nonconformity (PF)	Expressed increased conviction to one's authentic values and judgement. Responses were reflective of a reduced sense of obligation to external sources of direction (e.g., authority, culture).	5/2% (total); 11% (factor)
Author (PF)	Expressed the insight of being a responsible and powerful author of one's life and behaviors.	4/2% (total); 9% (factor)
Freedom (PF)	Expressed an empowered capacity to think, act, and behave in accordance with one's true values.	3/1% (total); 7% (factor)

(continued)

Table 4. Continued

Theme	*Definition*	*Ppts reported/% endorsed*
Compassion/affective empathy (CU)	Expressed increased capacity for feeling the experienced emotions of others. Responses were indicative of subjectively feeling more caring, loving, kind, and nice towards others; accepting and forgiving others for perceived wrongs or slights. Some reported increased initiation of volunteering activities.	26/13% (total); 28% (factor)
Warmth/friendliness/sociality (CU)	Expressed greater sociability and warmth towards others. Some responses reflected an enhanced capacity to connect with others emotionally, and a sense of being cared for.	17/8% (total); 18% (factor)
Self-trust/acceptance/love (CU)	Expressed feelings of trust in who one is, comfort with oneself, and ability to better show love to oneself.	16/8% (total); 17% (factor)
Reduced judgement (CU)	Expressed decreased negative appraisal of self and others; ability to listen and accept others despite initial negative appraisals. Responses indicated a lower critical attitude and higher tolerance.	15/7% (total); 16% (factor)
Connection to others (CU)	Expressed the capacity for feeling unified with other persons and a global connection to humanity.	10/5% (total); 11% (factor)
Reduced reactivity/anger/antagonism (CU)	Expressed lower reactivity to environmental stressors, irritability/anger, and a greater capacity to forego or de-escalate interpersonal conflict.	10/5% (total); 11% (factor)
Emotional stability (ES)	Expressed more moderate fluctuations in mood. Responses were indicative of calm and lower emotional reactivity to stressors.	48/24% (total); 40% (factor)
Peace/calm (ES)	Expressed increased psychological tranquility. Responses were indicative of reduced fear and agitation, and increased placidity/groundedness.	29/14% (total); 24% (factor)
Mental health (ES)	Expressed reduced intensity of feelings related to depression/anxiety. Responses reflected improvement in the ability to manage previous stressful life events.	27/13% (total); 23% (factor)
Resilience/coping/psychological flexibility (ES)	Expressed enhanced capacity to regulate emotions in response to stressors, identify and apply coping skills, and engage with negative emotions.	16/8% (total); 13% (factor)
Truth/meaning/understanding (OP)	Expressed greater interest in and commitment to understanding life/reality as it is. Responses reflected enhanced meaning in life, and respect for truth and understanding.	29/14% (total); 30% (factor)
New perspective (OP)	Expressed being less adherent to a rigid model of the world; more open to new worldviews and perspectives.	27/13% (total); 28% (factor)
Open-minded (OP)	Expressed an inclination to explore (and be influenced by) novel information and experiences.	24/12% (total); 24% (factor)
Small ego (OP)	Expressed a sense of being diminutive relative to a larger, complex world; epistemic humility with respect to understanding the complexity of reality; and a reduced sense of self-importance.	12/6% (total); 12% (factor)
Epistemic openness (OP)	Expressed acceptance of ambiguities in life and varied/contradictory experiences. Responses reflected openness to new experiences and perspectives.	6/3% (total); 6% (factor)
Openness to new experience	A broad theme coinciding with Five-Factor model Openness. Expressed cognitive exploration, aesthetic appreciation, and an inclination to try new 'things.' Responses reflected a positive attitude towards the general concept of change.	23/11% (total)
Intellect/philosophical (CS)	Expressed the desire to critically question and analyze experiences. Responses were indicative of interest in esoteric inquiry into the nature of existence and contemplation of abstract ideas.	15/7% (total); 35% (factor)
Introspective (CS)	Expressed thinking deeply about oneself, the world, and the universe. Responses were indicative of increased desire for critical reflection attributed to their psychedelic experience.	13/6% (total); 30% (factor)
Touchstone experience (CS)	Expressed the importance of their experience as a reference memory from which self-esteem and hope can be reoriented to.	11/5% (total); 26% (factor)

(continued)

Table 4. Continued

Theme	*Definition*	*Ppts reported/% endorsed*
Connective to self (CS)	Expressed enhanced inner emotional and cognitive awareness.	4/2% (total); 9% (factor)
Neuroticism/anxiety/depression (NC)	Expressed feelings of anxiety, paranoia, panic, and/or depression attributed to their experience. Many responses reflected generalized fear and anxiety.	12/6% (total); 43% (factor)
Cautious (NC)	Expressed greater cautiousness across life domains attributable to adverse psychedelic experience.	6/3% (total); 21% (factor)
Closed to psychedelics (NC)	Expressed personal conviction to never use psychedelic substances again.	6/3% (total); 21% (factor)
Introversion (NC)	Expressed feeling reserved and more self-conscious when around other people. Responses indicative of turning inward and being more conscious of one's behavior around others.	4/2% (total); 14% (factor)
Assertive/outgoing	Expressed the development of greater assertiveness, confidence, and courage. Responses were indicative of prioritizing core interests, and vigor in life pursuits and interactions.	17/8% (total)
Happiness/positivity/enthusiasm	Expressed increased feelings of eudaimonic and hedonic happiness. Responses were indicative of approaching life from a more positive perspective, and looking forward to future events and experiences.	15/7% (total)
Perspective-taking/cognitive empathy	Expressed enhanced understanding of and appreciation for others' unique mental experiences.	14/7% (total)
Communion bonding	Expressed an emotional connection to other people.	13/6% (total)
Reappraisal	Expressed the ability to observe and revise default limiting beliefs about oneself and the world.	8/4% (total)
Hope	Expressed renewed forecasting of positive future outcomes.	5/2% (total)
Humans as insignificant	Expressed regard for humans as small and insignificant in the broad context of the universe and all content of reality.	5/2% (total)
Clarity thought	Expressed feelings of being able to 'think clearly.' Responses reflected observations of one's mind as being cleaned/organized.	4/2% (total)
Creativity	Expressed the ability to view objects of awareness from different angles/perspectives; improved ability in divergent thinking. Responses were indicative of a desire to engage in more artistic and creative endeavors.	4/2% (total)
Vigor	Expressed enhanced energy, aliveness, and youthfulness.	4/2% (total)
Psychosis	Expressed symptoms of persecutory auditory hallucinations/perceptual illusions and delusions attributed to experience(s). Responses included an individual who reported being later diagnosed with schizophrenia.	2/1% (total)

Note. Themes are organized by factors listed in Table 8. US = Unitive Spiritual; GA = Gratitude Absorption; PF = Purpose Freedom; CU = Compassion Understanding; ES = Emotional Stability; OP = Openness Perspective; CS = Connection to Self; NC = Neuroticism Caution.

29% of factor). The number of unique participants endorsing at least one of the **Purpose Freedom** themes was $N = 45$, 22% of total coded responses.

Three characteristics of this factor were notable. First, participants expressed motivation to make a conscious effort toward positive life changes and self-improvement across multiple domains of functioning (e.g., physical health, emotional health, effective interpersonal communication). The factor also reflected a reclamation of self-control over the direction of one's life. One individual wrote, "[t]he experience…motivated me to get work done, to talk and check in with others and not give into anxiety or insecurity." Part of the impetus of this conscious effort appeared to involve an expanded sense of self-authorship and free will:

> "I feel like the biggest change to my personality was my belief in myself and my ability to live a life worth living. I stopped looking for a reason and realized that anything and everything is that reason."

Second, participants described a process of trusting their intuition and aligning with authenticity. This appeared to manifest for some in purposefulness and the formulation of clear goals:

> "It helped me be less fearful and more focused on trusting my intuition and conscience. That voice was so wise, knew me perfectly to know exactly what to say. That made me realize the importance of trusting that deep voice within and letting it guide me."

Participants also described enhanced self-expression, which may follow from enhanced self-authenticity (e.g., "I became…more willing to express myself to others").

Third, participants described a tendency toward taking responsibility in the service of growth:

> "I felt like I came to terms with a lot of issues about myself… that were bothering me that I had tried to ignore, lie to myself about, or shove deep down inside myself and ignore…Everything felt like it was a necessary step in my life that I was to use as a growing and learning experience."

This quote is also significant in describing the participant's awareness of her evolutionary arc of development (i.e., meta-awareness, lateral cognition), and the value placed on each step, regardless of its negative affective valence at the time.

Fourth, the four intercorrelated themes of *Author*, *Authenticity*, *Nonconformity*, and *Freedom* reflected a tendency towards originality of thought and non-conformity, suggestive that an increase in agency over one's life may facilitate improved confidence to explore ideas outside of previously defined psychological restraints.

> "I stopped caring as much to what people might think of me. I started focusing on things that actually mattered."

> "Our society needs to desperately open up to more worldly experiences. This was an enriching experience from my past, something that I think allowed me to open up to myself and the world, knowing that not all things are bad for you just because other people (the powers that be) say that they are."

Compassion understanding. The **Compassion Understanding** factor consisted of themes *Reduced reactivity/anger/antagonism*, *Reduced judgement*, *Compassion/affective empathy*, *Warmth/friendliness/sociality*, and *Connected to others*. All five themes were significantly intercorrelated with each other ($r > 0.22$, $p < 0.005$). *Reduced reactivity/anger/antagonism* ($\lambda = 0.61$) and *Reduced judgement* ($\lambda = 0.54$) exhibited the highest loadings onto the broad factor. The frequency of coded responses for all themes within the **Compassion Understanding** factor ranged from 10 (*Reduced reactivity/anger/antagonism* and *Connection to others*, 5% total sample, 11% of factor for each theme) to 26 (*Compassion/affective empathy*, 13% total sample, 28% of factor). The number of unique participants endorsing at least one of the **Compassion Understanding** themes was $N = 92$, 46% of total coded responses.

This factor was unique in representing interpersonal themes characterized by perceived changes in empathic concern and appeared to converge closely with the FFM personality domain of Agreeableness. Two characteristics of this factor were notable. First, the presence of *Reduced reactivity/anger/antagonism* and *Reduced judgement* was suggestive that for some, psychedelics were perceived to alter motives for undermining the interests of others:

> "I feel like a good portion of my ego dissolved as well and since I've felt less inclined to 'be the top dog' or hold any sort of power over anyone."

> "Since then, I've never felt violent or angry. I am very sensitive, hurting any creature big or small hurts my heart. I feel like I can feel others' emotions if I'm close enough to them… I'm a positive caring person now."

Specifically, participants' reports may be indicative that psychedelic experiences guide improvements in self-regulation and orient individuals toward prioritizing harmony versus dominance.

Second, the intercorrelation of themes *Compassion/affective empathy*, *Connected to others*, and *Warmth/friendliness/sociality* was suggestive of associated outcomes involving interpersonal empathy, connection, and prosocial sentiment. Another individual stated:

> "I feel that it made me much more connected to other people. The sense that I need people was very strong during the experience and there was a fear of being left by myself. This has made an imprint of a sort on me because I am so much quicker to see where I need others as opposed to before the experience because I never felt that need before. It may be more connected to a sense of oneness I felt with the other people that were with me that day which I remember crystal-clear all these years later."

This participant's response was reflective of an acknowledgement of one's need for connection, which may move individuals to place conscious importance on engaging interpersonal bonds and resources.

Emotional stability. The **Emotional Stability** factor consisted of themes *Emotional stability*, *Peace/calm*, *Mental health*, and *Resilience/coping/psychological flexibility*. The four themes were significantly intercorrelated with each other ($r > 0.32$, $p < 0.005$). *Emotional stability* ($\lambda = 0.82$) and *Peace/calm* ($\lambda = 0.63$) exhibited the highest loadings onto the broad factor suggesting they may reflect the factor's core. The frequency of coded responses for all themes within the **Emotional Stability** factor ranged from 16 (*Resilience/coping/psychological flexibility*, 8% total sample, 13% of factor) to 48 (Emotional stability, 24% of total sample, 40% of factor). The number of unique participants for at least one of the **Emotional Stability** themes was $N = 120$, 59% of total coded responses.

Respondents expressing themes from this factor described psychedelic-attributed changes including enhanced mental health, lower negative affectivity, and enhanced cognitive-emotional states of peace and calm. Of greatest interest within the data were that participants shared numerous mindsets, coping skills, and mindfulness strategies that they perceived to have learned during their psychedelic experiences:

> "It was such an impactful feeling of peacefulness that I wanted to hold on to. Afterward, I made a greater commitment to mindfulness meditation as a way of finding that calm and attentiveness in my everyday life. I wanted to always see nature that way, as alive as I was and full of wonder. I feel like I have accomplished this in some ways but continue on the path with patience and gratitude." (i.e., mindfulness strategy)

> "I no longer felt like I was doomed to feel only how my brain wanted me to feel. I knew that emotions could be changed and were fleeting." (i.e., mindset)

> "It is something I have never forgotten, and in times of trouble or deep sadness, I close my eyes and think about that joy and remind myself that the bad times don't last forever and good comes back sooner or later. It also helps to remind me to stay in the moment when I have happiness and good times, and sometimes to simply stop and 'smell the roses.'" (i.e., coping skill)

Improvements in emotional stability were furthermore associated with perceived shifts in participants' relationships to their own emotions, indexed by the *Resilience/coping/psychological flexibility* theme. Overall, these results are suggestive that psychedelic experiences promote the development of emotion-regulatory strategies that individuals may learn to apply to future life experience.

Openness perspective. The **Openness Perspective** factor consisted of themes *Open-minded*, *New perspective*, *Openness to new experience*, *Epistemic openness*, *Small ego*, and *Truth/meaning/understanding*. The five themes showed lower intercorrelation than within other factors (Supplementary Table S12). *Open-minded* ($\lambda = 0.58$) and *New perspective* ($\lambda = 0.50$) exhibited the highest loadings onto the broad factor. The frequency of coded responses for all themes within the **Openness Perspective** factor ranged from 6 (*Epistemic openness*, 3% total sample, 6% of factor) to 29 (*Truth/meaning/understanding*, 14% total sample, 30% of factor). The number of unique participants endorsing at least one of the **Openness Perspective** themes was $N = 98$, 49% of total coded responses.

Three characteristics of this factor were notable. First, the themes *Open-minded*, *New perspectives*, and *Openness to new experience* conceptually converge with the FFM personality domain of *Openness to new experience*. In particular, these themes seemed to exemplify the core of FFM Openness, which scholars propose relates to elevated *cognitive exploration*. Cognitively, there is some support that being higher in FFM Openness is characterized by a higher propensity to derive incentive value from uncertainty and information in artistic or intellectual environments (e.g., DeYoung, 2013, 2015). Many participants attributed to their psychedelic experiences an increase in their capacity for open-mindedness, new perspective-taking, and general openness to new experiences:

> "I feel I am more creative and enjoy tapping into the deeper recesses of my mind just for fun. I can sit and contemplate convoluted subjects for hours. Time just melts away, if it was ever there to begin with."

> "I found myself questioning what is real or illusion, and what is natural or what is not. I resolved myself after that experience to not just accept things without question, but to be open yet curious to all ideas and experiences that I would encounter in the future."

These quotes illustrate an increased appetite for cognitive exploration and questioning. Many participants also provided examples of subtle, advantageous shifts in perspective.

> "I started my new job with a very open mind and was humbled and that transferred to the kitchen, I didn't come in thinking I was the best[;] I came in thinking I had the potential to be ONE of the best. I have always felt that psychedelics when used responsibly are a doorway to another realm of yourself."

Future research would be valuable that examines the processes underlying such adaptive shifts in cognition and behavior. For example, do there exist antecedent (1) insights into truth (e.g., in reality, I am deceiving myself about my 'bestness' to fulfill a defensive function), (2) insights into the consequences of former perspectives (e.g., thinking I was the best would close me off from relationships and produce stress), or (3) insights into the consequences of new perspectives (e.g., open-minded humility will enable me to be more at ease and freely creative)?

Second, many descriptions of open-mindedness involved an element of dialectical reasoning, a cognitive feature present in contemporary conceptualizations of wisdom involving intellectual humility and consideration of the limits of knowledge (Baltes & Smith, 2008; Grossmann, 2017). The *Epistemic openness* theme in particular reflected a shift toward identifying and tolerating ambiguity, specifically with respect to the validity of narrow perspectives and perceptions, as well as consideration of what is not yet known:

> "I think it made me much more open to believing in the fallibility of the brain in perceiving reality. Basically it made me much more open to believing in far more possibilities than just that which I can easily see. I am much less quick to judge something as not possible in general."

> "I feel like I'm more open to ideas being wrong, and I see the ambiguity in everything. I have a little trouble seeing things as absolutely right or wrong."

Third, participants described an evolution in their relationship to cultural systems and traditions, including an openness to different lifestyles and customs.

> "I became a person who was much more open to opinions and traditions different than the ones I had been raised on. I embraced elements of others cultures and religions and ignored some of the taboos of the traditions I had been raised by. This new identity let me develop the talents that I wanted to grow and to live the life I had decided was right for me."

Fourth, there was a significant correlation between themes *Small ego* and *Epistemic openness* ($r = 0.33$, $p < 0.005$), suggesting that enhanced cognitive exploration and tolerance of ambiguity may be supported by recognition of one's smallness in a vaster context. One individual wrote, "I thought about my life in a way I never had before. I realized how very, very small I was, but also how very, very important I was. How important the human experience is. It made me open to try new things, to live."

Connection to self. The **Connection to Self** factor consisted of themes *Introspective*, *Connected to self*, *T. experience*, and *Intellect/philosophical*. Only the *Introspective* theme was significantly correlated with other themes, indicating lower coherence. *Introspective* ($\lambda = 0.70$) and *Connected to self* ($\lambda = 0.51$) exhibited the highest loadings onto the broad

factor. The frequency of coded responses for all themes within the **Connection to Self** factor ranged from 4 (*Connected to self*, 2% total sample, 9% of factor) to 15 (*Intellect/philosophical*, 7% total sample, 35% of factor). The number of unique participants endorsing at least one of the **Connection to Self** themes was $N = 43$, 21% of total coded responses.

In general, this factor was more heterogenous than others, and explained just 10% of the variance in themes. The factor can be broadly characterized by heightened engagement with oneself, self-reflection, and introspective ability:

> "I have always felt that psychedelics when used responsibly are a doorway to another realm of yourself. I feel like you can learn a lot about yourself and the world through a good and responsible psychedelic experience."

Notably, a number of participants referred to an exploration of different "realms of oneself," which is suggestive of potentially greater access to the contents of self and identity.

Second, a unique characteristic of this factor was the *T. experience* theme. Reported by 11 participants, this theme reflected participants' use of meaningful psychedelic experiences as reference memories in the service of navigating away from negative rumination and a reorientation to contentedness and self-esteem:

> "It is something I have never forgotten, and in times of trouble or deep sadness, I close my eyes and think about that joy and remind myself that the bad times don't last forever and good comes back sooner or later."

Participants appeared to infer from their experiences the transience of challenging versus pleasant experience, and their capacity for psychological flexibility in the face of difficult emotions.

Neuroticism caution. The **Neuroticism Caution** factor consisted of themes *Closed to psychedelics*, *Cautious*, *Introversion*, and *Neuroticism/anxiety/depression*. The four themes were generally significantly intercorrelated ($r > 0.20$, $p < 0.01$) (exception: *Neuroticism/anxiety/depression*, *Cautious*). *Closed to psychedelics* ($\lambda = 0.62$) and *Cautious* ($\lambda = 0.57$) exhibited the highest loadings onto the broad factor. The frequency of coded responses for all themes within the **Neuroticism Caution** factor ranged from 4 (*Introversion*, 2% total sample, 14% of factor) to 12 (*Neuroticism/anxiety/depression*, 6% total sample, 43% of factor). The number of unique participants endorsing at least one of the **Neuroticism Caution** themes was $N = 28$, 14% of total coded responses.

The themes comprising this factor captured adverse consequences of psychedelic experience. Three characteristics are notable. First, participants who expressed the *Closed to psychedelics* theme reported an aversion to future psychedelic use, often attributed to distressing experience:

> "The biggest influence was in wanting the experience to end, and feeling like it never would and I'd never get my mind back or be myself again. That was the catalyst that convinced me I wasn't doing it again. I didn't have any experiences profound enough to outweigh the terror that had permanently altered myself."

Second, multiple respondents described negative shifts in their basal emotions, including stronger and more frequent negative emotions and reduced extraversion:

> "The experience changed aspects of my personality because I became much more anxiety ridden and panicky afterwards. I became more reserved and quiet and less trusting. I became more afraid of trying new things and I was definitely very anxious and worried a lot where before the experience those traits were not apart of my personality."

Importantly, two participants pointed to their psychedelic experience as the source of symptoms of psychosis:

> "I ended up having a psychotic break because of the experience. About three weeks after I took the drug, I had a period of psychosis in which I thought I was a divine prophet. I ended up being hospitalized in a psychiatric ward for over two weeks. I stayed in this altered psychotic state for about three months afterward, going back to the psych ward three more times. I damaged my career, alienated friends and had to move back in with my parents because of this experience."

> "It caused me to become a psychotic individual for an extended period of time. After I snapped out of the psychosis I fell into a deep depression that lasted for months. I was so ashamed and embarrassed by what I had done while psychotic. It made me much more cautious about drugs in general and less trusting of people."

None *and* short-lived. Thirty percent of participants ($N = 61$) denied the presence of post-acute changes in personality. Of the remaining 141 participants who endorsed changes in personality, 11% ($N = 16$) described the change as relatively short in duration. However, this value is only a rough estimate, as participants were not systematically asked about the duration of their personality changes.

Correlations between factors. Mean factor scores for each participant were computed from themes loading above 0.30. Table 5 presents descriptive correlations between these factor scores. **Unitive Spiritual** and **Compassion Understanding** was the only pair to exhibit a correlation exceeding a small effect size of $r > 0.20$ (Cohen, 2013).

Relationships between themes, settings, and drugs

Association between setting and perceptions of personality change. Table 6 shows correlations between settings and themes. Only correlations of small size ($r > 0.19$) (Cohen, 2013) were interpreted. Relative to other setting types, using psychedelics in a nature setting was associated with the most numerous themes, including *Connection to the world* ($r = 0.29$), *Introspective* ($r = 0.27$), *Humans insignificant* ($r = 0.24$), *Happiness/positivity/enthusiasm* ($r = 0.22$), and *Nature-relatedness* ($r = 0.20$). Using psychedelics alone was associated with themes *Hope* ($r = 0.32$), *Reappraisal* ($r = 0.23$), and *Mental health* ($r = 0.22$). Using psychedelics

Table 5. Descriptive correlations between factors

	US	GA	PF	CU	ES	OM	CS
US	–						
GA	0.02	–					
PF	0.07	−0.04	–				
CU	0.25	0.02	0.09	–			
ES	0.06	0.07	0.00	0.12	–		
OM	0.09	−0.05	0.06	0.04	−0.03	–	
CS	0.11	0.02	0.02	0.17	0.03	0.05	–
NC	−0.13	−0.10	−0.08	−0.10	−0.20	−0.20	−0.08

Note. US = Unitive Spiritual; GA = Gratitude Absorption; PF = Purpose Freedom; CU = Compassion Understanding; ES = Emotional Stability; OP = Openness Perspective; CS = Connection to Self; NC = Neuroticism Caution.

at another person's home was negatively associated with the theme *Reduced judgment* ($r = -0.20$). Finally, using psychedelics at a special occasion was associated with the theme *Shamanic* ($r = 0.27$).

Perceptions of personality change by drug. Figure 3 shows differences in the number of participants reporting each theme by drug type, i.e., the drug used during the experience associated with perceptions of personality change. Only differences between LSD and Psilocybin are presented, as other drug types were used by too few participants to yield reliable results.

Of the 53 themes (including None), 70% were reported more frequently in relation to the use of Psilocybin than LSD. Psilocybin was associated with more than double the reports of the following themes relative to LSD: Reappraisal, Goals/purpose, Reduced reactivity/anger/antagonism, Creativity, Reduced judgment, Self-trust/acceptance/love, Happiness/positivity/enthusiasm, Letting go of small concerns, Spiritual, Connection to others, Perspective-taking/cognitive-empathy, Communion bonding, Intellect/philosophical, Connection to the world, Touchstone experience, Clarity of thought, Psychosis, and Author. LSD was associated with double the reports of the following themes relative to Psilocybin: Conscientiousness, Hope, Humans as insignificant, Vigor, Cautious, Connected to self, and Freedom.

Selection of setting by drug. Figure 4 shows how the settings of participants' most intense psychedelic experiences differed by drug used. Use in music listening and festival/concert settings was reported more than 50% more frequently for LSD than for Psilocybin. Use in nature, with one's romantic partner, and alone was reported more than 50% more frequently for Psilocybin than for LSD.

Personality determinants of psychedelic use

Differences in personality between subsamples. Table 7 provides mean personality scores for the three samples and significant differences between samples. With respect to differences in FFM domain and BFAS aspect scores, results indicated that users were significantly lower in *IPIP-NEO Neuroticism* and higher in *IPIP-NEO Extraversion* than interested non-users; users were also significantly higher in *IPIP-NEO Openness* than uninterested non-users, and higher in *BFAS Intellect* than both non-user groups. Interested non-users were also significantly higher in *IPIP-NEO Openness* than uninterested non-users.

Relations between personality and interest in psychedelic use. Table 8 provides correlations between personality and *interest in psychedelic use*. In the combined non-user samples, *interest* showed a small to moderate correlation with *IPIP-NEO Openness* ($r = 0.30$, $p < 0.001$) and *BFAS Openness* ($r = 0.20$, $p = 0.004$) (consistent with hypotheses), and with *FFM Neuroticism* ($r = 0.28$, $p < 0.001$). In the user sample, *interest* showed a small correlation with *IPIP-NEO Openness* ($r = 0.19$, $p = 0.005$) that was not statistically significant at the Bonferroni-adjusted threshold. Descriptives of *interest in psychedelic use* are provided in Supplementary Table S15.

DISCUSSION

The present study aimed to model personality changes attributed to psychedelics by qualitatively examining open-ended responses from individuals in the general population concerning perceptions of trait change. Using the largest sample to date for such a qualitative analysis ($N = 202$), we sought insight (1) into potentialities of psychedelic change extending beyond the boundaries of the current literature and known scales, and (2) the structural organization of nominally disparate psychedelic-related changes. The study additionally aimed to identify moderators of perceived changes (including settings and drug types); and investigate personality determinants of psychedelic use by comparing three groups from the population (218 psychedelic users, 104 interested non-users, and 104 uninterested non-users) and observing the association between personality and interest in using psychedelics among non-users.

What were the dominant perceptions of personality change?

Eight higher-order thematic factors of perceived personality change emerged from our exploratory factor analysis of themes, including **Unitive Spiritual, Gratitude Absorption, Purpose Freedom, Compassion Understanding,**

Table 6. Relations between themes and settings

Theme	Alone	With companion	Romantic partner	Home	Own home	Other's home	Nature	Public	Festival/ concert	Special occasion	Music listening
Connection to the world	0.07	0.02	−0.03	−0.13	−0.08	−0.09	**0.29**	0.09	−0.11	−0.05	−0.03
Spiritual	0.07	−0.12	−0.04	0.01	0.07	−0.10	0.08	−0.02	0.06	0.02	0.03
Letting go of small concerns	0.16	0.02	−0.03	0.07	0.00	0.04	0.09	−0.08	−0.08	0.09	0.00
Metaphysical	0.08	0.07	−0.03	0.03	0.00	0.04	0.00	−0.04	−0.01	0.09	0.04
Mystical	0.02	0.11	0.06	0.13	0.05	0.04	0.00	−0.03	0.10	0.12	0.14
Shamanic	0.10	−0.02	0.02	−0.04	−0.02	0.05	−0.09	0.08	0.08	**0.27**	0.00
Nature-relatedness	0.00	0.07	0.03	−0.08	−0.03	−0.04	**0.20**	0.09	−0.12	−0.05	−0.08
Observant of surroundings	−0.05	0.06	−0.04	0.00	−0.09	0.06	0.01	0.04	−0.01	−0.05	0.00
Gratitude appreciation	−0.02	−0.08	−0.02	0.02	0.02	0.01	−0.05	0.02	0.09	−0.06	0.03
Savor beauty	−0.07	0.02	−0.03	0.03	0.00	0.04	0.00	0.00	−0.01	−0.04	0.00
Aesthetic openness	0.04	−0.10	−0.04	0.00	0.03	−0.03	0.03	0.02	−0.06	0.00	0.01
Goals/Purpose	0.00	0.07	−0.03	−0.14	−0.04	−0.09	0.18	0.12	0.07	−0.04	0.09
Authenticity	−0.06	−0.07	−0.06	−0.02	0.05	−0.06	0.05	0.02	0.01	−0.09	0.03
Conscientiousness	−0.06	−0.01	−0.11	−0.02	−0.05	0.04	0.05	−0.03	0.10	−0.02	−0.02
Nonconformity	0.08	−0.01	0.00	−0.08	0.03	−0.11	0.03	0.04	−0.05	0.04	0.06
Author	−0.04	0.07	−0.07	−0.04	−0.02	−0.02	0.06	0.01	−0.04	0.05	0.00
Freedom	−0.03	0.06	−0.06	0.01	0.10	−0.08	0.01	−0.03	−0.04	−0.05	0.03
Compassion/affective empathy	0.12	−0.09	0.03	0.05	0.10	−0.11	0.10	−0.06	−0.01	−0.01	0.03
Warmth/friendliness/ sociality	0.05	−0.09	−0.02	0.01	0.03	−0.06	−0.04	−0.03	0.10	0.05	0.08
Self-trust/acceptance/ love	−0.01	−0.05	−0.01	−0.01	0.04	−0.05	0.09	−0.01	−0.02	0.00	−0.03
Reduced judgment	−0.01	−0.01	0.00	−0.02	0.10	**−0.20**	0.06	−0.03	0.12	0.07	0.15
Connection to others	0.02	−0.07	0.06	−0.06	0.00	−0.11	0.10	0.02	0.01	0.12	0.03
Reduced reactivity/ anger/ant	−0.06	−0.01	0.00	−0.02	0.05	−0.11	0.15	−0.03	−0.07	0.05	0.09
Emotional stability	0.06	−0.09	0.07	0.05	0.02	0.01	0.01	−0.06	−0.01	0.03	−0.02
Peace/calm	−0.01	−0.06	0.08	−0.01	−0.06	0.02	0.04	−0.04	−0.07	0.02	−0.10
Mental health	**0.22**	−0.11	0.10	0.06	0.15	−0.08	0.00	−0.04	0.09	−0.02	0.02
Resilience/cope/psych flex	−0.01	0.00	−0.01	0.11	0.00	0.11	−0.07	−0.01	0.04	0.06	0.01
Truth/meaning/ understanding	0.05	−0.03	0.08	0.02	0.09	−0.07	0.10	−0.04	−0.07	0.02	0.07
New perspective	0.06	−0.08	−0.09	0.00	−0.01	0.01	0.00	−0.04	−0.01	−0.02	−0.08
Open-minded	−0.05	−0.02	−0.11	−0.07	−0.11	0.07	0.13	0.12	0.00	0.09	−0.06
Small ego	0.01	0.01	−0.07	−0.03	0.11	−0.13	0.11	0.02	−0.08	−0.09	0.15
Epistemic openness	0.06	−0.07	−0.01	−0.05	0.01	−0.06	0.08	0.07	0.05	−0.07	−0.03
Intellect/philosophical	0.06	−0.06	−0.05	0.02	−0.07	0.09	0.06	0.04	−0.02	0.01	0.02
Introspective	0.00	0.02	−0.08	−0.09	−0.04	−0.05	**0.27**	0.08	0.07	−0.04	0.09
Touchstone experience	0.10	−0.06	0.04	0.09	0.03	0.07	−0.02	−0.09	0.08	0.04	0.07
Connected to self	−0.04	0.07	−0.07	−0.04	−0.02	−0.02	0.14'	0.08	0.08	−0.05	0.09
Neuroticism/anxiety/ dep	−0.07	0.01	−0.02	0.10	0.11	0.01	−0.03	−0.11	−0.08	−0.09	−0.14
Cautious	0.06	0.01	−0.09	−0.05	−0.12	0.07	−0.12	0.01	−0.05	0.02	0.04
Closed to psychedelics	−0.05	0.08	−0.09	0.07	−0.12	0.19	−0.12	0.07	0.05	0.11	0.04
Introversion	−0.04	−0.02	−0.07	−0.04	−0.02	−0.02	−0.09	0.01	0.08	−0.05	0.00
Openness to experience	−0.04	−0.03	−0.02	−0.02	−0.10	0.09	0.07	−0.05	0.00	0.05	−0.05
Assertive/outgoing	0.19	−0.09	−0.06	0.08	0.18	−0.06	−0.08	0.01	−0.03	0.10	0.08
Happiness/positivity/ enthusias	−0.01	−0.01	−0.14	−0.14	−0.07	−0.07	**0.22**	0.12	0.05	−0.11	0.02
Perspective taking/cog empath	0.07	−0.02	−0.04	0.05	−0.05	0.06	0.08	0.02	−0.08	−0.04	−0.06

(continued)

Table 6. Continued

Theme	Alone	With companion	Romantic partner	Home	Own home	Other's home	Nature	Public	Festival/ concert	Special occasion	Music listening
Communion bonding	0.00	−0.03	−0.03	0.03	0.09	−0.05	0.09	−0.04	−0.08	−0.10	0.00
Reappraisal	**0.23**	−0.17	−0.10	0.05	0.09	−0.03	0.03	−0.03	−0.06	−0.08	−0.05
Hope	**0.32**	−0.17	−0.08	0.06	0.10	−0.04	0.03	−0.15	−0.05	−0.06	−0.01
Humans as insignificant	−0.05	0.08	−0.08	−0.14	−0.04	−0.11	**0.24**	0.17	−0.05	−0.06	0.06
Clarity of thought	0.10	0.07	0.02	0.03	0.06	0.05	−0.02	−0.06	−0.04	−0.05	−0.08
Creativity	−0.04	0.07	0.02	0.11	−0.02	0.13	0.06	−0.06	−0.04	−0.05	0.09
Vigor	−0.04	−0.02	0.02	−0.19	−0.09	−0.10	0.14	0.08	0.08	−0.05	0.00
Psychosis	−0.03	0.05	−0.05	−0.03	−0.07	0.04	−0.07	−0.09	−0.03	0.11	−0.06
None	−0.06	0.09	0.19	0.05	0.01	0.03	−0.15	0.00	0.03	0.05	0.04

Note. Correlations equal to or exceeding 0.20 are bolded. $N = 202$.

Emotional Stability, Openness Perspective, Connection to Self, & Neuroticism Caution. These eight factors showed remarkable overlap with previously identified themes from qualitative work, while also revealing new information. On a broad level, the emergent eight factors spanned psychological, cognitive, spiritual, and adverse changes, and constitute a preliminary organizing structure to possible psychedelic-mediated changes.

The psychological factors (i.e., **Purpose Freedom, Compassion Understanding, Emotional Stability, Openness Perspective, Connection to Self**) included multiple themes previously identified (e.g., relational salience, authenticity, lateral cognition, emotional stability, and self-efficacy), and tended to map onto Five-Factor Model personality including cognitive exploration, openness to different customs and lifestyles, and epistemic openness (mapping onto openness), compassion, perspective-taking, and reduced anger and judgment (agreeableness), purposefulness, self-improvement, responsibility, and authenticity/non-conformity (mix of conscientiousness and extraversion), and greater peace and enhanced self-regulation strategies (emotional stability/neuroticism).

Cognitive changes reflected in the **Gratitude Absorption** factor involved perceptions of increased focus on objects in the environment that formerly were either not seen or considered mundane. The emergence of this cognitive change was intriguing given its commonality with trait absorption, a construct describing the tendency toward cognitive engagement with sensory and imagined phenomena (Tellegen & Atkinson, 1974), and mindfulness, a cognitive state that can include present-moment awareness of one's surroundings (Shapiro et al., 2006). These constructs along with enhanced connectedness to nature have all shown evidence of elevation following psychedelic experience. Absorption (Weiss et al., in press), mindfulness (Madsen et al., 2020; Radakovic, Radakovic, Peryer, & Geere, 2022), and nature-relatedness (Gandy et al., 2020; Kettner, Gandy, Haijen, & Carhart-Harris, 2019; Lyons & Carhart-Harris, 2018) have been observed to increase following psychedelic experiences. The conceptual and empirical associations between mindful external awareness, absorption, aesthetic openness, and nature-relatedness observed in the present work may be suggestive of a common underlying cognitive substrate, which we regard as a fruitful area of inquiry in future research.

Spiritual changes were reflected in the **Unitive Spiritual** thematic factor. Themes reflected a world that is large, good, and interdependent, i.e., each individual is regarded as part of the whole, meaning that all people should be tended to with kindness and compassion. The structure of themes may be useful as a preliminary window onto the multifaceted nature of psychedelic-related spiritual change (Yaden et al., 2017). Notable shifts in metaphysical beliefs, the weight placed on personal concerns, and feelings of connectedness to the world were associated. The **Unitive Spiritual** factor appears consistent with previous work demonstrating enhanced connectedness following psychedelic experience (Watts et al., 2017, 2022), higher scores on self-transcendence among regular psychedelic users (e.g., Barbosa et al., 2016; Schneider et al., 2015), and changes to metaphysical beliefs in the direction of non-physicalist (versus materialist) beliefs (Nayak et al., 2022; Timmermann et al., 2021). These are notable convergences given that there was no priming for metaphysical or connection-related content in the study survey.

A factor involving adverse outcomes also emerged (i.e., **Neuroticism Caution**). Adverse outcomes were considerably less common than benefits (in this research <7%), and thus may be obfuscated within small studies focused on group-means versus outlying negative responders. Our results are consistent with a large observational survey study of psychedelic users ($N = 1{,}993$), wherein 7.6% of participants reported seeking treatment for enduring psychological symptoms following psychedelic use (Carbonaro et al., 2016), as well as previous case reports of post-psychedelic symptoms resembling psychotic episodes (Cohen & Dilman, 1962; Keeler & Reifler, 1967; Kopra, Ferris, Winstock, Young, & Rucker, 2022; Rosenthal, 1964), extended difficulties following psychedelic use (Evans et al., 2023), and adverse psychedelic experiences (Ona, 2018). In particular, 14% of our sample attributed to their psychedelic experiences an extended period of anxiety, stress, introversion, and caution/aversion with respect to psychedelic drugs. Low base rate negative responses such as these deserve expanded

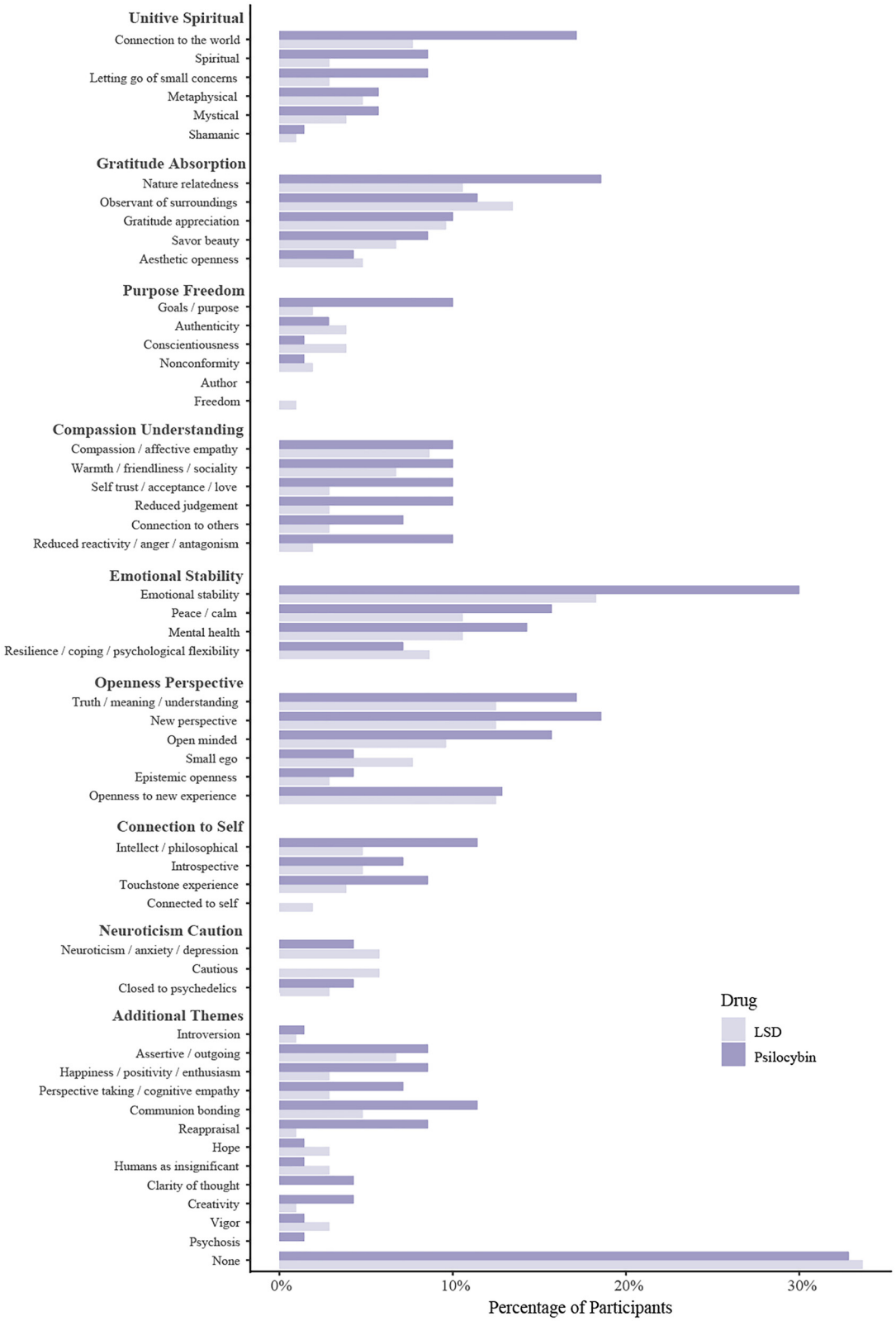

Fig. 3. Illustration of the percentage of participants reporting change themes by the drug used during the antecedent psychedelic experience

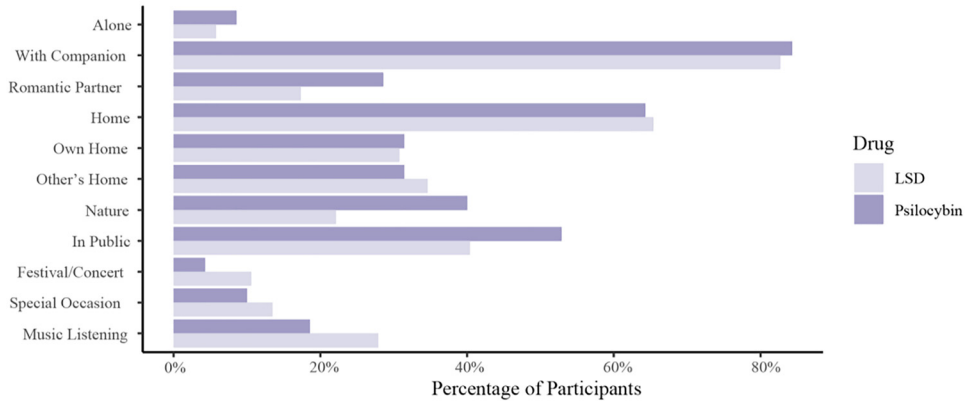

Fig. 4. Illustration of the percentage of participants who used LSD or Psilocybin in particular settings

Table 7. Descriptive statistics – personality means and variance

Domain/facet	Users	Interested Non-users Mean (SD)	Uninterested Non-users
Neuroticism	2.78 (0.87)[a]	3.16 (0.92)[a]	2.69 (0.89)
Extraversion	3.20 (0.76)[a]	2.80 (0.77)[a]	2.98 (0.77)
Openness	3.86 (0.61)[b]	3.77 (0.62)[c]	3.40 (0.66)[bc]
Agreeableness	3.95 (0.56)	3.92 (0.59)	3.96 (0.54)
Conscientiousness	3.82 (0.67)	3.69 (0.68)	3.92 (0.65)
BFAS Intellect	4.06 (0.62)[ab]	3.83 (0.72)[a]	3.73 (0.89)[b]
BFAS Openness	4.06 (0.70)[b]	4.03 (0.72)	3.75 (0.77)[b]

Note. SD = standard deviation. [a] indicates significant difference between users and interested non-users; [b] indicates significant difference between users and uninterested non-users; [c] indicates difference between interested non-users and uninterested non-users. Differences in Openness, BFAS Intellect, and BFAS Openness between users and non-user groups were evaluated at $p < 0.05$. Other comparisons were evaluated at $p < 0.002$.

Table 8. Correlations between FFM domains/aspects and Interest in psychedelic use

Trait	Users		Non-users	
	r	*p*-value	*r*	*p*-value
Neuroticism	0.01	0.889	0.28**	0.000
Extraversion	0.07	0.316	−0.04	0.550
Openness	0.19*	0.005	0.30**	0.000
Agreeableness	−0.08	0.233	−0.02	0.820
Conscientiousness	−0.08	0.237	−0.17'	0.013
BFAS Intellect	0.08	0.239	0.08	0.284
BFAS Openness	0.15'	0.025	0.20*	0.004
n	218		206-208	

Note. '$p < 0.05$,*$p < 0.01$,**$p < 0.002$.

study, ideally aimed at identifying and managing risk factors for such outcomes (e.g., psychological preparation and supportive setting) (Johnson, Richards, & Griffiths, 2008). Recent work in this regard has employed 'bottom margin analysis' to identify negative responders and has observed tentative signs of personality disorder accompanying higher odds of negative response (Marrocu, Kettner, Weiss, Zeifman, Erritzoe, & Carhart-Harris, 2023). Notably, the incidence of post-acute symptoms appears to be substantially lower in controlled drug administration studies, namely 0.90% of 110 participants in the Vollenweider laboratory in Switzerland, and 0.90% of 250 participants in the Johns Hopkins laboratory (Yaden, Earp, & Griffiths, 2022). Juxtaposed with the higher levels of harm observed in the present (largely) recreational sample, these findings illustrate the importance of promoting safety guidelines to reduce real and substantive risk in wider society. For this reason, recent work has employed 'bottom margin analysis' to identify negative responders and potential characteristics that may predict negative outcomes, e.g., personality disorder (REF).

In sum, our qualitatively- and retrospectively-derived model captured elements of psychedelic change observed in previous studies including elements of internalizing psychopathology (e.g., within the **Emotional Stability** factor), Five-Factor Model personality, and previously observed themes of change. Our results may be suggestive that despite being a useful map for personality change, the FFM model should not be considered sufficient. The benefit of the FFM model is coverage and convertibility, but the narrative themes provide areas to look for more psychological constructs of importance.

How did settings and drug types influence perceptions of personality change?

Our study provides preliminary evidence for the potential moderating influence of setting and drug type on personality changes. Natural settings were associated with the greatest number of positive perceived changes, including enhanced connectedness to the world, introspection, happiness/positivity/enthusiasm, and nature-relatedness. A growing body of research has linked nature contact to mental health (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Neill, Gerard, & Arbuthnott, 2019), psychedelic experiences to nature-relatedness (Kettner et al., 2019; Lyons & Carhart-Harris, 2018), and nature-relatedness to covarying changes in adaptive outcomes such as well-being (Gandy et al., 2020). However, to our knowledge, these results are the first evidence of a relationship between using psychedelics in a natural setting and distinct psychological outcomes,

tentatively supporting hypotheses posited by other scholars that the nature setting will produce incremental therapeutic benefit (Gandy et al., 2020). Should such results replicate using an experimental design, they would empirically support the importance of factors of (mind)set and setting as drivers of particular longer-term changes in personality, and accord with previously observed relations between set and setting factors and psychedelic experience as well as response (Hartogsohn, 2016; Hyde, 1960). Based on our results, we hypothesize that psychedelic experience interacts with the nature setting in such a way that individuals are disposed toward longer-term post-acute personality changes involving greater connectedness, introspection, happiness, and nature-relatedness. Perceptions of lower human significance are additionally hypothesized to emanate from a state of expanded contemplation of organismal subjectivity associated with the nature setting.

In addition, a greater number of psilocybin users (versus LSD users) reported positive perceived personality changes. Notable examples of this pattern included greater reports of Connection to the world, Nature-relatedness, Goals/purpose, Self-trust/acceptance/love, Emotional stability, Intellect/philosophical, Communion bonding, and Reappraisal. The reasons underlying these differences in response are not yet known, and as other researchers have speculated (Forstmann et al., 2023), could involve distinct pharmacodynamics, individual differences between psilocybin and LSD users, and/or distinct preferences for settings which rather mediate differential responses. The present study found partial support for the latter explanation as psilocybin users were substantially more likely to conduct their acute experience in a nature setting. Our results converge with a recent study that observed a specific association between psilocybin and nature-relatedness (compared to other psychedelic substances) that was reliable across five independent samples (Forstmann et al., 2023). It should be noted, however, that previous work in a laboratory setting observed no substantive differences in the subjective acute effects of psilocybin versus LSD (Holze et al., 2022), though differential personality changes were not measured.

What personality traits predispose psychedelic use?

Our study attempted to advance understanding of the personality determinants of psychedelic use. Examining non-users only, we observed that individuals who expressed stronger interest in psychedelic experience were generally higher in openness to new experience and neuroticism. Because openness is associated with greater cognitive exploration and appetite for varied experience, this result makes conceptual sense. Neuroticism's association with interest was more surprising as psychedelic experience is known to occasion at times challenging and aversive experience (Carbonaro et al., 2016). At the same time, psychedelics are gaining a reputation as a source of emotional peace, though it is not clear this understanding was well-entrenched at the time of data collection.

Comparing psychedelic users to non-users, we observed that psychedelic users were more open than non-users in terms of intellect and aesthetic openness. These results were consistent with previous observations of higher self-transcendence and openness among regular psychedelic users (Barbosa et al., 2016; Bouso et al., 2015; Jiménez-Garrido et al., 2020; Nour & Carhart-Harris, 2017; Schneider Jr et al., 2015). Given the impressive stability of personality traits over time (Ferguson, 2010; Roberts & DelVecchio, 2000), our results could reflect personality traits that predispose psychedelic use.

Equally, however, they could reflect ways in which users' personalities change in response to psychedelics. We designed our comparison between users and interested non-users (thereby adjusting for personality differences related only to differences in interest) to facilitate a stronger basis for this interpretation. We observed that users reported lower neuroticism, and higher extraversion and intellect compared to interested non-users. Few studies have attempted to control for interest, which itself indexes a distinctive personality trait profile (i.e., higher openness and neuroticism). An exception is Jimenez-Garrido et al.'s (2020) recent study in which ayahuasca-experienced users were compared to ayahuasca-naïve individuals who were actively planning their first ayahuasca ceremony. The study's observation of higher self-transcendence among experienced users may partially converge with our observation of higher intellect, an aspect of openness and indicative of philosophical and abstract thinking (though no direct association has been tested).

In sum, trait openness was consistently observed as both a correlate of interest and a distinctive trait among psychedelic users (relative to non-users), indicating that psychedelic use may be associated with increased openness both as a driver and a consequence, i.e., involving a positive feedback loop. In contrast, neuroticism was associated with the desire to use psychedelics, but lower neuroticism may be a more likely outcome (Bouso et al., 2018), i.e., constituting a negative feedback loop. Clinically, such findings may be valuable for informing clinicians about which patients (i.e., higher openness and neuroticism) may bear greater receptivity to and readiness for psychedelic treatments.

Limitations

A number of limitations should be noted. First, our psychedelic personality change model was derived from retrospective accounts of personality change, which are subject to retrospective bias and motivated reasoning, especially among respondents bearing a positive relationship to psychedelics. We believe these concerns are somewhat mitigated by our recruitment approach which reduced sample bias toward psychedelic enthusiasts who bear greater demand and placebo biases.

Second, it should be clearly stated that although we believe our study is likely to capture some actual trait changes, it is methodologically capable of observing only

perceived trait changes. This we regard as a necessary starting point before examining candidate changes using more rigorous pre-post designs (e.g., active placebo-controlled, recruitment of low expectancy, psychedelic-naïve subjects) (Aday et al., 2022).

Third, our thematic analytic method was not capable of detecting whether each participant experienced each change theme, as it was based on open-ended responses and thus perceptions of change participants volunteered. As such, future research is needed to test the model's structure while directly querying the magnitude of each change theme.

Fourth, the current study is limited by a relatively small sample size of users and non-users, with which to estimate population values. This research is therefore a preliminary attempt to understand the personality determinants of psychedelic use.

Fifth, because our study did not measure personality in relation to drugs beyond psychedelics, it cannot comment on the specificity of personality determinants of psychedelic use. That is, it is possible that the observed personality determinants are merely related to drug use in general, or multiple drugs including psychedelics. It should be emphasized however that such a limitation does not meaningfully negate the utility of our results for predicting psychedelic use.

Finally, our study did not take advantage of peer-report measurement, which limits the breadth and reliability of our self-report-based findings. Future research is encouraged that incorporates reporting from others to corroborate and reinforce self-perceptions of change.

CONCLUSION

The present data provide a preliminary model of psychedelic personality change involving personality-based determinants of psychedelic use, the impact of psychedelic use/experience on personality and self-structure, and the possible moderating effects of setting and drug type variables on personality changes. By using a qualitative approach, our results are more nuanced and comprehensive than is otherwise possible with content-limited quantitative measures. We accordingly believe the present model constitutes a significant advance toward a holistic model of how personality interacts with psychedelic use/experience. Because our cross-sectional and retrospective approach was only capable of measuring perceptions of changes rather than actual changes, the principal utility of our model is in guiding hypotheses for future prospective and experimental work.

A model of psychedelic personality change cannot avoid being inherently limited in characterizing the diversity of psychedelic-mediated changes in the self, especially if such changes follow probabilistic and entropic neural processes (Carhart-Harris & Friston, 2019). Nevertheless, a well-validated model may still be valuable in undergirding future measurement and therapeutics. Measurement scales that comprehensively capture possible changes in relation to the recreational and therapeutic use of psychedelics can enable individuals and patients to monitor useful domains of self-functioning beyond narrow treatment conditions and FFM domains. We also hope that our qualitative-first bottom-up approach identifies more obscure potentialities of change that in turn can be further potentiated with the assistance of tailored psychological and psychotherapeutic change modalities. As two examples, validation of the **Compassion Understanding** factor would guide the application of psychedelic-assisted antagonism-focused therapy for antagonism-based personality disorders (B. Weiss, V. Nygart, et al., 2021; Weiss, Sleep, Miller, & Campbell, 2023; Zeifman & Wagner, 2020); and validation of the **Purpose Freedom** factor would guide the development of synergistic modalities geared toward specific goal attainment and motivation. Future research is thus strongly encouraged that continues to advance these goals.

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Research data/data availability: The study data and analysis scripts used for this article can be accessed at https://osf.io/56xzd/?view_only=8edf9e50832446748c83890c37372496.

SUPPLEMENTARY DATA

Supplementary data to this article can be found online at https://doi.org/10.1556/2054.2023.00291.

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