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ARTICLE

Psychedelics and psychological strengths

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Abstract: Classical psychedelics appear efficacious in improving psychological well-being in randomized clinical trials, but their effects in the population at large are relatively unknown. In the present paper, which includes three studies conducted by online survey with a collective 3,157 participants, classical psychedelic users showed greater psychological strengths and well-being, and lower levels of distress, after controlling for demographic variables, respondents' beliefs about the potential benefits of psychedelics, and their use of other psychoactive drugs. These benefits contrast with patterns for cannabis and alcohol users, both of whom showed comparatively maladaptive profiles. Reported relationships between psychedelic use and the combined index of psychological strengths was fully mediated by self-transcendence. We show an effect of motivation for psychedelic use, where those who reported a 'growth' motivation showed the most robustly adaptive psychological profile. Psychedelic users reported more lifetime meditation experience, and within psychedelic users, greater frequency of use correlated with greater hours of lifetime seated meditation practice. Meditation experience did not account for the differences in strengths, well-being, and distress. In these studies, psychedelic users showed an adaptive psychological pattern on a wider array of strengths than previously studied, which were not attributable to several salient covariates. While causality cannot be inferred from this study, findings align with and advance past research which provides evidence for the potential benefits associated with psychedelics.

Keywords: psychedelics; positive psychology; psychological strengths; mindfulness; self-transcendence; entheogens

1. Introduction

There is a current resurgence in the research and clinical applications of classical psychedelics[119,] namely psilocybin, DMT/ayahuasca, lysergic acid diethylamide (LSD), mescaline, and analogous drugs, which have common pharmacodynamic mechanisms as agonists at the 5-HT_{2a} receptor[116]. In addition to experimental and clinical trials, these drugs have been widely used in the general population. In the United States alone, the estimated lifetime prevalence of use is about 10% of the population, or approximately 32 million individuals[85.] Classical psychedelics have been shown to produce long-lasting trait changes in certain aspects of personality, which were thought to be relatively stable across the lifetime[79,91]. Notably, psychological changes derived from a single psychedelic experience in the context of clinical trials can last between 4-14 months[56,58,76,148,177], and some research suggests changes may persist longer than currently demonstrated, even up to a lifetime[43]. In this prospective survey-based study, we attempt to expand upon the set of psychological traits conceivably altered by psychedelic use.

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2. Background

Psychedelics have been associated with a range of both state- and trait-level psychological characteristics [79]. Pre/post changes in the following areas have been shown in trials of psychedelic-assisted psychotherapy: improvements in mood/positive affect[84,141], increased overall well-being[56,133,141,158,167], increased openness[29,78,103,142], increased mindfulness[61,104,135,147], increased empathy[44] increased meaning in life[141], decreased depression[3,55,57] and anxiety[63], and decreased substance misuse[3,51,53]. A number of these findings were explicit therapeutic targets for the clinical trials, others unanticipated and oblique to the stated aims, while nonetheless psychologically beneficial, and attributable to the psychedelic experience in a therapeutic setting[103]. These findings raise the possibility that the use of classical psychedelics in non-clinical contexts also might lead to lasting trait changes. Preliminary research suggests this might be the case. Changes in the following traits have been shown pre/post treatment with psychedelics in a structured but naturalistic setting (e.g. an ayahuasca ceremony): increased acceptance[151], increases in trait self-transcendence[17,19], improved physical health[8], increased meaning in life[17], increased mindfulness[152], increased self-compassion[135], increases in both agreeableness and openness[8], decreased substance misuse[157], decreased physical pain[7], and improved convergent and divergent thinking[181]. In these non-clinical experimental settings, as with clinical settings, changes in psychological traits often persist, sometimes for years[1,9,17,26,56,101].

Prospective studies, conducted by online surveys, have reported relationships between the use of psychedelics in a naturalistic setting and changes on a largely overlapping set of psychological measures, as shown in clinical trials and non-clinical experimental settings. Previously reported differences include an increased sense of meaning in life[59,77], increased self-compassion[153], increased prosociality[72,168,179], increased empathy[95], increased openness[117], greater overall well-being[24], greater life satisfaction[24], and less substance misuse[77]. Of these studies, only Lerner & Lyvers (2006)[95], Walsh et al. (2016)[168] and Hendricks et al. (2018)[71] report findings comparing psychedelic users to non-users, and only Hendricks et al. (2018)[72] reports findings from a large sample of the United States population. These psychological attributes, potentially altered by the use of classical psychedelics, are generally associated with greater overall psychological well-being in the psychological literature, as well as in the psychedelic literature specifically[79,123]. Beyond these changes, naturalistic (e.g. non-clinical) psychedelic use in US population level samples is associated with an equal or reduced instance of mental health problems, psychological distress, and suicidality[70,74]. The aggregate psychedelic literature suggests the potential for increases in positive psychological traits[56,79] as well as possible reductions in psychological maladies[58,70].

Psychedelics dose-dependently produce distinct neural correlates and a concomitant subjective experience variously called a peak experience[82], mystical experience[60], self-transcendence[128], or ego dissolution[91,92,110]. This type of unitive experience entails a constellation of subjective correlates including feelings of a dissolution of the boundaries between self and other, subject and object, the self and the external world, and a sense of union with something larger than oneself[27]. In modern literature, self-transcendence and ego dissolution are often used interchangeably[128]. While self-transcendence is generally measured as an acute state, psychedelic use has also been found to increase trait self-transcendence, a more enduring aspect of self-identification with a larger whole[17,19]. State self-transcendence scores are reliably positively correlated with clinical outcomes[3,15,39,51,91,117, 110,132,133]. Particularly germane in the context of this paper, the degree of participants' self-transcendence or ego dissolution experiences correlated with long term positive psychological effects beyond the scope of explicitly desired clinical outcome(s)[58,76,148]. Naturalistic psychedelic users appear to experience similarly meaningful peak

experiences as those demonstrated in clinical settings[35,59,60,102,180] which also mediate positive outcomes[52,77].

Second-wave psychedelic studies report mostly positive psychological effects. It should be noted that this is not always the case. Negative affect, including extreme anxiety and fear are reportedly common during psychedelic experiences (39%), which include a clinical setting[58.] Other studies report 'challenging experiences' in 40% of participants in a clinical setting[51.] In an online self-report survey study with a large sample size (n = 1993), 8% of participants indicated that their psychedelic experience(s) actually decreased their life satisfaction and well-being [24.] It is strongly suspected that in rare cases naturalistic psychedelic use can provide a stressor that leads to a psychotic break in users predisposed to psychosis[32,183,184,185]. Despite this suspicion, both past and current studies investigate(d) psychedelics for the potential treatment of psychosis[186].

3. Purpose/hypotheses

Several lasting trait level changes have been shown in the psychedelic literature, however, subjective reports of psychedelic use, such as those found on reddit.com/psychedelics or erowid.org/experiences, can include a wider array of benefits and drawbacks than the ones established to date by quantitative studies[136]. These indicate effects of psychedelic use may not be limited to hitherto measured domains. Most studies focus on one or two key psychological traits that may indicate treatment efficacy[79]. The aim of this study was to replicate traits altered in clinical trials in a larger survey-based sample while measuring an expanded array of traits that might be associated with psychedelic use.

The present studies were undertaken in an iterative manner for the accrual and honing of a battery of psychological traits which might be associated with the use of classical psychedelics as well as internal replications of such findings. The rationale for including three studies is to indicate the way in which multiple studies homed in on a battery of traits that seemed to replicate and remain consistently different between psychedelic users and non-users. In Study 1, we began by establishing links between psychedelic use and well-being and mindfulness measures, as well as measures of self-transcendence, all previously shown in the literature to be significantly altered by psychedelic experience(s), as well as some exploratory measures. In Study 2, we expanded mindfulness and related measures, replicated well-being and self-transcendence measures, and added exploratory measures of maladaptive social functioning. We also expanded covariates and introduced a comparison between psychedelic users and users of cannabis and alcohol to ascertain if the psychedelic profile appeared unique. In Study 3, we included the widest range of traits for which we previously saw associations, applied both the covariates and cannabis/alcohol comparisons, and conducted a meditation analysis to see if, like in clinical research, differences were mediated by the degree of self-transcendence. We inquired into participants' 'motivation' for psychedelic use, analyzed the differences between intentions, and added beliefs about psychedelics as covariates. We apply the terms "adaptive" and "maladaptive" to indicate directionality in all study analyses and the final figure. "Adaptive" indicates differences in a direction shown to contribute to psychological health, and "maladaptive" indicates differences in a direction shown to be associated with poorer psychological health.

Based on previously reported findings in the literature, we hypothesized that lifetime psychedelic users would score significantly higher on adaptive psychological traits as well as significantly lower on maladaptive traits, while controlling for salient covariates, and that differences in these traits would be mediated by self-transcendence. Further, we predicted that

the intention among psychedelic users to use the substances for personal growth, as opposed to fun/recreation, would predict the largest differences in psychological strengths.

4. Participant recruitment

Participants were recruited via email and social media by undergraduate students at a northeastern university who received a small amount of course credit for participation as well as participant recruitment, where not participating had no effect on students' course grades. Participants were naive to the purpose of the studies. Students could send a link to the survey via email or social media to up to ten individuals unrelated to the class, as well as fill it out themselves. It was specified that participants must be community-dwelling adults, age 18-years or older. This type of sample recruitment allowed for a more demographically diverse sample (in terms of age, education level, etc.) than limiting the sample to college students or online psychedelic-themed forums, as well as a greater diversity of opinions and attitudes surrounding psychedelics. A link to a Google Forms survey was provided that had an informed consent, demographic questions (age, sex, years of formal education, religious affiliation, and lifetime hours of meditation), and a survey that was approved by the Stockton University Institutional Review Board, in accordance with the ethical principles of the American Psychological Association and the Declaration of Helsinki. Data were imported into SPSS to be analyzed. Effect sizes are reported as partial eta squared values from SPSS in accordance with the cutoff values suggested by Cohen, 2013[33] . To improve data validity, two instructed response items were included in the survey (e.g. "Please click on number 5 for this item.") Participants who did not answer both items correctly were dropped from analyses. Further, extreme univariate outliers (>3.0 SD beyond the mean) were also dropped from analyses[36,108].

Rather than studies specifically targeting psychedelic users and relying on pre- vs. post-treatment self-reported changes[3,59], we gathered large samples without indicating the purpose of the study. This allowed direct comparison between psychedelic users and non-users. Since experimental and clinical trials tend to have limited sample sizes, correlational studies may help establish if those results are seen in larger populations. Correlational studies can also investigate whether any of the findings of clinical trials are found when a controlled clinical setting and trained clinician are not present[37,139].

Second generation psychedelic research findings are potentially skewed toward positive results given participant recruitment in clinical trials relies on self-selection and often targeted social media ad campaigns - all but ensuring participants have a positive view of psychedelics. Previous survey studies[3,52,59] have recruited almost exclusively from psychedelic-related internet forums and social media platforms targeting psychedelic users. While these types of studies can provide proof of concept-style evidence, the present studies utilized broader samples, including both users and non-users. Further, the psychedelic users in these samples were not limited to those who are self-motivated to use specialized psychedelic internet forums, or those who are algorithmically selected for social media advertisement targeting based on a history of interest in psychedelics. While our recruitment method is a type of convenience sample, the lack of targeting and hidden purpose of the study insulates the results from the types of biases pervasive in even well designed modern psychedelic studies. Larger samples allow for greater statistical power in analyses and controlling for the potential influence of several demographic or other social and behavioral confounds. A particularly salient confound is the influence of the use of other psychoactive drugs, which may not be uncommon among psychedelic users[115] . If so, then other studies have, in effect, been evaluating polydrug users and not controlling for these extraneous and confounding effects, rather than isolating the influence of classic psychedelic use.

5. Study 1

The goal of Study 1 was to establish whether people who have used classical psychedelics one or more times show greater well-being and mindfulness than non-users across measures. This study also examined self-transcendence using a variety of validated measures. Increases in trait mindfulness have been reported after use in both laboratory and naturalistic settings[56,59,61,148]. There appear to be phenomenological similarities[99] , neurophysiological similarities[111], and mindfulness meditation and the psychedelic experiences have been shown to combine to synergic effect[146] . Long-term meditation practice is associated with greater self-transcendence, and both long term meditation and the use of classical psychedelics have been associated with altered connectivity of the default mode network (DMN)[164,175] . Models have shown self-transcendence, mindfulness, self-compassion, and emotion regulation are interrelated, collectively reducing negative emotion and increasing psychological well-being[166] . Given these overlaps we sought to examine the relationships between psychedelic use and self-transcendence, mindfulness, compassion for oneself and others, positive and negative affect, and life satisfaction. It was hypothesized that psychedelic users, compared to non-users, would demonstrate higher scores on these measures, apart from negative affect, after controlling for demographic influences and meditation experience.

5.1 Methods

5.1.1 Survey completion, demographics, and measures

Participants (N = 465) completed demographic and characteristic surveys (see Supplement 1), as well as psychological well-being surveys with measures including but not limited to measures of self-transcendence, positive psychological and psychological distress measures (see Supplement 2 for a full list). All measures, unless otherwise specified, used a 7-point Likert-type scale to provide consistency across items. Where possible, shorter scales, or shorter versions, were chosen to maximize the array of constructs measured and minimize participant burden. Intrascale reliabilities (Cronbach's α) obtained in this sample are reported here for all relevant scales. See Supplement 1 for survey completion statistics and demographic information and Supplement 2 for a full list of questions/scales included.

5.1.2 Procedure

The procedure for all 3 studies is described in the introduction. Participant data and validity are detailed in Supplement 1 for all three studies.

5.1.3 Data transformation

Data were inspected for skewness before statistical testing. Since the statistical tests to be used (e.g. MANCOVA) assume a normal distribution, any variables with a considerable degree of skewness (> .3 or < -.3) were subjected to data transformation in order to normalize their distribution[157] . All scores for all scales were converted into standardized scores and then T-scores (M = 50, SD = 10) to serve a standard for comparison across measures with different scoring systems[157] . See Supplement 5 for details.

5.2 Results

5.2.1 Analysis of covariance (ANCOVA).

An ANCOVA controlling for age, sex, and education showed that psychedelic users reported more hours of lifetime meditation practice than non-users [$F(1,460) = 3.86$, $p > .001$, $\eta_p^2 = .04$], M

= 814.0 *SD* = 2428.3 vs. *M* = 231.0 *SD* = 1538.3, respectively. Thus, lifetime meditation experience was used as a covariate, along with demographic variables, in the subsequent analysis to disentangle that behavior from any results obtained. See Supplement 4 for full ANCOVA.

5.2.1 Multivariate Analyses of Covariance (MANCOVA).

A MANCOVA was performed to examine differences between lifetime psychedelic users vs. nonusers to more conservatively protect against both Type I error and the chance that covariables were influencing the outcome. This result was significant, $F(11,445) = 3.71$, $p <= .001$; Wilk's $\Lambda = .92$, $\eta_p^2 = .08$. The MANCOVA controlled for the covariates of age, sex, education, having a religious affiliation, and lifetime hours of meditation. Significant differences in the predicted direction were observed for all measures except mindfulness. See Table 1 for results.

	Psychedelic Users M (SE)	Psychedelic Nonusers M (SE)	F	ηp²	Directionality
Mysticism	54.1 (1.3)	49.2 (.5)	6.47‡	.10	A
Inclusive Identity	**53.9 (1.2)**	**49.3 (.5)**	**8.54‡**	**.13**	**A**
Self-Transcendence	50.7 (1.2)	49.7 (.5)	6.32‡	.10	A
Mindfulness	50.6 (1.2)	50.0 (.5)	1.20	-	-
Equanimity	53.0 (1.2)	49.6 (.5)	7.19‡	.11	A
Kindness (FSA)	52.1 (1.3)	49.6 (.5)	3.97‡	.07	A
Self-Compassion	**53.2 (1.2)**	**49.4 (.5)**	**9.64‡**	**.15**	**A**
Life Satisfaction	50.3 (1.2)	50.0 (.5)	5.87‡	.09	A
Positive Affect	50.5 (1.2)	49.8 (.5)	3.81‡	.06	A
Negative Affect	49.5 (1.2)	50.1 (.5)	2.46*	.04	A

*A = Adaptive, M = Maladaptive

Table 1. *Study 1 MANCOVA of differences between psychedelic users (n = 72) and non-users (n = 392) on psychological strengths and affect. Means and standard errors (in parentheses) are provided. Analysis is controlling for age, sex, education, religious affiliation, antianxiety/antidepressant medication, and lifetime meditation hours. Significance: *p <= .05, †p <= .01, ‡p <= .001. Bold indicates medium-large effect size.*

5.3 Discussion

These results are consistent with the hypothesis that psychedelics are associated with greater well-being and psychological traits linked to it. Consistent with clinical trials, psychedelic users showed greater self-transcendence on three different scales, greater positive emotion, and less negative emotion. They further showed greater mindful acceptance (i.e. equanimity), kind attitudes towards others, self-compassion, and overall life satisfaction. These are adaptive characteristics that link to greater well-being across multiple domains[166]. Contrary to predictions, no differences were found in mindful awareness. Effect sizes were moderate apart from a small effect size for negative affect and large effect sizes for inclusive identity and self-compassion. By statistically controlling for demographic factors and meditation experience, we eliminate possible confounds. This approach particularly critical for meditation, since the subjective results of meditation practices and psychedelic use share some overlap[111]. Indeed, psychedelic users in this

sample reported substantially more meditation experience than non-users, but this difference was not responsible for the group differences observed.

6. Study 2

The goal of Study 2 was to replicate and expand the findings of Study 1 regarding psychological measures associated with psychedelic use.

Study 2 expanded mindfulness and related measures. The measure of mindfulness used in Study 1 (PM.awa) explicitly focuses on awareness of thoughts and emotions. In contrast, the items of the Mindful Attention Awareness Scale (MAAS) deal with the degree of mind wandering[23]. The MAAS has been demonstrated to relate to functional connectivity in the DMN[13,45]; both psychedelics and mindfulness alone, as well as in concert, are known to modulate connectivity in the DMN with lasting effects[148]; For this reason, the MAAS may present a relevant measure related to potential alterations in the DMN, whose structure and function relate to the degree of self-transcendence reported[19,28]. On this evidence we suspect the MAAS may be more sensitive to psychedelic related alterations. We measured gratitude with the G3, forgiveness with the TTF[22] , and humility with the HUM. These are three psychological strengths consistently associated with greater mental and physical well-being and potentially associated with psychedelic use[172,173,174].

Study 2 added exploratory measures of maladaptive social functioning. Greed, malicious envy, and chronic hostility are indicative of maladaptive patterns that relate to poorer cognitive, emotional, and social functioning, as well as physical health[89,109,112,145].

Study 2 replicated and expanded well-being and self-transcendence measures. Meaning in life and life satisfaction are overarching aspects of functioning that relate to multiple psychological strengths and adaptive functioning in many aspects of life[41,69,125]. Psychological well-being, health, and sleep quality are interrelated, with psychological strengths possibly exerting influence on well-being through health behaviors, physiological processes, and/or coping ability[122,154]. Perceived social support and perceived health were measured rather than attempting to measure actual support or health since perceived aspects involve psychological interpretation of events and are more closely tied to well-being[64,107,134]. Whereas Study 1 inquired about attitudes of kindness, we sought to examine whether this translated into prosocial behavior. We inquired about the number of days per month, on average, people spent a significant part of their day volunteering or helping others.

We inquired about the lifetime use of other psychoactive drugs. Use of one class of psychoactive substances has been shown to predict increased odds of using others[140]. This highlights the likelihood that many psychedelic users may have used other categories of psychoactive drugs. To determine whether the characteristics associated with psychedelic users are specific to psychedelic use, it would be necessary to control for the potentially confounding effects of the concomitant use of other psychoactive substances. Beyond controlling for substance use, Study 2 expanded covariates by introducing a comparison between psychedelic users and users of cannabis and alcohol to ascertain if the psychedelic profile appeared unique. Income and work status were also gathered as covariates.

It was again hypothesized that psychedelic users would score higher in measures of well-being, mindfulness, self-transcendence and volunteering behavior and lower in maladaptive characteristics (greed, malicious envy, and chronic hostility) relative to non-users and that these differences would again be independent of demographic variables as well as lifetime non-medical use of other classes of psychoactive drugs (alcohol, cannabis, opioids, sedatives, 3,4-methylenedioxymethamphetamine [MDMA], dissociative, and major stimulants). It was

hypothesized the profile for psychedelic users would be distinct compared with cannabis and alcohol users.

6.1 Methods

6.1.1 Survey completion, demographics, and measures

Same as Study 1, see Supplement 1 for survey completion and demographics and Supplement 2 for measures. The final sample was $N = 1550$.

6.1.2 Procedure

The procedures for participant recruitment, data collection, response validity, and data transformation were the same as in Study 1. See Supplemental Material 1 for transformations [156].

To assess lifetime and recent psychoactive drug use, participants were inquired about their lifetime use of opioids, major stimulants, cannabis, MDMA, sedatives, classic psychedelics, and dissociatives (ketamine or PCP). The questions specified non-medical use only. Participants were asked to estimate the number of times they used each class of drug using a Likert-type ordinal scale (Never = 0, Once or twice = 1, 3-10 times = 2, 11-19 times = 3, 20-50 times = 4, 51-99 times = 5, 100+ times = 6), which was also used to dichotomize into those who had ever vs. never used a drug in each category.

6.2 Results

6.2.1 Psychoactive drug usage

See Supplement 1.

6.2.2 Correlations

Non-parametric, Spearman's rho ($df = 1548$) tests were used to correlate use of psychedelics and other drugs since ordinal ratings were used. Correlations were significant and positive between psychedelic use and use of all other classes of drugs ($p < .001$). This indicates the need for controlling for the use of other non-psychedelic classes of drugs as covariates in the subsequent analyses. See Supplement 3.

6.2.3 Multivariate analyses of covariance

A MANCOVA examining differences between psychedelic users versus nonusers on the well-being measures was significant [$F(14,1496) = 2.38$, $p = .003$; Wilk's $\Lambda = .98$, $\eta_p^2 = .02$]. The MANCOVA controlled for the covariates of age, sex, education, ethnicity, affiliation with a religion, student status, and the non-medical use of other classes of drugs(major stimulants, sedatives, opioids, cannabis, MDMA, and alcohol). Significant differences were observed on all well-being measures except for sleep quality. All measures, except for perceived social support, were in the predicted direction, i.e. showing a relatively more adaptive pattern in psychedelic users. See Table 2 (below) for results.

6.2.4 Cannabis

To compare these results with cannabis use, a MANCOVA was performed to examine differences between cannabis users versus nonusers on the well-being measures, controlling for demographic variables and use of other psychoactive drugs. This result was significant for cannabis use [$F(14,1496) = 3.24$, $p <= .001$; Wilk's $\Lambda = .97$, $\eta_p^2 = .03$]. The MANCOVA controlled for

the covariates of age, sex, education, ethnicity, affiliation with a religion, student status, and the non-medical use of other non-cannabis classes of drugs (major stimulants, sedatives, opioids, psychedelics, MDMA, and alcohol). Significant differences were seen in all measures except sleep quality, with effect sizes ranging from small to medium. Differences were in the adaptive direction on six measures and maladaptive on the remaining six measures. See Table 2 and Figure 3 for results.

	Psychedelics				**Cannabis**				**Alcohol**			
	Users	Non-users			Users	Non-users			Users	Non-users		
	M (SE)	M (SE)	F	D	M (SE)	M (SE)	F	D	M (SE)	M (SE)	F	D
Mindfulness	51.5 (0.8)	49.6 (0.3)	8.60‡	↑	49.8 (0.3)	50.1 (0.4)	8.60‡	↓	49.8 (0.3)	50.1 (0.5)	8.31‡	↓
Equanimity	50.8 (0.8)	49.8 (0.3)	10.07‡	↑	49.6 (0.3)	50.5 (0.4)	10.07‡	↓	49.6 (0.3)	50.6 (0.5)	10.07‡	↓
Gratitude	51.2 (0.8)	49.7 (0.3)	3.58‡	↑	50.1 (0.3)	49.7 (0.5)	3.58‡	↑	49.9 (0.3)	50.0 (0.5)	3.54‡	↓
Forgiveness	50.6 (0.8)	49.9 (0.3)	3.91‡	↑	49.7 (0.3)	50.6 (0.5)	3.91‡	↓	50.3 (0.3)	49.4 (0.5)	3.99‡	↑
Humility	51.9 (0.8)	49.7 (0.3)	3.23‡	↑	50.5 (0.3)	49.4 (0.4)	3.23‡	↑	49.6 (0.3)	51.1 (0.5)	3.13‡	↓
Perceived Support	49.5 (0.8)	50.4 (0.3)	2.42‡	↓	50.2 (0.3)	50.4 (0.5)	2.42‡	↓	50.4 (0.3)	50.0 (0.5)	2.45‡	↑
Inclusive Identity	51.1 (0.8)	49.8 (0.3)	3.26‡	↑	50.7 (0.3)	48.8 (0.5)	3.26‡	↑	50.0 (0.3)	49.9 (0.5)	3.24‡	↑
Self-trans.	52.7 (0.8)	49.4 (0.3)	4.63‡	↑	50.4 (0.3)	49.2 (0.4)	4.63‡	↑	49.9 (0.3)	50.1 (0.5)	4.59‡	↓
Sleep Quality	50.2 (0.8)	50.1 (0.3)	1.51		50.0 (0.3)	50.2 (0.5)	1.51		50.5 (0.3)	49.4 (0.5)	1.6	
Perceived Health	51.1 (0.8)	50.2 (0.3)	1.69*	↑	50.5 (0.3)	50.1 (0.5)	1.69*	↑	50.8 (0.3)	49.4 (0.5)	2.05†	↑
Volunteering	50.4 (0.8)	49.9 (0.3)	2.51‡	↑	49.3 (0.3)	51.0 (0.5)	2.51‡	↓	49.8 (0.3)	50.2 (0.5)	2.40‡	↓
Greed	48.1 (0.8)	50.3 (0.3)	13.36‡	↓	50.5 (0.3)	49.1 (0.4)	13.36‡	↑	50.8 (0.3)	48.4 (0.4)	12.97‡	↑
Envy	48.0 (0.8)	50.0 (0.3)	9.23‡	↓	49.6 (0.3)	50.0 (0.4)	9.23‡	↓	50.3 (0.3)	48.6 (0.5)	8.97‡	↑
Hate	48.7 (0.8)	50.0 (0.3)	9.84‡	↓	50.2 (0.3)	49.0 (0.4)	9.84‡	↑	49.9 (0.3)	49.5 (0.5)	9.59‡	↑

Table 2. *Study 2 MANCOVA of differences between users and non-users of psychedelic users on measures of psychological strengths, well-being, and distress. Sample sizes: Psychedelics (users, n = 239; non-users, n = 1288), Cannabis (users, n = 959; non-users, n = 568), and Alcohol (users, n = 495; non-users, n = 1032). Means and standard errors (in parentheses) are provided. Analysis is controlling for age, sex, education, ethnicity, religious affiliation, local residency, income, student status, work status, local residency, and lifetime non-medical use of other categories psychoactive drugs. Significance: *p <= .05, †p <= .01, ‡p <= .001. D = Directionality. Bold indicates medium-large effect size; all others are small effect sizes with sleep quality being nonsignificant. Items below the line are negative psychological qualities.*

6.2.5 Alcohol

A third MANCOVA was performed to examine the differences between those who use alcohol on a regular basis (i.e. 1 or more alcoholic beverages in an average week; *n* = 1032) versus those who do not consume any on a regular basis (*n* = 495). The result was significant for alcohol [$F(14,1496) = 3.66$, $p <= .001$; Wilk's $\Lambda = .97$, $\eta_p^2 = .03$]. The MANCOVA controlled for the covariates of age, sex, education, ethnicity, affiliation with a religion, student status, and the non-medical use of other classes of drugs (major stimulants, sedatives, opioids, psychedelics, MDMA, and cannabis). Significant differences were observed on all well-being measures except for sleep quality, with effect sizes ranging from small to medium. Differences on four measures were in

the adaptive direction for regular alcohol consumers (forgiveness, perceived social support, inclusive identity, and perceived health), and in the maladaptive direction on nine measures. See Table 2 for results.

6.3 Discussion

Demographic patterns are well-established in aspects of wellbeing and psychoactive substance use[11,161]. In our data, those who had used psychedelics at least once were more likely to have used other categories of psychoactive substances. These data bolster justification for controlling for these factors in group analyses to ensure that any differences found were not related to extraneous variables and instead isolate the associations. When those influences were controlled for, psychedelic users showed more adaptive psychological patterns (i.e. greater levels of strengths and lower levels of maladaptive traits) compared to non-users, with the exception of perceived social support. In contrast, the patterns with cannabis and alcohol users versus nonusers were far more varied. Cannabis users showed more maladaptive patterns in half of the measures, while regular alcohol users showed maladaptive patterns in roughly two-thirds of the measures. It is important to caveat this discussion with the understanding that observed differences showed primarily small-moderate effect sizes, potentially limiting the interpretability of results. With that in mind, all but one of the differences between users and non-users appeared in the predicted direction.

Alcohol and cannabis use have been associated with mixed health outcomes. While alcohol has no approved medical uses, cannabis constituents and products have known therapeutic uses[4]. The quantity, context, and motivation for use likely play important roles in the costs versus benefits of the outcomes. For example, while light to moderate consumption of alcohol is associated with lower levels of depression in the presence of stress, this is not the case in young adults or the elderly[50,100]. There is also a positive association between alcohol use disorders and clinical depression, where the presence of one disorder doubles the risk of the other[14]. Similarly, heavy cannabis use is associated with depression[97] and because of the pharmacological variability inherent to cultivated cannabis, coupled with the confusion surrounding this variability even in interested and conscientious cannabis consumers[126], it may be difficult to make any serious assertions regarding psychological strengths and liabilities related to cannabis consumption. It is important to note that this study specifically inquired about the non-medical use of cannabis. We saw cannabis and psychedelics as a useful comparison; while cannabis is used more commonly than psychedelics, the perception of risk associated with the two categories of drugs are comparable in the general population[5,113]. This contrasts with categories like major stimulants and opioids where recreational use is perceived to have greater risk.

7. Study 3

The goal of Study 3 was to replicate the range of traits for which we previously saw associations, applying applicable covariates, and running cannabis and alcohol comparisons. We sought to conduct a mediation analysis to see if increases in positive psychological traits were mediated by the degree of self-transcendence (single item self-transcendence measure)[138], as well as an analysis of 'motivation' for psychedelic use.

By chance, Study 3 took place during the beginning of the COVID-19 pandemic. Data collection took place during the entire month of April and first week of May 2020. This was approximately two weeks after quarantines began in many regions[68]. Data collection was centered in New Jersey, which along with New York, was becoming the epicenter of the pandemic. For this reason, items relevant to the pandemic were tailored toward psychological

adjustment to the developing situation. This allowed for a unique opportunity to examine the effects of psychedelics during an ongoing global crisis. We predicted the pandemic would not affect the relatively adaptive psychological profile seen in the psychedelic users group.

In this study, we sought to further control for peoples' beliefs about the potentially beneficial effects of psychedelics. It is well known that beliefs about a drug cause expectancy effects, both placebo and nocebo[16]. Historically, there have been a wide range of attitudes and beliefs about classical psychedelics, ranging from sacred to hazardous to psychotherapeutic[93]. Thus, controlling for potential effects of beliefs might be useful to discern the effects of the psychedelic experiences themselves rather than beliefs about them.

The effects of set and setting in the context of psychedelic experiences are well established[31,144]. A subcategory of psychological set is the motivation and beliefs of the users. A range of motives have been associated with the use of psychedelics including euphoric effects, broadening consciousness, activity enhancement[80], personal growth[81], and psychological self-exploration[77]. There is evidence that intention (e.g. the desired result of taking a psychedelic) or motivation for use is a predictor of positive outcome in recreational psychedelic drug users[66,182]. Motivation and beliefs of that user might be expected to inform where they take psychedelics, for example, in a structured context where a religious or spiritual substructure is implicit in the psychedelic experience[144]. In Study 3, we asked participants to indicate their most common "intention" for taking psychedelics, either "fun/recreational" or "growth motive" in order to ascertain possible effects.

We hypothesized psychedelic users would again show a predominantly adaptive pattern among psychological strengths and distresses and that these results would be independent of beliefs about psychedelics. We hypothesized that alcohol and cannabis users would show mixed patterns of results compared to psychedelic users. We further hypothesized that one's motivation for psychedelic use would be relevant among psychedelic users, where those with growth-related motivations (i.e. psychological, spiritual) would show a more adaptive pattern than those with predominantly recreational motivations, and that frequency of psychedelic use would predict increased levels of at least some of these traits.

7.1 Methods

7.1.1 Survey completion, demographics, and measures

Same as Study 1 and 2, see Supplement 1 for survey completion and demographics and Supplement 2 for measures. Of the 1,142 counted respondents, 1,008 provided data on whether they practiced sitting or moving meditation. Since that was considered a critical covariate in this study, the sample was effectively reduced to those respondents in the multivariate analyses of covariance (N = 1008).

7.1.2 Procedure

The procedures for participant recruitment, data collection, response validity, and data transformation were the same as in Studies 1 and 2. See Supplemental Material 1 for transformations[157].

Use of psychoactive drugs was assessed per Study 2. In addition to self-reported drug use, an open-ended item was added asking for those who have used classic psychedelics to specify which ones: 125 reported psilocybin mushrooms, 133 reported LSD, 13 reported DMT, 3 reported ayahuasca, and 21 reported mescaline-containing plants (peyote or San Pedro cacti). Additionally, participants were asked their motive for using psychedelics ("What is/was your

main reason for using psychedelics, if you ever have?", with possible responses of: "Growth (psychological, spiritual, and/or consciousness)", "Fun/recreation", or "I've never used them". One item dichotomously assessed the belief about whether psychedelics can be used in a beneficial manner ("I believe that it's possible for psychedelics to be used in a way that promotes psychological well-being"), with "Agree"/"Disagree" as possible responses.

7.2 Results

7.2.1 For psychoactive drug usage

See Supplement 1. Of psychedelic users, 70.6% reported primarily fun/recreation motives, while 29.4% reported primarily growth motives. Broken down by users/nonusers, 85.4% of psychedelic users believed they could be used for beneficial purposes, while 45.2% of nonusers endorsed this belief.

7.2.2 Correlations between use of psychedelics and other drugs

See Supplement 3. A non-parametric correlation analysis showed (as in Study 2), that more frequent use of psychedelics was positively associated with more frequent nonmedical use of all measured drug classes, but not alcohol.

7.2.3 Psychedelic use

A MANCOVA examining differences between psychedelic users (n = 182) versus nonusers (n = 826) who provided meditation data on the well-being measures was significant [$F(22,956) = 2.17$, $p < .001$; Wilk's $\Lambda = .95$, $\eta_p^2 = .05$]. See Supplement 4 for significant and non-significant influences of covariates:

Significant differences were observed on all well-being measures. The directionality was in the adaptive direction for all measures except for financial fear during the pandemic (SIFF), on which psychedelic users scored slightly higher than nonusers. See Table 3 and Figure 1 for results.

7.2.4 Cannabis use

A MANCOVA examining differences between cannabis users (n = 675) versus nonusers (n = 333) on the well-being measures was significant [$F(22,956) = 2.17$, $p < .001$; Wilk's $\Lambda = .95$, $\eta_p^2 = .05$]. Significant differences were observed on all well-being measures. The directionality was in the maladaptive direction for all measures except for three: Cannabis users scored higher in gratitude (G3), self-transcendence (SIST), and lower on financial fear during the pandemic (SIFF). Results show moderate to large effect sizes. See Table 3 for results.

7.2.5 Alcohol use

A MANCOVA examining differences between regular alcohol users (n = 693) versus nonusers (n = 315) on the well-being measures was significant [$F(22,956) = 1.79$, $p = .014$; Wilk's $\Lambda = .96$, $\eta_p^2 = .04$].

Significant differences were observed on all well-being measures. Alcohol users showed more adaptive levels in 12 areas: higher scores on altruism (CASA), elevation (ELEV), benefit reminding (BRS), gratitude (G3), forgiveness (TTF), perceived support (SIPSS), meaning in life (SIMIL), life satisfaction (SILS), subjective sleep quality (SISQ), and lower levels of pain perception (SIPS) and pandemic fear (SIPF). Other measures showed a maladaptive pattern in alcohol users. With the exception of peer support, results show moderate to large effect sizes. See Table 3 for results.

	Psychedelics				Cannabis				Alcohol			
	Users	Non-users			Users	Non-users			Users	Non-users		
	M (SE)	M (SE)	F	D	M (SE)	M (SE)	F	η_p^2	M (SE)	M (SE)	F	D
Mindfulness	**50.4 (.9)**	**50.0 (.3)**	**5.93‡**	↑	**49.8 (.4)**	**50.4 (.6)**	**5.96‡**	↓	**49.6 (.4)**	**50.9 (.6)**	**6.06‡**	↓
Equanimity	**52.0 (.9)**	**49.6 (.3)**	**6.36‡**	↑	**49.5 (.4)**	**51.2 (.6)**	**6.39‡**	↓	**49.6 (.4)**	**51.0 (.6)**	**6.51‡**	↓
Self-Kindness	51.4 (.9)	49.7 (.4)	4.23‡	↑	49.2 (.4)	51.6 (.6)	4.18‡	↓	49.8 (.4)	50.3 (.6)	4.24‡	↓
Altruism	52.2 (.9)	49.6 (.4)	3.46‡	↑	50.0 (.4)	50.1 (.6)	3.37‡	↓	50.1 (.4)	49.9 (.6)	3.46‡	↑
Awe	53.2 (.9)	49.2 (.3)	3.69‡	↑	49.8 (.4)	50.0 (.6)	3.73‡	↓	49.7 (.4)	50.4 (.6)	3.68‡	↓
Elevation	51.6 (.9)	49.6 (.4)	3.46‡	↑	49.9 (.4)	50.0 (.6)	3.27‡	↓	50.0 (.4)	49.8 (.6)	3.49‡	↑
Benefit Rem.	52.0 (.9)	49.6 (.4)	2.62‡	↑	49.9 (.4)	50.5 (.6)	2.66‡	↓	50.3 (.4)	49.5 (.6)	2.65‡	↑
Gratitude	50.2 (.9)	49.6 (.4)	2.78‡	↑	49.7 (.4)	49.6 (.6)	2.72‡	↑	49.9 (.4)	49.3 (.6)	2.72‡	↑
Forgiveness	51.4 (.9)	49.7 (.3)	3.06‡	↑	49.4 (.4)	51.2 (.6)	3.00‡	↓	50.3 (.4)	49.2 (.6)	3.16‡	↑
Self-Trans.	53.4 (.9)	49.6 (.3)	4.80‡	↑	50.4 (.4)	50.2 (.6)	5.00‡	↓	50.2 (.4)	50.5 (.6)	5.03‡	↓
Perc. Support	51.2 (.9)	49.8 (.4)	1.75†	↑	49.5 (.4)	51.2 (.6)	2.03‡	↓	50.7 (.4)	48.7 (.6)	1.85†	↑
Meaning/life	52.4 (.9)	49.5 (.4)	2.98‡	↑	49.3 (.4)	51.3 (.6)	3.01‡	↓	50.2 (.4)	49.5 (.6)	3.02‡	↑
Life Satisfaction	51.0 (.9)	49.9 (.4)	3.78‡	↑	49.6 (.4)	51.3 (.6)	3.81‡	↓	50.5 (.4)	49.3 (.6)	3.90‡	↑
Perc. Health	51.1 (.9)	49.8 (.4)	2.48‡	↑	49.4 (.4)	51.3 (.6)	3.28‡	↓	50.3 (.4)	49.4 (.6)	2.53‡	↑
Sleep	51.6 (.9)	49.2 (.4)	3.24‡	↑	49.3 (.4)	50.4 (.6)	3.43‡	↓	49.7 (.4)	49.6 (.6)	3.21‡	↑
Anxiety	**49.0 (.8)**	**50.3 (.3)**	**6.50‡**	↓	**50.2 (.4)**	**49.9 (.6)**	**6.56‡**	↑	**50.3 (.4)**	**49.5 (.5)**	**6.48‡**	↑
Depression	**48.5 (.8)**	**50.0 (.3)**	**6.12‡**	↓	**50.3 (.4)**	**48.6 (.6)**	**5.97‡**	↑	**50.0 (.4)**	**49.2 (.5)**	**6.19 v**	↑
Helplessness	48.3 (.9)	50.2 (.3)	4.64‡	↓	50.4 (.4)	48.8 (.6)	4.38‡	↑	49.9 (.4)	49.6 (.6)	4.64‡	↑
Boredom	**47.0 (.8)**	**49.8 (.3)**	**9.43‡**	↓	**49.9 (.4)**	**48.1 (.5)**	**9.30‡**	↑	**49.6 (.3)**	**48.7 (.5)**	**9.32‡**	↑
Pain Perception	49.6 (.9)	50.1 (.4)	2.28‡	↓	50.7 (.4)	48.5 (.6)	3.33‡	↑	49.4 (.4)	51.4 (.6)	2.50‡	↓
Pandemic Fear	49.6 (.9)	49.8 (.4)	4.33‡	↓	50.4 (.4)	48.5 (.6)	4.14‡	↑	49.8 (.4)	49.9 (.6)	4.29‡	↓
Financial Fear	50.1 (.9)	50.1 (.3)	3.29‡	↑	49.8 (.4)	50.6 (.6)	3.80‡	↓	50.2 (.4)	49.8 (.6)	3.21‡	↑

Table 3. *Study 3 MANCOVA of differences between users and non-users of psychedelic users on measures of psychological strengths, well-being, and distress. Sample sizes: Psychedelics (users, n = 182; non-users, n = 826), Cannabis (users, n = 675; non-users, n = 333), and Alcohol (users, n = 693; non-users, n = 315). Means and standard errors (in parentheses) are provided. Analysis is controlling for age, sex, education, ethnicity, religious affiliation, local residency, income, student status, work status, cohabitation status, lifetime meditation hours, local and US residency, and recent and lifetime non-medical use of other categories psychoactive drugs, the belief that psychedelics can be beneficial. D = Directionality. Significance: *p <= .05, †p <= .01, ‡p <= .001. Bold indicates a large effect size, all other effect sizes are medium, with only perceived support being small.*

7.2.6 Motivation for psychedelic use (growth vs fun/recreation motive)

A MANCOVA comparing psychedelic users only based on their primary motive for using them (growth [*n* = 53] vs fun/recreation [*n* = 127]) on the well-being measures was significant [$F(22,132) = 1.65$, $p = .044$; Wilk's $\Lambda = .78$, $\eta_p^2 = .22$]. 16 of the 22 measured trait differences reached significance, all differences were in the adaptive direction for growth-oriented users, and all 16 significant results had large effect sizes. See Table 4 for details.

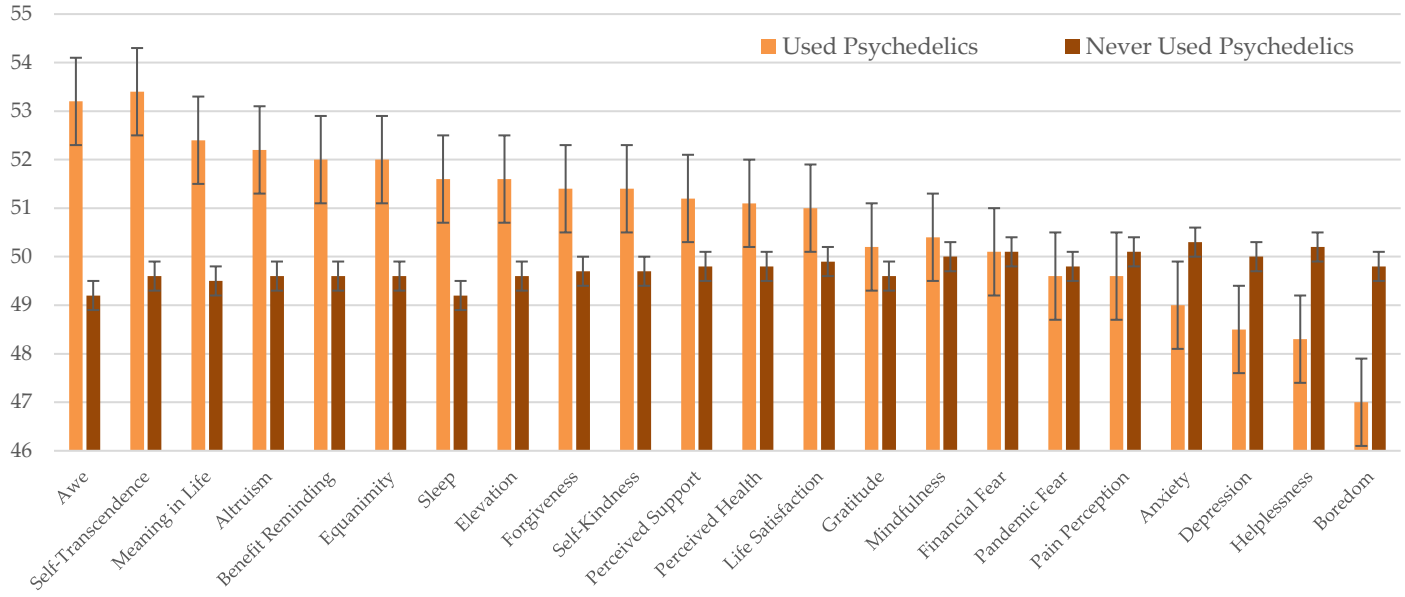

Figure 1. *Differences between psychedelic users and non-users on measures of psychological strengths and distress. N = 1142. All differences are statistically significant (p > .001), except Benefit Reminding and Perceived support, where p > .01. Error bars show standard error.*

7.2.6 Fun/recreational psychedelic users vs. non-users

A MANCOVA was performed to compare psychedelic users with fun/recreational motivations (n = 132) vs. nonusers (n = 799), which was significant [$F(22,900) = 1.57$, $p = .046$; Wilk's $\Lambda = .96$, $\eta_p^2 = .04$]. See Table 5.

Significant differences were found on all well-being measures: differences were in the adaptive direction for fun/recreational users on 12 measures [equanimity (PM.acc), self-kindness (USKS), altruism (CASA), awe (AWE3), benefit reminding (BRS), forgiveness (TTF), self-transcendence (SIST), perceived support (SIPSS), meaning in life (SIMIL), life satisfaction (SILS), sleep quality (SISQ), helplessness (SISH)], and in the maladaptive direction on the other 10 measures [mindfulness (MAAS6), elevation (ELEV), gratitude (G3), perceived health (SIPH), anxiety (PHQ.anx), depression (PHQ.dep), state boredom (SISB), pain perception (SISP), pandemic fear (SIPF), financial fear (SIFF)]. Effect sizes were moderate with the exception of mindfulness, equanimity, anxiety, depression, and boredom, which were large.

	Growth Motive	Recreational Motive	F	ηp²	Directionality
Mindfulness	54.3 (1.4)	49.4 (.9)	2.40‡	.29	A
Equanimity	55.4 (1.3)	50.8 (.8)	3.08‡	.34	A
Self-Kindness	51.8 (1.6)	48.7 (.9)	1.63*	.22	A
Altruism	53.4 (1.4)	51.3 (.9)	1.47	-	(A)
Awe	56.9 (1.4)	51.2 (.8)	2.30‡	.28	A
Elevation	52.6 (1.5)	49.4 (.9)	1.78*	.23	A
Benefit Reminding	55.7 (1.5)	49.8 (.9)	1.43	-	(A)
Gratitude	52.4 (1.5)	47.7 (.9)	1.96†	.25	A
Forgiveness	52.2 (1.5)	49.9 (.9)	1.45	-	(A)
Self-Transcendence	59.7 (1.4)	52.8 (.9)	1.86*	.24	A
Perceived Support	50.2 (1.5)	48.9 (.9)	1.15	-	(A)
Meaning in Life	52.1 (1.6)	49.3 (1.0)	1.57*	.21	A
Life Satisfaction	50.7 (1.4)	48.6 (.9)	2.64‡	.31	A
Perceived Health	53.2 (1.3)	49.6 (.8)	2.73‡	.32	A
Sleep	53.3 (1.4)	50.2 (.9)	1.78*	.23	A
Anxiety	47.0 (1.3)	51.1 (.8)	3.06‡	.34	A
Depression	47.3 (1.4)	50.9 (.9)	2.39‡	.29	A
Helplessness	48.1 (1.5)	50.8 (.9)	1.85*	.24	A
Boredom	43.8 (1.4)	48.5 (.8)	2.26‡	.28	A
Pain Perception	48.5 (1.5)	52.6 (.9)	1.22	-	(A)
Pandemic Fear	47.6 (1.6)	51.1 (1.0)	1.55	-	(A)
Financial Fear	48.2 (1.4)	50.4 (.8)	1.61*	.22	A

*A = Adaptive, M = Maladaptive

Table 4. *MANCOVA of differences in psychological strengths, well-being and distress between psychedelic users with growth (n = 127) vs. recreational motives (n = 153) from Study 3. Means and standard errors (in parentheses) are provided. Analysis is controlling for age, sex, education, ethnicity, religious affiliation, local residency, income, student status, work status, cohabitation status, lifetime moving meditation hours, and the recent and lifetime use non-medical use of other psychoactive drugs (i.e. opioids, major stimulants, MDMA, dissociatives, sedatives, and alcohol). Results are consistently in the adaptive direction, A, for growth motive psychedelic users, with nonsignificant differences indicated with parentheses. Significance: *p <= .05, †p <= .01, ‡p <= .001. No text is bold because all effect sizes are large.*

	Fun/Rec. Users	Psychedelic Non-users	F	η_p^2	Directionality
Mindfulness	**48.4 (.9)**	**50.0 (.3)**	**5.65‡**	**.14**	**M**
Equanimity	**49.8 (.9)**	**49.7 (.3)**	**6.01‡**	**.15**	**A**
Self-Kindness	50.8 (.9)	49.7 (.4)	4.33‡	.11	A
Altruism	51.3 (1.0)	49.5 (.4)	3.19‡	.09	A
Awe	52.0 (.9)	49.1 (.4)	2.88‡	.08	A
Elevation	49.6 (1.0)	49.9 (.4)	3.17‡	.09	M
Benefit Reminding	51.0 (1.0)	49.5 (.4)	2.02†	.06	A
Gratitude	49.6 (1.0)	49.6 (.4)	2.46‡	.07	M
Forgiveness	50.7 (.9)	49.7 (.3)	2.74‡	.07	A
Self-Transcendence	51.9 (.9)	49.3 (.4)	3.03‡	.08	A
Perceived Support	51.5 (1.0)	49.9 (.4)	1.93†	.05	A
Meaning in Life	51.8 (1.0)	49.6 (.4)	2.76‡	.08	A
Life Satisfaction	50.4 (1.0)	50.0 (.4)	3.81‡	.10	A
Perceived Health	49.0 (.9)	49.8 (.3)	2.25‡	.06	M
Sleep	50.2 (1.0)	50.0 (.4)	2.69‡	.07	A
Anxiety	**50.5 (1.0)**	**49.7 (.4)**	**6.28‡**	**.16**	**M**
Depression	**51.1 (1.0)**	**49.2 (.4)**	**6.12‡**	**.15**	**M**
Helplessness	50.1 (.9)	50.4 (.3)	4.68‡	.12	A
Boredom	**50.1 (.9)**	**49.9 (.3)**	**8.87‡**	**.21**	**M**
Pain Perception	50.1 (.9)	49.9 (.3)	2.63‡	.07	M
Pandemic Fear	50.7 (.9)	49.8 (.4)	4.66‡	.12	M
Financial Fear	50.6 (.9)	50.2 (.3)	3.38‡	.09	M

* A = Adaptive, M = Maladaptive

Table 5. *MANCOVA of differences in psychological strengths, well-being and distress between psychedelic recreational users (n = 149) vs. psychedelic non-users (n = 800) in Study 3. Means and standard errors (in parentheses) are provided. Analysis is controlling for age, sex, education, ethnicity, religious affiliation, local residency, income, student status, work status, cohabitation status, lifetime meditation hours, and the recent and lifetime use non-medical use of other psychoactive drugs (i.e. opioids, major stimulants, MDMA, dissociatives, sedatives, and alcohol). Results are consistently in the adaptive direction for growth motive psychedelic users, with nonsignificant differences indicated with parentheses. Significance: *p <= .05, †p <= .01, ‡p <= .001. Bold indicates large effect size. Traits below the line are psychological distresses.*

7.2.7 Mediation analysis

A mediation analysis was performed to determine whether self-transcendence mediated any relationship between psychedelic use and overall subjective well-being. In order to do this, a Principal Components Analysis using Varimax rotation was performed to the 9 psychological strengths (MAAS6, EQPM.acc, USKS, CASA, AWE3, ELEV, BRS, G3, TTF), excluding self-transcendence. Two non-overlapping factors were extracted that had eigenvalues of 3.2 and 1.9, which accounted for 32.4% and 24.2% of the variance respectively (56.6% cumulative). Factor I (CASA, ELEV, BRS, G3, AWE3) and Factor II (PM.acc, EQ, MAAS6, TTF, USKS), in turn, formed a single second-order factor that had an eigenvalue of 1.24 and explained 70.0% of the variance.

This was termed the Cumulative Strengths Index (CSI) and was formed by averaging the T-scores of the 9 scales (α = .76).

A mediation analysis was performed using PROCESS macro for SPSS, with Model 4, was used for the mediation analysis (Hayes, 2018). This was to determine whether the relationship between lifetime use of psychedelics (independent variable, X) and cumulative strengths (CSI; dependent variable, Y) was mediated by self-transcendence (SIST; M). The model was statistically significant, $F(1, 1139)= 56.91$, $p < 0.001$, $R^2=0.05$. Psychedelic use frequency positively predicted self-transcendence (SIST; $\beta = 2.20$, $p < .001$). Psychedelic use did not directly predict cumulative strengths (CSI; $\beta = -.04$, $p = .799$), but SIST did ($\beta = .27$, $p < .001$), [$F(2, 1138) = 153.67$, $p < 0.001$, $R^2=0.21$] . The interaction of psychedelic use by self-transcendence (i.e X by M) was significant, $F(1, 1137) = 4.63$, $p = 0.032$, and the indirect effect of X on Y via M (Psychedelic use on CSI via SIST) was significant (IE = .60, 95%CI = .43, .79) [Figure 2]. Thus, the relationship between psychedelic use and Cumulative Strengths CSI was fully mediated by self-transcendence[78].

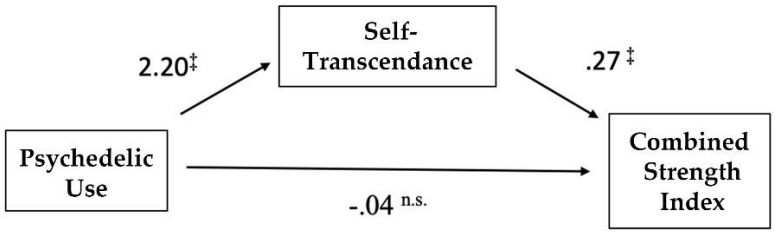

Figure 2. *Mediation analysis (Study 3). The relationship between psychedelic use and a combined index of psychological strengths was fully mediated by self-transcendence. Significance: *p <= .05, †p <= .01, ‡p <= .001.*

	Beta	SE	95% CI LL	95% CI UL	p
Self-Transcendence (SIST)					
Psychedelic Use	2.20	.29	1.62	2.77	<.001
Cumulative Strength Index (CSI)					
Psychedelic Use	-.04	.16	-.36	.27	.799
SIST	.27	.02	.24	.31	<.001

Table 6. *Results of the PROCESS Linear Regression for the Mediation Analysis*

7.2.8 Correlation

A correlational analysis was used to test whether more frequent use of psychedelics among psychedelic users related to a greater degree of psychological strengths, well-being, more meditation experience, and lower levels of distress. A Spearman rank-order correlation was performed since the frequency of use item employed an ordinal scale. In order to control for multiple comparisons, but not be overly stringent and increase the false negative rate, a Benjamini Hochberg procedure was used[12]. See Supplement 3.

7.3 Discussion

Consistent with Study 2, psychedelic use correlated positively with all other classes of psychoactive drugs except alcohol. This underscores the need to control for the use of other psychoactive drugs in these analyses. The multivariate analyses comparing users vs. nonusers of psychedelics, cannabis, and alcohol mirror the results of Study 2. Psychedelic use was associated with greater psychological well-being, apart from slightly higher financial fear during the pandemic, controlling for relevant covariates including demographic variables, lifetime and recent use of other psychoactive drugs, and the belief that psychedelics could have beneficial effects. These findings are generally consistent with those of psychedelic users in Studies 1 and 2, with the exception that perceived social support was higher in psychedelic users in Study 3 but not Study 2. Also consistent with Study 2 is the findings that cannabis and alcohol users, in contrast, again showed a mixed pattern of results (See Figure 3 for comparison). It is potentially noteworthy that the positive psychological profile shown Study 3 appeared during the acute stressor of the early COVID-19 pandemic.

Consistent with our predictions, psychedelic users who cited a growth motive for using psychedelics showed greater strengths and well-being, and lower distress, on most measures (16 out of 22) compared with those whose reported motive was fun/recreation. Effect sizes are large for all 16 observed differences. It must be noted that these differences were at a trend level when seated meditation was included in the covariates, but significant when it was removed. We believe a pertinent explanation might be that seated meditation requires a great deal of motivation for growth because of the time and discipline required, so controlling for the influence of meditation would diminish the effects of growth motivation based on the overlap[124,130].

Frequency of psychedelic use showed positive correlations with mindfulness, equanimity, forgiveness, self-transcendence, and sitting meditation experience, and inverse correlations with state boredom and pandemic fear. Mindfulness/equanimity, meditation, self-transcendence, and boredom (conversely) are associated with activity of the DMN[21,38,54,159] a network known to be modulated by psychedelic experiences[21,28,83].

Consistent with Study 1, psychedelic users reported more lifetime hours of sitting meditation experience than non-users. This was true for both seated and moving meditation practices and after controlling for demographic influences. Further, among psychedelic users, more frequent psychedelic use correlated with greater seated meditation experience. Relatively little attention seems to have been given to the prevalence of contemplative practices among non-clinical psychedelic users in the literature. The finding of greater meditation hours among psychedelic users in this study might be a meaningful association given that randomized clinical trials showing use of psychedelics during formal sitting meditation retreats increases trait mindfulness[147] and the notable overlaps between these domains of self-exploratory practices[111].
It is uncertain why psychedelic users reported greater financial concern, especially since age, income, education, and work status were controlled for. Further, psychedelic users showed lower anxiety and less fear of the COVID-19 pandemic. One explanation could be that psychedelic users or their family members are more likely to be in occupations that were affected by the pandemic.

		Psychedelic Use			Cannabis Use			Alcohol Use		
	Study:	1	2	3	1	2	3	1	2	3
Well-being/Strength Measures	Mindful focus		↑↑	↑↑		↓↓	↓↓		↓↓	↓↓
	Mindful awareness	–								
	Equanimity	↑↑	↑↑	↑↑		↓↓	↓↓		↓↓	↓↓
	Gratitude		↑↑	↑↑		↑↑	↑↑		⇣	⇡
	Forgiveness		↑↑	↑↑		↓↓	↓↓		↑↑	↑↑
	Perceived Support		⇣	⇡		↓↓	↓↓		↑↑	↑↑
	Perceived Health		↑↑	↑↑		⇡	⇣		↑↑	↑↑
	Self-transcendence	↑↑	↑↑	↑↑		↑↑	↑↑		↓↓	↓↓
	Kindness	↑↑	↑↑	↑↑		↓	↓		⇣	⇡
	Sleep		–	↑		–	↓		–	↑
	Humility		↑			↑			↓	
	Sense of Connection	↑↑	↑↑			↑			↑	
	Self-Kindness	↑↑		↑↑			↓			↓
	Positive Affect	↑								
	Awe			↑			↓			↓
	Elevation			↑			↓			↑
	Benefit Reminding			↑			↓			↑
	Meaning in Life			↑			↓			↑
	Life Satisfaction	↑↑		↑↑			↓			↑
Distress/Dysfunction Measures	Anxiety			↓			↑			↑
	Depression			↓			↑			↑
	Helplessness			↓			↑			↑
	Boredom			↓			↑			↑
	Pain Perception			↓			↑			↓
	Pandemic Fear			↓			↑			↓
	Financial Fear			↑			↓			↑
	Negative Affect	↓								
	Greed		↓			↑			↑	
	Envy		↓			↓			↑	
	Hate		↓			↑			↑	

Figure 3. Comparison of psychedelics, cannabis, and alcohol across studies Up (↑) and down (↓) arrows indicate whether users in each category of drug scored higher or lower than nonusers, respectively, while a dash (–) menans no significant difference found. Absence of a symbol and color indicates that measure was not used in that study. Green/red coloring indicates whether the difference is adaptive (green) or maladaptive (red) for users. Double arrows (↑ ↑, ↓ ↓) indicate consistent findings across the two datasets, while dashed (⇡, ⇣) arrows with a yellow background indicate conflicting results.

8. General discussion

8.1 Summary of findings

In three studies, with 3157 participants (Study 1, n = 465; Study 2, n = 1550; Study 3, n = 1142), psychedelic use was associated with greater psychological strengths and lower maladaptive psychological traits, after controlling for demographic variables and other drug use. Findings present significant differences observed on a range of traits (shown in Figure 3). Traits associated with psychedelic use appeared almost wholly in the adaptive direction; This is in contrast to the patterns seen for cannabis or alcohol use, both of which present mixed associations with the battery of psychological traits. The current studies advance and replicate results that show naturalistic psychedelic use can be associated with overall well-being[56,133,141,157,166].

A mediation analysis revealed that relationships between psychedelic use and psychological strengths were fully mediated by self-transcendence. This mediation supports a solid body of evidence linking the 'self-transcendent', 'ego dissolution', or 'mystical-type' experience to positive clinical[15,39,51,91,110,117,132,133] and naturalistic[31,49,52,76,80,162,163] outcomes of psychedelic use.

The intention for psychedelic use appears to enhance benefits observed in association with the use of psychedelics in a naturalistic setting. Participants who reported 'growth' as a primary motivation showed a more adaptive profile than those who reported 'fun/recreation'. Some traits showed a reversal of the adaptive pattern seen with overall psychedelic users (see Table 5).

8.2 Novel and replicated trait findings

Novel psychological strengths associated with psychedelic use previously unreported in the psychedelic literature include higher awe, equanimity, kindness/altruism, benefit reminding, sleep quality, forgiveness, elevation, gratitude, and lower helplessness, and boredom (See Figure 3 for summary of results). In most cases, precedents in the literature explicitly predict psychedelics would impact these psychological traits, but they have never been quantitatively demonstrated. Awe has been hypothesized as a putative mechanism of underlying successes in psychedelic psychotherapy[71]. While trait equanimity appears unreported in the psychedelic literature, several authors have suggested increases based on subjective reports[120,155]. A recent paper reported post-psychedelic decreases in 'experiential avoidance'[178], which is essentially the inverse of equanimity as measured in this study[65]. In the vein of greater empathy[44,95] and prosocial behavior[72,168] seen in previous studies, we found that psychedelic users are higher in trait kindness as well as self-reported volunteer hours, which we referred to as "altruism". Interestingly, extraordinary altruists show an increased overlap of self and other processing, a neural correlate and phenomenological component shared by self-transcendent psychedelic experiences[34,96]. Elevation is unreported although perhaps greater empathy[106,127] underlies this finding since it is essential to care about the well-being of others to experience elevation at the sight of others' virtuous acts. The same may be true of forgiveness, another hitherto unreported adaptive aspect also explicitly suspected by previous authors[62]. Gratitude has been reported as a common subjective aspect of a cathartic psychedelic experience[131,156,157] but to the authors' knowledge, never quantified. Benefit Reminding may emerge in a similar vein, since both involve enhancing appreciation of events, although this has not been reported or suggested to our knowledge in the psychedelic literature. We observed greater reported humility among psychedelic users. A previous survey-based study failed to find a significant difference between psychedelic users and non-users on trait humility albeit with a much smaller sample size[95]. Greater subjective sleep quality is unreported.

We observed several lower maladaptive psychological traits and distress previously unreported in the literature. Psychedelic users reported lower state levels of helplessness and boredom. Perceived helplessness appears to be a core aspect of depression[105]. Boredom susceptibility has been linked to increased odds of psychedelic drug use[18], as well as other substance use and anxiety and depression (LePera, 2011). We report lower scores on scales measuring greed, envy, and hate among psychedelic users. Psychedelic use has been linked to decreased greed in one other study where psychedelic users score lower on the value of financial prosperity[95].

The following findings replicate those of previous research, showing psychedelics associated with: greater self-transcendence[17,19], greater mindfulness[61,104,135,147,152], greater self-compassion[135,153], greater positive affect[84,141], greater perceived health[8] , greater life satisfaction[24] , greater meaning in life[59,76], less anxiety[63], and depression[55,57], and decreased levels of perceived physical pain[7,171]. All our findings align with previous research, whose reported findings were all replicated in the same direction.

Only four findings are contrary to our hypotheses for psychedelic users vs nonusers. Psychedelic users showed more financial fear related to the COVID-19 pandemic in Study 3; perceived social support was in the maladaptive direction in Study 2 but changed to adaptive in Study 3; mindfulness was non-significant in Study 1 but significant in Studies 2 and 3; sleep quality was non-significant in Study 2 but adaptive in Study 3. While the variation in effect sizes and nature of a survey methodology might make detailed interpretation difficult, the directionality of the totality of results is potentially more revealing than any individual result (see Figure 3).

8.3 Psychedelics and psychological strengths during the COVID-19 pandemic

Study 3 was conducted during an early phase in the United States of the worldwide COVID-19 viral pandemic. Due to the potential for idiosyncratic results and as a particularly salient cultural zeitgeist, we included two ad hoc items, regarding "pandemic fear" and "financial fear", as well as ascertaining whether the participant or a close family member had been infected. Infection of the participant or a family member was then used as a covariate in the analysis. Psychedelic users reported less pandemic fear, but contrary to our hypothesis, reported increased financial fear after controlling for annual income. The time frame of data collection (within April 2020) was in the first few weeks of the pandemic, so employment disruptions had not really begun. It's unclear to the authors why this is the case but might be related to the lower value psychedelic users place on financial prosperity[95]. The economic stress of the pandemic may introduce cognitive dissonance by making the value of financial prosperity more salient. Alternatively, it may be because psychedelic users tend to work in industries that were more susceptible to disruption during the COVID-19 pandemic (such as the creative sector). We note the retention of significance of psychological traits in the adaptive direction, even during a pandemic.

8.4 Psychedelic users show substantially different psychological profile from cannabis and alcohol users

Both cannabis and alcohol show ambiguous and multivalent effects on measured psychological traits, after controlling for demographics and other drug use (see Figure 3). The association of psychedelic use with adaptive traits contrasts with both a commonly used legal and a commonly used illegal drug (federally), both of which are associated with trait profiles difficult to parse. Carhart-Harris and Nutt[30] reported a similar finding in a survey of recreational drug users, where 67% of LSD users and 60% of psilocybin users claimed that use of these drugs had produced long-term positive effects on their sense of well-being. They indicated, by contrast, only

6% of alcohol users claimed similar improvements in well-being attributed to alcohol use[30] . Our studies suggest these reported long-term positive effects may not merely be a claimed perception.

8.5 Psychological strengths mediated by self-transcendence

Reported relationships between psychedelic use and strengths were fully mediated by self-transcendence (see Figure 2). This mediation analysis supports a large number of precedents indicating that self-transcendent experiences mediate the positive effects of psychedelic experiences[15,26,39,51,57,91,110,117,132,133,187]. This is consistent with the significant positive correlation observed by Nour et al. (2016)[118] between a measure of self-transcendence and long-term well-being and life satisfaction. This finding suggests the centrality of the self-transcendent experience might extend beyond a clinical setting.

8.6 Intention for psychedelic use predicts adaptive psychological set

In Study 3 we report the effects of intention/motivation for psychedelic use between 'fun/recreation' and 'growth' (psychological, spiritual, and/or consciousness) users. Intention to use psychedelics for 'growth' was associated with a psychologically adaptive pattern as compared to 'fun/recreation". 16 of 22 associations are in the adaptive direction with large effect sizes and the remaining six are treading in the adaptive direction but failed to reach significance. Compared to non-users, 'Fun/recreation' users showed increased depression and anxiety, decreased sleep quality, elevation, mindfulness, perceived health, and increased fear of the COVID-19 pandemic. Four of the five differences with large effect sizes were in the maladaptive direction. Motivation for use appears to be a significant determinant of associations, with growth motivation associated across the board with adaptive associations when compared to fun/recreational motivation. While fun/recreational users show 12 adaptive vs 10 maladaptive traits compared to non-users, four of five associations showing large effect sizes were in the maladaptive direction, making the data difficult to interpret. Previous authors reported 'clear intentions' and the intention for 'spiritual connection' both predict psychedelic-induced mystical experiences[66] , as does 'religious intent'[114]. Although other authors have reported variable mental health outcomes in naturalistic settings[182], to the authors' knowledge, this is the first study to report the effect of intention for personal growth compared to fun/recreation on psychedelic use in naturalistic settings.

8.7 Psychedelic users report more meditation experience

Psychedelic users reported more lifetime hours of sitting meditation experience in Study 1 and Study 3 (Study 2 did not inquire about meditation experience). Within psychedelic users, greater frequency of use correlated with greater hours of lifetime seated meditation practice. Survey studies have previously reported that the majorities of their samples experienced desirable changes in contemplative practices, including meditation practice, attributed by the participants to psychedelic experience(s)[59,160]. Despite the known overlap in the history[120], phenomenology[111], and neural correlates[121], and synergy[73] between meditation and the psychedelic experience, to the authors' knowledge, no study has shown that psychedelic users report more hours of sitting meditation experience or a relationship between frequency of use and hours of lifetime seated meditation.

8.8 Theoretical conclusions

The adaptive psychological differences observed in psychedelic users might variously be viewed as the average intrinsic psychological disposition of individuals prone to take psychedelics and/or the result of the transformative psychological effects of the experiential and pharmacological components of the psychedelic experience. These can be viewed as competing hypotheses about why psychedelic users would exhibit these associations, which are not necessarily mutually exclusive. The former might be referred to as the 'gravitational hypothesis': people with greater psychological strengths tend to gravitate toward the consumption of psychedelics in naturalistic settings, in which case greater strengths are not a causal effect of psychedelic use but rather reflect predisposing factors behind psychedelic use. The latter can be referred to as the 'transformational hypothesis': people who take psychedelics in naturalistic settings can undergo transformational change that results in a variety of increases in psychological strengths, causally connected to the pharmacological action of psychedelic drugs.

While the methodology of the current study prohibits a conclusive determination, within the context of this study the gravitational hypothesis appears less likely for a number of reasons. The principal reason is that psychedelic users are not seeking out psychedelic drugs in isolation. In the current studies, psychedelic users are more likely to have used other classes of psychoactive drugs. A small minority of psychedelic users (0.83% in Study 2, and 1.0% in Study 3) have used psychedelics only, with no other non-medical psychoactive drug use (not including alcohol). Possibly as a result of their legal status, the vast majority of psychedelic users are not exclusively gravitating toward psychedelic use only. This has previously been found by other authors[115]. The retention of relative benefit even in cases where the intent was purely 'fun/recreational' casts further doubt on the gravitational hypothesis, as polydrug use appears common in 'fun/recreational' settings where psychedelics are likely to be consumed (e.g. music festivals or raves)[10,20,48,94]. In favor of the transformational hypothesis, many controlled clinical studies have already shown that psychedelics can cause lasting changes in psychological traits. In follow up studies to clinical trials with psychedelics, authors have reported long-term psychological changes causally linked to psychedelic experiences[76] including decreased depression at six months[26] and continued elevations in well-being, life satisfaction, positive mood, and social behavior at 14 months[56,58].

Causally linked long-term psychological changes lend plausibly to similarly lasting changes in naturalistic psychedelic users, in accordance with the transformational hypothesis.

The terms 'recreational'[66,102] and 'naturalistic'[77,117] are used synonymously in the psychedelic literature to indicate the usually illicit use of psychedelics outside a clinical or laboratory setting. The ambivalent connotation of the term 'naturalistic' might contribute to its increasing prevalence in the literature, as opposed to the more classically pejorative term 'recreational'. The current studies cast some doubt on the coherence of a single categorization for non-clinical psychedelic users. The distinction between 'fun/recreational' intent and 'growth' intent reflected in our data suggests future studies should potentially differentiate multiple categories of non-clinical psychedelic users.

Our data suggest naturalistic psychedelic use might be associated with particular psychological traits, highlighting the potential implications of increasing access to psychedelics. Particularly in comparison to cannabis and alcohol, the current studies suggest psychedelics can be associated with an adaptive psychological profile.

In Study 3, 52% of participants reported a belief that it's possible for psychedelics to be used in a way that promotes psychological well-being. While this was collected and used for the

purpose of a covariate in analyses, it is potentially indicative of a warming public perception of classical psychedelics as medicines.

8.9 Study strengths and limitations

The methodological strengths of this study include the large number of measured psychological strengths and weaknesses, a large sample size and concomitant statistical power, and adjustment for demographic and other substance use covariates. Nonetheless, several methodological limitations exist in this study. We relied on self-selecting/self-report data, which have the inherent potential for a range of implicit biases. Foremost, this study did not collect a truly randomized sample but rather a type of convenience sample, primarily from the East Coast of the United States, and therefore it remains unclear to us how representative our sample is of the population at large. The total sample was around 70% female, which may be an artifact of the starting student population and the individuals they chose to recruit (sex was factored out of all analyses as a covariate). An intrinsic drawback of this recruitment method is that while each study was done in its own time interval, there is a chance a participant of Study 1 could also have participated in a proceeding study, either by being a student in another class or via random snowball recruitment. Self-reported substance use data reported retroactively is subject to bias in recall, as memories may have faded over time. Data might have been collected years or even decades after the last use of a particular class of substances (e.g. older participants who may have experimented with psychedelics in their youth). Subjects may wish to downplay their use of particular substances or exaggerate their use of others.

9. General conclusion

This study is the first to compare psychedelic users and non-users on a broad range of psychological traits in a large sample. Taken as a whole, lifetime psychedelic use appears to be associated with greater positive psychological traits and lower maladaptive traits and distress, even during the beginning of the COVID-19 pandemic. Associations with these traits appear independent of other illicit drug use (including MDMA and dissociative anesthetics purported to offer similar benefits), meditation experience, and demographic factors. The psychological profile associated with classical psychedelic use is overwhelmingly adaptive, while the same profile of psychological measures associated with cannabis and alcohol use show much more ambiguous mixtures of adaptive and maladaptive. A mediation analysis indicates the observed psychological strengths are fully mediated by trait self-transcendence. Further we show the impact of intention; using psychedelics in a naturalistic setting with 'growth' motivation is associated with the most robust set of psychological strengths and lower distress. A future study should explore if set & setting, preparation, integration, or ancillary practices such as meditation, mediate the adaptive profile seen in growth motivated users. We also report psychedelic users meditate more, with increasing psychedelic use being associated with increased lifetime sitting meditation hours. The tendency of psychedelic users to display higher levels of a broad spectrum of positive psychological traits and lower levels of maladaptive traits and distress should be explored in randomized clinical trials to establish causality.

Conflict of interest statement

The authors declare no conflicts of interest.

Data accessibility

Data files are available on request from the corresponding author. Validation data for CASA and Four Sublime Attitudes are available as well.

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