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Highlights

- Participants planned to take psychedelics or MDMA in a naturalistic context
- Neuroticism was reduced four weeks after consumption
- Shame and feelings of tension showed the greatest reductions
- Importance of values related to pro-sociality and spirituality increased temporarily

Changes in neuroticism and values after naturalistic use of psychedelics and MDMA: a prospective survey study

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Abstract

Background: Serotonergic psychedelics and MDMA may improve mental health through reductions in neuroticism and changes in personal values. While decreases in neuroticism following serotonergic psychedelics are sometimes observed, it is unclear which facets of neuroticism respond the most, and MDMA remains understudied. People also report value shifts after psychedelic experiences, but prospective data are limited. This study examined changes in neuroticism and twelve personal values after planned, naturalistic use of psychedelics and MDMA.

Methods: Participants planning to use psychedelics or MDMA (N=74) completed surveys at baseline, one day post-experience, one week, and four weeks follow-up. Neuroticism was assessed with the NEO-FFI and personal values with a modified Valued Living Questionnaire. Linear mixed effects models examined changes over time.

Results: Neuroticism significantly decreased at four weeks (β=-2.64, p<.001), though not at one week (β=0.01, p=0.99), for users of both serotonergic psychedelics and MDMA. Reductions were most pronounced for items assessing shame and feelings of tension. Participants rated the values of citizenship (β = 0.68, t = 2.63, p = 0.01), family (β = 0.80, t = 3.64, p < .001), intimate relationships (β = 0.57, t = 2.88, p = 0.01), and spirituality (β = 1.04, t = 4.08, p < .001) as more important one week after their psychedelic experience; only family remained elevated at four weeks (β = 0.57, t = 2.41, p = 0.02). Serotonergic psychedelics were associated with greater spirituality increases than MDMA (β = 2.19, t = 4.19, p = .005).

Discussion: Planned consumption of psychedelics and MDMA in naturalistic settings was associated with decreased neuroticism and transiently increased importance of relational and spiritual values. The increased importance of family persisted longest, lasting up to four weeks. These findings expand the literature on self-reported changes in neuroticism and identify potential mechanisms underlying changes in well-being after psychedelic experiences.

Keywords: psychedelics, MDMA, neuroticism, values

Introduction

Serotonergic psychedelics, such as LSD and psilocybin, are known for their strong influence on perception, emotion, and cognition and are increasingly being recognized for their potential long-term positive effects (Nichols, 2016). These include clinically relevant reductions in symptoms of depression and anxiety in psychedelic-assisted therapy (PAT) (Yao et al., 2024), but also positive changes in mental health and well-being even outside of controlled settings (Nayak et al., 2023). Changes in neuroticism and personal values are two possible contributors to these purported improvements in well-being which are relevant to both clinical and non-clinical populations.

It has been suggested that psychedelics' therapeutic effects are partially due to reductions in the personality trait of neuroticism (Aday et al., 2020). Neuroticism describes one's vulnerability to negative emotions under stress, including anxiety, depression, and irritability, and it is closely related to psychopathology (Hasler et al., 2004). Higher neuroticism has also been linked to reduced well-being and life satisfaction in the general population (Anglim et al., 2020; Schunk and Trommsdorff, 2023). Decreases in neuroticism following the use of serotonergic psychedelics, which include lysergic acid diethylamide (LSD), psilocybin, and ayahuasca, have been observed in patients undergoing PAT (Erritzoe et al., 2018; Irrmischer et al., 2025; Pagni et al., 2025), though meta-analyses of experimental studies of psychedelics have not found an overall effect on neuroticism (Goldberg et al., 2020; Solaja et al., 2024). In people who use psychedelics outside of controlled settings, decreases in neuroticism have been observed for up to several weeks after psychedelic experiences (Nayak et al., 2023; Weiss, Nygart, et al., 2021).

Though decreases in neuroticism following serotonergic psychedelics are sometimes reported, there is comparatively little research on the impact of MDMA on neuroticism. Though not a serotonergic psychedelic, MDMA is also used in PAT and shares some relevant properties with psychedelics. These include induction of an altered state of consciousness often conducive to personal insights, a possible impact on cortical neuroplasticity, and therapeutic efficacy in a safe and supportive setting (Nardou et al., 2023; Yin et al., 2019). MDMA may reduce neuroticism in patients treated for post-traumatic stress disorder (PTSD) (Wagner et al., 2017), though greater neuroticism at baseline may increase the risk of anxious reactions to MDMA (Studerus et al., 2021). Research on lasting effects of MDMA on neuroticism outside of clinical populations are limited to one experimental study which observed no change after 48 hours (Maples-Keller et al., 2024). It remains to be seen whether MDMA has lasting effects on neuroticism outside of clinical populations.

Additionally, previous studies have identified exposure to childhood adversity as a possible predictor of long-term changes in constructs related to neuroticism after naturalistic psychedelic use. Cross-

sectional studies suggest that greater exposure to childhood adversity may be associated with a higher risk of lasting difficulties after psychedelic experiences, including but not limited to lasting increases in anxiety, depression, and other emotional difficulties (Olofsson et al., 2026; Simon et al., 2025). On the other hand, a prospective observational study found that those with greater exposure to childhood adversity showed greater reductions in trait anxiety and experiential avoidance after ceremonial psychedelic use (Mehmood et al., 2025). Because neuroticism is a related construct which positively correlates with exposure to adverse childhood experiences (Fletcher and Schurer, 2017), it is possible that the degree of childhood adversity predicts changes in neuroticism after psychedelic use, but this has not yet been studied.

Additionally, changes in neuroticism could conceivably be mediated by the nature of the acute psychedelic experience (Godfrey et al., 2025), as well as by the generally positive views of psychedelics that tend to be present in study samples (Gomez et al., 2025). It is also conceivable that participants with a higher number of previous psychedelic exposures would experience weaker changes in neuroticism than those with relatively few exposures, i.e. diminishing returns. Finally, neuroticism encompasses one's vulnerability to several different types of stress-related negative emotions, including anxiety and worry, shame, loneliness, hopelessness, irritability, or low self-worth. It is unclear whether some of these are more responsive to psychedelics than others.

In addition to changes in neuroticism, people undergoing psychedelic experiences sometimes describe changes in their values or priorities, often manifesting as reconnection with "what's really important" in life (Belser et al., 2017). For example, several participants in a trial of psilocybin for smoking cessation – most of whom successfully quit smoking – described reconnecting with core values which helped them prioritize their health (Noorani et al., 2018). The importance people place on core life domains, including relationships, health, and meaningful activities, is generally associated with well-being and stress resilience (Ceary et al., 2019). After psychedelic experiences, whether value changes occur and which values are affected may depend on the context and intention with which a psychedelic substance is consumed, as well as one's motivation to maintain changes after the experience (Kähönen, 2024). Previous research suggests that psychedelic experiences may impact how people value their relationships with others (Belser et al., 2017; Schmid and Liechti, 2018), spirituality (Griffiths et al., 2011; Schutt et al., 2024), connection to nature (Forstmann and Sagioglou, 2017; Lyons and Carhart-Harris, 2018), and health-related behaviors (Teixeira et al., 2022). However, most studies have asked people about changes in values only after the psychedelic experience in question has already occurred, leaving the results vulnerable to recall biases. It would be informative to investigate changes in values with prospective designs which measure attitudes toward values both before and after a psychedelic experience.

The goal of this prospective, longitudinal study was to understand changes in neuroticism and personal values and their possible interactions after the use of serotonergic psychedelics and MDMA in naturalistic settings. Firstly, we attempt to replicate previous findings on serotonergic psychedelics and neuroticism and investigate whether they also apply to users of MDMA. Building on this, we investigate possible predictors of changes in neuroticism after psychedelic experiences, as well as which aspects of neuroticism are most responsive to psychedelics. Finally, we assess the effects of psychedelics on twelve specific personal values and explore predictors of changes in values, including context of use and reasons for use.

Materials and Methods

Study design and recruitment

We conducted an online, prospective survey study of people planning to use psychedelics or MDMA within the next three months. The study was conducted in accordance with the Declaration of Helsinki and approved by the Bern Cantonal Ethical Committee (BASEC-No. 2022-01529). Participants were recruited online through organizations and forums dedicated to psychedelic use between April 2023 and May 2024. Advertisements invited people intending to take a psychedelic within the next three months to participate in the survey. We used neutral language in the advertisements and study information packet, which invited people to a study about "how psychedelics affect people." Participants were not told in advance that the study would assess neuroticism or personal values. All participants provided written informed consent.

Participants had to be planning an experience with a single psychedelic drug. For this study, we defined "psychedelics" to include MDMA and the serotonergic psychedelics LSD, psilocybin, ayahuasca, DMT, 5-MeO-DMT, mescaline, and 2C-B. Microdoses were excluded. Only participants who indicated that they were over 18, were fluent in the study language, and did not currently have any psychiatric illnesses were included. For ethical reasons, participants were not financially compensated and were required to have consumed a psychedelic or MDMA at any dose at least once before.

A total of 96 participants completed the baseline survey and at least one follow-up survey, while 74 completed the one-week follow-up and 58 completed the entire study. Participants were excluded from analysis if they did not complete any follow-up surveys after the baseline (n = 9). No participants had to be excluded for completing surveys unrealistically quickly.

Study procedures

Participants filled out a total of four surveys: one before, then three after their psychedelic experience (Figure 1). The first survey assessed neuroticism and personal values at baseline and also included questions about demographics, history of psychedelic use, attitudes toward psychedelic drugs, and childhood adversity. At the end of the first survey, participants shared the planned date of their psychedelic experience, which they could later change if needed. One day after the planned experience, participants received an invitation to the second survey, which contained questions about the psychedelic substance and the context in which it was taken. Participants were required to complete the second survey within 72 hours of consuming the substance, and those who indicated that they had taken more than one substance during their experience were excluded. Invitations for the third and fourth surveys were sent one and four weeks after the date of the psychedelic experience, respectively. Like survey 1, surveys 3 and 4 assessed neuroticism and personal values. The exact wording of questionnaire items can be found in the supplementary methods.

Questionnaires

Neuroticism

Neuroticism was assessed with the Neuroticism subscale of the NEO Five-Factor Inventory (NEO-FFI) (McCrae and Costa, 2004). The scale consists of 12 questions rated on a 5-point Likert scale from "strongly agree" to "strongly disagree."

Personal values

We assessed personal value orientation with a modified version of the Valued Living Questionnaire (VLQ). The VLQ was developed for studying personal values in the context of third-wave behavioral therapies, particularly Acceptance and Commitment Therapy (ACT) (Wilson et al., 2010). The original VLQ asks respondents to rate the importance of ten value domains in their lives on a 10-point Likert scale from "not at all important" to "extremely important." It includes marriage and intimate relationships, parenting, family (other than marriage and parenting), friendships and social life, work, education and training, recreation and fun, spirituality, citizenship and community life, and physical self-care. Additionally, a growing body of literature suggests that psychedelics may increase self-reported connection to nature and pro-environmental behavior (Forstmann and Sagioglou, 2017; Lyons and Carhart-Harris, 2018), as well as appreciation for the arts and aesthetic experience (Noorani et al., 2018; Studerus et al., 2011). In order to assess changes in the valuation of

environmental issues and aesthetic experiences, we constructed two additional value items following the phrasing and response format of the existing scale ("environmental issues" and "art, creative expression, aesthetics"). Item wording was developed through discussion among the research team.

Demographics

At baseline, participants indicated their age, biological sex, ethnicity, country of residence, level of education, marital status, and employment status. They also indicated the number of times they had ever used psychedelics or MDMA before (excluding microdosing).

Drug, set and setting

One day after their psychedelic experience, participants were asked questions about the substance and dose they consumed, as well as questions about their motivations for taking that substance and the environment in which they did so. Participants first specified the substance and dose they took, as well as the route of administration and how the substance was acquired. As an additional indicator of dose, they also rated the subjective intensity of their psychedelic experience on a sliding scale from 0 ("I did not feel any effects") to 100 ("I felt extremely intense effects"). Next, participants were asked whether they tested their substance (e.g. at a drug testing center or with a reagent) before consumption, as well as whether any signs of drug impurity were apparent due to testing, substance appearance or taste, or expected drug effects. Participants who were unsure of the substance they actually took were excluded.

Next, participants were asked about their motivations for taking the psychedelic based on previously published lists of possible motivations (Basedow and Kuitunen-Paul, 2022). They also indicated whether other people had been present during the experience, whether any kind of tripsitter or guide had been present, and whether the experience took place outdoors in nature. Finally, they rated the overall valence of their psychedelic experience on a continuous scale from 0 ("extremely negative") to 100 ("extremely positive"), with 50 being "neutral or ambivalent."

Psychedelic attitudes and prior use

We anticipated that our sample would be positively biased toward psychedelic use, and that this could influence our results. To assess possible effects of positive bias, we used an in-house questionnaire on psychedelic attitudes (PAQ, Table S1). We introduced it as follows: "We would now

like to ask you how you feel about the use of psychedelic drugs. There are no right or wrong answers. For each statement, please select the option that best describes your beliefs." Participants rated their agreement using a 5-point Likert scale from "strongly agree" to "strongly disagree."

Childhood adversity

To assess whether any psychedelic-induced changes in neuroticism would be mediated by exposure to childhood adversity, we included the 28-item Childhood Trauma Questionnaire (CTQ) at baseline (Bernstein et al., 2003). The CTQ lists types of adverse experiences covering emotional, physical, and sexual abuse, as well as emotional and physical neglect. Respondents are asked to rate how often each item was true when they were a child or a teenager on a 5-point Likert scale from "never true" to "very often true." We used the total CTQ score as a continuous measure of participants' overall exposure to childhood adversity.

Statistical Analysis

Statistical analyses were performed in R (Version 4.4.1) (R Core Team, 2024). Differences between participants who finished the study and those who dropped out before completing all follow-ups were analyzed with Student's *t*-tests, Wilcoxon rank-sum tests or chi-square tests as appropriate and without correction for multiple comparisons. Based on the results, data were assumed to be missing at random for all further analyses, which were only conducted with complete cases for the relevant timepoints.

The study's primary outcomes were changes in neuroticism and values after psychedelic use, analyzed with linear mixed effects models using the lme4 package (Bates et al., 2003). Models included timepoint as a fixed effect and participant as a random intercept. To evaluate the overall effect of timepoint, we conducted an omnibus F-test using Type III analysis of variance (ANOVA) on the fitted model. When this was significant, we examined the parameter estimates for specific timepoint contrasts. Sensitivity analyses were run by re-fitting the model after removing influential cases, defined as Cook's distance >1.0 (Cook and Weisberg, 1982). The possible influence of covariates was investigated by fitting corrected models that included fixed effects for sex, age, number of previous psychedelic experiences, CTQ scores, psychedelic attitudes, and valence of the psychedelic experience.

Additionally, exploratory analyses investigated predictors of changes in neuroticism and values. To this end, we calculated the change from baseline and used this as the dependent variable in multiple

linear regressions. Bootstrapping was used to calculate test statistics and confidence intervals when model assumptions were violated. For all models, predictors included drug class (serotonergic psychedelics vs. MDMA), sex, age, PAQ scores, baseline scores of that variable, number of previous psychedelic experiences, valence of the psychedelic experience, and the presence of a tripsitter. For regressions evaluating changes in neuroticism, we also included CTQ scores. For regressions evaluating VLQ scores, we also included certain self-reported motivations for taking psychedelics in a theory-driven manner. Specifically, we investigated the relationship between the intentions of having a spiritual experience, enhancing creativity, enjoying the sensations, and connecting with others on the values of spirituality, creativity, recreation/fun, and social values (i.e. family, intimate relationships, parenting, friendship, and citizenship), respectively. Furthermore, we evaluated the effect of using psychedelics in nature on the value of environmental concern. Finally, Spearman correlation coefficients were calculated to evaluate the relationship between changes in neuroticism and changes in each of the twelve values at both follow-up timepoints (1 week, 4 weeks). Correction for multiple comparisons was performed familywise using the Benjamini-Hochberg method (Benjamini and Hochberg, 1995).

Results

Sample characteristics

A total of 96 participants completed the baseline assessment and the first follow-up one day after their psychedelic experience, while 74 completed the one-week follow-up and 58 completed the four-week follow-up. To control for attrition, we tested whether dropouts significantly differed from those who completed the study on key outcomes and covariates. For both those who dropped out after one day and those who dropped out after one week, dropouts and completers did not significantly differ on any of the demographic characteristics, the drugs and doses taken, intensity or valence of the psychedelic experience, neuroticism, or total VLQ scores (Table S2).

Table 1 shows demographic characteristics of the sample. Participants were relatively young and skewed male, and most were of European descent, located in Europe or North America, and in possession of at least a Bachelor's degree. Most had multiple previous experiences with psychedelics. The mean PAQ score was 0.87 (SD: 0.52) on a scale from -2 to 2, corresponding to an average answer of "somewhat agree" for questions assessing positive views of psychedelics (Figure S1).

Table 1. Demographic characteristics of the sample for participants who completed at least the second follow-up survey (T + 1 week). Data are shown as mean (SD) or a percentage unless otherwise stated. N = 74.

Age		33.0 (10.7)
% female		37.8%
No. previous psychedelic experiences (median, range)		12 (0-1000)
Location	Europe	55.4%
	North America	33.8%
	South America	9.5%
	Africa	1.4%
Ethnic background	European	86.49%
	Hispanic	10.81%
	African	2.7%
	Asian	2.7%
	Middle Eastern	2.7%
Education	High school	27.0%
	Trade school	8.1%
	Bachelor's degree	31.1%
	Master's degree	31.1%
	Ph.D., M.D.	2.7%
Marital status	Single	39.2%
	Committed relationship	25.7%
	Married	28.4%
	Divorced	5.4%
	Other	1.4%
Employment	Full-time	63.5%
	Part-time	10.8%
	Student	18.9%
	None	6.8%

Table 2 shows the psychedelic drugs and doses which participants reported consuming. All participants reported consuming their substances orally except for users of DMT, who reported smoking (83.3%) or rectal administration together with a MAO-I (16.7%), and one user of 5-MeO-DMT, who reported intranasal administration. Nearly one third (29.7%) reported testing the substance before consumption, and nearly all (98.6%) reported no noticeable signs of drug impurity. Participants reported buying the substance online (25.7%), from another person (17.6%), or from a legal store (8.1%), or obtaining it as a gift from a friend (12.2%), stranger (25.7%), or guide (10.8%). Most participants (94.6%) took the psychedelic substance in their country of residence. The mean intensity rating for the psychedelic experience was 71.4 out of 100 (SD = 22.2). The mean valence rating was 79.0 out of 100 (SD = 20.8), indicating that most people reported positive experiences.

Table 2. Drugs and total doses reportedly taken by participants on the day of their psychedelic experience. Data are shown as mean (SD). N = 74.

Substance	% of sample	Dose
Psilocybin mushrooms	35.1%	10.5 (6.4) g wet 3.0 (1.3) g dry
LSD	21.6%	188.3 (142.3) µg
MDMA	18.9%	270.0 (209.3) mg
Ayahuasca	12.2%	2.2 (0.8) cups
DMT	8.1%	23.7 (20.1) mg
2C-B	1.4%	24 mg
Mescaline	1.4%	2 cactus pups
5-MeO-DMT	1.4%	15 mg

Participants indicated that they took psychedelics for a variety of reasons, most commonly to enjoy the sensations, introspect about themselves, and understand things differently (Table S3). The majority of participants reported being indoors for most of the experience (71.6%), while the rest were outdoors in nature (18.9%), outdoors but not in nature (8.1%), or both indoors and outdoors (1.4%). Some participants reported being alone (31.1%), while others were in a small group of less than three others (36.5%) or a larger group (23.0%). More than half of participants (59.5%) reported having a tripsitter, guide, or similar present at least some of the time.

Changes in neuroticism

We first investigated the impact of psychedelics on neuroticism. The omnibus F-test showed a significant overall effect of timepoint on neuroticism ($F(2,128.7) = 8.7$, $p < .001$). Linear mixed effects models revealed that neuroticism had not changed from baseline one week after the experience ($\beta = 0.01$, $t = 0.01$, $p = 0.99$), but a significant decrease had developed by four weeks after the experience ($\beta = -2.64$, $t = -3.72$, $p < .001$) (Figure 2A, Table S4). This effect did not change after removal of influential cases or correcting for possible covariates (Table S5). Furthermore, the decrease in neuroticism at four weeks existed separately for both serotonergic psychedelics ($\beta = -2.60$, $t = -3.15$, $p = 0.002$) and MDMA ($\beta = -2.93$, $t = -2.36$, $p = 0.03$) (Figure 2B, Table S4).

Next, we sought to determine which specific components of neuroticism decreased after psychedelic use. We repeated the linear mixed effects model for each of the twelve individual neuroticism questions. After corrections for multiple comparisons, two of the questions showed a significant change from baseline, namely “I often feel tense and jittery” and “At times I have been so ashamed I just wanted to hide” (Table 3).

Table 3. Change in each of the twelve neuroticism questions four weeks after psychedelic use. N = 58.

Item	β	Std. error	df	*t*	*p*
1. I am not easily worried	0.43	0.17	62.43	2.52	0.058
2. I often feel inferior to others	-0.09	0.12	58.43	-0.73	0.564
3. When I'm under a great deal of stress, sometimes I feel like I'm falling apart	-0.30	0.18	63.54	-1.71	0.203
4. I rarely feel lonely or blue	0.15	0.16	63.23	0.90	0.493
5. I often feel tense and jittery	**-0.50**	**0.15**	**59.29**	**-3.35**	**0.008****
6. Sometimes I feel completely worthless	-0.26	0.14	58.21	-1.82	0.203
7. I rarely feel fearful or anxious	0.21	0.18	64.28	1.19	0.355
8. I often get angry at the way people treat me	-0.03	0.13	61.26	-0.24	0.808
9. Too often when things go wrong, I get discouraged and feel like giving up	-0.13	0.11	59.18	-1.20	0.355
10. I am seldom sad or depressed	0.29	0.18	63.73	1.66	0.203
11. I often feel helpless and want someone else to solve my problems	0.08	0.14	59.56	0.54	0.648
12. At times I have been so ashamed I just wanted to hide	**-0.55**	**0.15**	**58.91**	**-3.59**	**0.008****

Finally, we investigated possible predictors of the change in neuroticism at four weeks. The linear model significantly predicted changes in neuroticism ($F(9,45) = 2.38$, $R^2 = 0.32$, $p = 0.028$). Inspection of model coefficients revealed that higher neuroticism and older age at baseline were significantly associated with greater reductions in neuroticism at four weeks (Table S6).

A model including only these two predictors explained 24% of the variance in neuroticism changes ($F(2,52) = 8.28$, $R^2 = 0.24$, $p < 0.001$). No other predictors were significant, including CTQ scores, number of previous psychedelic experiences, psychedelic bias scores, sex, valence of the experience, or the presence of a tripsitter.

Changes in value orientation

We next investigated the impact of the psychedelic experience on the importance of each of the twelve values from the modified VLQ, as well as the total score. After correction for multiple comparisons, F-tests showed significant overall increases for the values of citizenship and community life ($F(2.0, 134.1) = 3.45$, $p = 0.035$), family (other than parenting and intimate relationships) ($F(2.0, 132.3) = 6.98$, $p = 0.001$), marriage and intimate relationships ($F(2.0, 131.8) = 5.36$, $p = 0.006$), and spirituality ($F(2.0, 131.2) = 9.21$, $p < .001$). Model coefficients revealed that all four of these values were rated as higher than baseline one week after the experience (Figure 3, Table S7). Only the value of family was rated significantly more highly than baseline at both one week ($\beta = 0.80$, $t = 3.64$, $p <$

0.001) and four weeks after the experience (β = 0.57, *t* = 2.41, *p* = 0.02). Controlling for the influence of sex, age, number of previous psychedelic experiences, and psychedelic attitudes did not alter any of the results on value orientation, and they were not driven by outliers or influential cases.

In a final exploratory analysis, we investigated predictors of changes in values at one week. For all twelve values, a lower baseline rating of importance significantly predicted increases in that value (Table S8). Additionally, people who consumed serotonergic psychedelics were significantly more likely to rate spirituality as more important after their experience than those who consumed MDMA (β = 2.19, *t* = 4.19, *p* = .005), and female sex was significantly associated with greater increases in the value of art and creative expression (β = 1.24, *t* = 4.12, *p* < .001). None of the other possible predictors of changes in values were significant, including participants' intentions for taking psychedelics. Finally, no changes in values were related to the change in neuroticism (Table S9).

Discussion

This prospective survey study observed that planned consumption of either serotonergic psychedelics or MDMA in a naturalistic setting was associated with decreased self-reported neuroticism at four weeks (but not one week) after the experience. Exploratory item-level analysis of neuroticism questions suggested that the strongest reductions affected feelings of shame, tension, and jitteriness. Reductions in self-reported neuroticism were partially predicted by older age and higher initial levels of neuroticism. Additionally, consumption of psychedelics or MDMA was associated with increased ratings of the importance of citizenship and community life, family, intimate relationships, and spirituality. The increase in the importance of family was the only change which remained stable at four weeks, and serotonergic psychedelics were more strongly associated with increases in the value of spirituality than MDMA. In this sample, value changes were statistically unrelated to participants' self-reported intentions for taking psychedelics, nor were they related to the number of previous psychedelic experiences, positive bias towards psychedelics, valence of the psychedelic experience, or the presence of a tripsitter.

To our knowledge, this study is the first to report an association between self-reported changes in neuroticism and MDMA consumption in a naturalistic setting, though the MDMA group was quite small (n = 14). One previous experimental study investigated changes in neuroticism after MDMA, reporting no change after a relatively short follow-up time of 48 hours (Maples-Keller et al., 2024). Interestingly, a cross-sectional study comparing users of psychedelics and MDMA to a control group found no between-group differences in neuroticism (Erritzoe et al., 2019). Though clear inferences cannot be made, this could speculatively imply that self-reported changes in neuroticism and other personality traits after psychedelic use tend to fade over time, or that they reflect short-term state

changes rather than true personality change. It will be important to investigate possible changes in neuroticism after MDMA in larger, controlled studies, given the exploratory nature of our findings.

Regarding serotonergic psychedelics, our findings add to the somewhat inconsistent literature on possible changes in neuroticism after psychedelic experiences. Controlled studies of patients with treatment-resistant depression and alcohol use disorder have reported sustained decreases in neuroticism scores several months after PAT with psilocybin (Erritzoe et al., 2018; Irrmischer et al., 2025; Pagni et al., 2025). In healthy subjects, one controlled study found reductions in neuroticism one week after administration of N,N-dimethyltryptamine (DMT) (Timmermann et al., 2024). On the other hand, however, two recent meta-analyses of controlled studies with psychedelics found no overall effect on neuroticism (Goldberg et al., 2020; Solaja et al., 2024). In naturalistic settings, reductions in neuroticism scores have been reported in the weeks and months following use of ayahuasca (Kiraga et al., 2021; Netzband et al., 2020; Weiss et al., 2023; Weiss, Miller, et al., 2021) and psilocybin (Kiraga et al., 2022). Other prospective survey studies have found decreases in both neuroticism and trait anxiety 2-3 months after psilocybin use (Nayak et al., 2023), as well as decreased neuroticism four weeks after the use of any serotonergic psychedelic (Weiss, Nygart, et al., 2021).

The emerging pattern in the literature seems to be a lack of reliable psychedelic effects on self-reported neuroticism (and other personality traits) in meta-analyses of experimental studies, yet a trend toward reduced neuroticism scores in studies of naturalistic use. Notably, observational studies of naturalistic use are less able to control for expectancy and placebo effects, observation effects, concurrent life events, and self-selection bias, suggesting that their findings should be interpreted with caution. This sample reported relatively positive attitudes toward psychedelics, and though these did not predict changes in neuroticism or other outcomes, their effect may not have been statistically visible in such a homogenous sample. Additionally, greater neuroticism at baseline predicted larger decreases at four weeks in this sample. This raises the possibility that the decrease reflects regression to the mean, which could occur if participants chose to take a psychedelic (e.g. for therapeutic purposes) when neuroticism-related states are relatively high. Relatedly, although the NEO-FFI is designed to measure trait neuroticism, it is possible that participants' responses at the four-week follow-up were influenced by transient state variables, (e.g. elevated mood or reduced anxiety) rather than enduring trait-level change. Though the study of naturalistic psychedelic use outside of controlled settings offers valuable insights into the effects of psychedelics in diverse settings, findings should be interpreted cautiously.

Exploratory item analysis of the NEO-FFI neuroticism subscale showed the strongest reductions for feelings of tension and jitteriness, shame, and worry. Reductions in shame and self-criticism have

also been reported in patients undergoing PAT for alcohol use disorder (Agin-Liebes et al., 2024) and HIV-related shame (Mehtani et al., 2024), as well as naturalistic psilocybin users (Mathai et al., 2025). They are theorized to arise from reductions in negative self-focused attention and increased self-compassion, possibly arising from altered perceptions of the self during psychedelic experiences. Psychedelics have also been shown to decrease anxiety and stress in both humans and animal models (Calder and Hasler, 2023). However, the item-level analysis should be considered exploratory and mechanistic speculation is premature before replication in larger samples.

Interestingly, the decrease in self-reported neuroticism did not develop immediately, but after at least one week. This could be related to short-term aftereffects from psychedelics and MDMA, as well as to the fact that the long-term effects of psychedelic experiences may take time to unfold. Previous studies on adverse effects suggest that some degree of fatigue and mood changes are common in the week after experiences with both MDMA and serotonergic psychedelics (Calder and Hasler, 2024; Vizeli and Liechti, 2017). Though usually transient and manageable, it is possible that these symptoms would mask any decreases in neuroticism until they subside. Beyond this, it can simply take time to process and integrate a psychedelic experience, and perceived effects on neuroticism may not be evident before some processing has occurred.

Participants rated the values of citizenship and community life, family, intimate relationships, and spirituality as more important after their psychedelic experiences. With the exception of family, however, value ratings had returned to baseline by four weeks. This suggests that changes in the perceived importance of personal values after naturalistic psychedelic use may tend to be relatively short-lived, possibly reflecting a brief increase in the salience of certain values rather than lasting transformation. Temporary though they were, the specific pattern of value changes is somewhat in line with previous research suggesting that some of the most commonly reported value changes after psychedelic use involve relationships. Both healthy people and patients in PAT regularly report greater altruism, prosociality, and connection to others after psychedelic experiences (Griffiths et al., 2006; Noorani et al., 2018; Ross et al., 2016; Schmid and Liechti, 2018). Loved ones also frequently appear in peoples' psychedelic experiences, and several studies suggest that psychedelics can catalyze positive transformations in these close relationships (Breeksema et al., 2020). A qualitative study of patients in a trial of psilocybin-assisted therapy found that without prompting, all interviewed patients reported lasting positive changes in relationships with family members, who also often appeared to them during psilocybin-induced visions (Belser et al., 2017). These patients reported both feeling more connected to loved ones and giving greater priority to important relationships. Similarly, a study of healthy subjects found that feelings of love and gratitude toward

close family members was one of the most common themes during an acute psilocybin experience (McCulloch et al., 2022).

The increased importance of spirituality at one week was more strongly associated with serotonergic psychedelics than MDMA and is also consistent with previous research. Naturally-occurring psychedelics have a long history of spiritual and religious use (Nichols, 2016), and their effects are sometimes described in spiritual terms even in controlled experimental settings. Studies consistently find that a majority of patients and healthy subjects alike describe psychedelic experiences as some of the most spiritually significant of their lives (Griffiths et al., 2006; Ross et al., 2016; Schmid and Liechti, 2018). After such an experience, people may be more likely to prioritize spirituality, engage in spiritual practices, and report personal spiritual growth, and these changes can last for months or years (Schutt et al., 2024). Furthermore, survey studies suggest that approximately half of people who use psychedelics outside of controlled settings are motivated by the possibility of having a spiritual experience or promoting spiritual development, a finding consistent with the 45% of our sample who were seeking a spiritual experience (Kettner, Mason, et al., 2019). Recent comparisons of serotonergic psychedelics with other substances also suggest that serotonergic psychedelics have a greater propensity to cause meaningful, spiritual-type experiences than MDMA and other classes of psychoactive substances (Calder et al., 2025).

Psychedelics were not associated with changes in participants' valuation of environmental issues, creative expression, or physical self-care, which is less consistent with previous research. Other survey studies have related psychedelic experiences to increased nature-relatedness and environmental concern (Forstmann and Sagioglou, 2017; Lyons and Carhart-Harris, 2018), particularly for those who had psychedelic experiences in natural surroundings (Kettner, Gandy, et al., 2019). Some of these studies had larger sample sizes than ours, and we may have been underpowered to detect effects on environmental concern, though these may also have a smaller magnitude than the other changes in values. Further purported changes in values after psychedelic experiences include an increase in greater aesthetic appreciation of the creative arts (Noorani et al., 2018; Studerus et al., 2011) and greater care for one's physical well-being (Teixeira et al., 2022), which we also did not find in this sample. Overall, however, the pattern of value changes we observed was consistent with the theory that psychedelics most strongly affect those values which are related to self-transcendence, including both spirituality and social values (Kähönen, 2023).

Any impact of psychedelics on values likely depends on contextual factors, including the context and setting in which the substance was consumed and the intention with which participants approached the experience (Haijen et al., 2018). For instance, the absence of effects on nature-relatedness in our sample may partly reflect the fact that relatively few participants consumed psychedelics in natural

surroundings, a context that has been specifically linked to increased environmental concern (Kettner, Gandy, et al., 2019). Our analyses included a limited set of theory-driven contextual predictors, but the sample size precluded a more comprehensive examination of how these factors shaped value changes, which remains an important direction for future research.

Finally, and perhaps surprisingly, none of the changes in values or neuroticism were predicted by the number of previous psychedelic experiences. We had expected that people with more previous experiences would show diminishing effects, i.e. less change in neuroticism and values, after this most recent psychedelic experience. This did not appear to be the case in our sample. One possible reason is that the self-reported changes in personality or values may be relatively temporary, as we saw with changes in valuation of citizenship, intimate relationships, and spirituality. It is possible that the changes in neuroticism and family values that were still present at four weeks would also eventually return to baseline levels. On the other hand, we cannot rule out the possibility that psychedelic experiences could cause incremental changes in neuroticism or the importance of certain values with each subsequent experience, even after many experiences. More research on experienced users of psychedelics would be needed to determine whether this is the case.

Limitations

This study has important limitations. The sample size was small, particularly for the MDMA group. Some analyses were likely underpowered, particularly investigation of predictor variables related to changes in values and neuroticism. The drop-out rate was also high, and though we did not detect any systematic effects of attrition, this analysis may also have been underpowered. Future prospective studies with larger samples would allow for more robust analyses, including analyses of contextual and other factors which may moderate changes in neuroticism and values. Participants may have been prone to expectancy or observation effects when repeatedly self-reporting on neuroticism and personal values. Relatedly, the study lacked a control group of people who were not using psychedelics, precluding causal inferences. The two additional items of the VLQ have not undergone psychometric validation, and repeated sampling of trait neuroticism could have been confounded by short-term changes in related state-level variables. Limitations inherent to online survey studies also apply, including the potential unreliability of data and lack of control over the substances and doses people consumed. Additionally, most participants were relatively young, male, and from Europe or North America, which limits the generalizability of the results to other populations. Participants also held relatively positive views of psychedelics, had had psychedelic experiences before, and planned their psychedelic experiences ahead of time. The generally positive

views of psychedelics in our sample could impact the generalizability of our results to other populations (e.g. first-time users of psychedelics or patient groups). It is possible, or even likely, that experienced users who plan their psychedelic use ahead of time show differing long-term effects than inexperienced or more spontaneous users.

Conclusions

Planned consumption of psychedelics in a naturalistic setting was associated with decreased neuroticism four weeks later, and this was true for both serotonergic psychedelics and the small subgroup using MDMA. More specifically, participants reported decreased feelings of shame, tension or jitteriness, and worry. Additionally, participants also rated the personal values of citizenship and community life, family, intimate relationships, and spirituality as more important one week after the experience, and family was still rated as significantly more important four weeks after the experience. None of these findings were related to self-reported positive views of psychedelics, the number of previous psychedelic experiences, valence of the experience, or having a tripsitter. Whether these findings generalize to other samples is unclear given the small, self-selected sample of participants with positive attitudes toward psychedelics, and they may have been confounded by regression to the mean. Nevertheless, these findings expand the literature on the effects of a planned psychedelic experience outside of controlled settings and particularly contribute to the literature on planned MDMA use.

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CRediT authorship contribution statement

AEC and GH conceptualized the study. AEC was responsible for data acquisition, analysis, and visualization. GH was the principal investigator and supervised the project. All authors contributed to the writing and editing of the final manuscript.

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Declaration of competing interests

The authors have no competing interests to declare.

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Figure captions

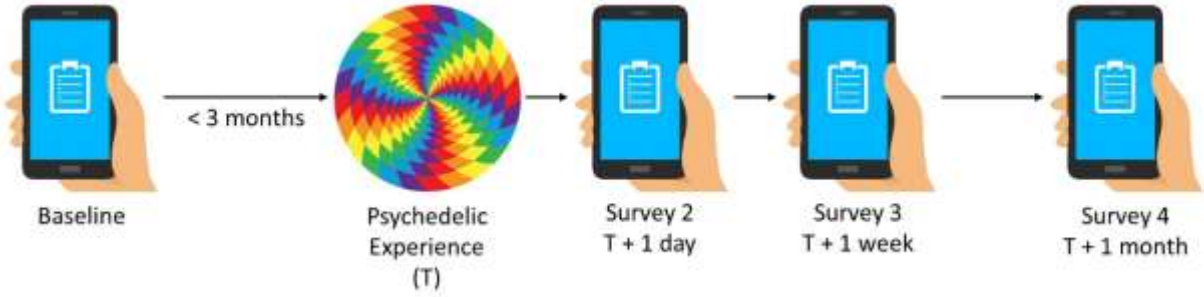

Figure 1. Timeline of study participation showing the four timepoints at which data was collected.

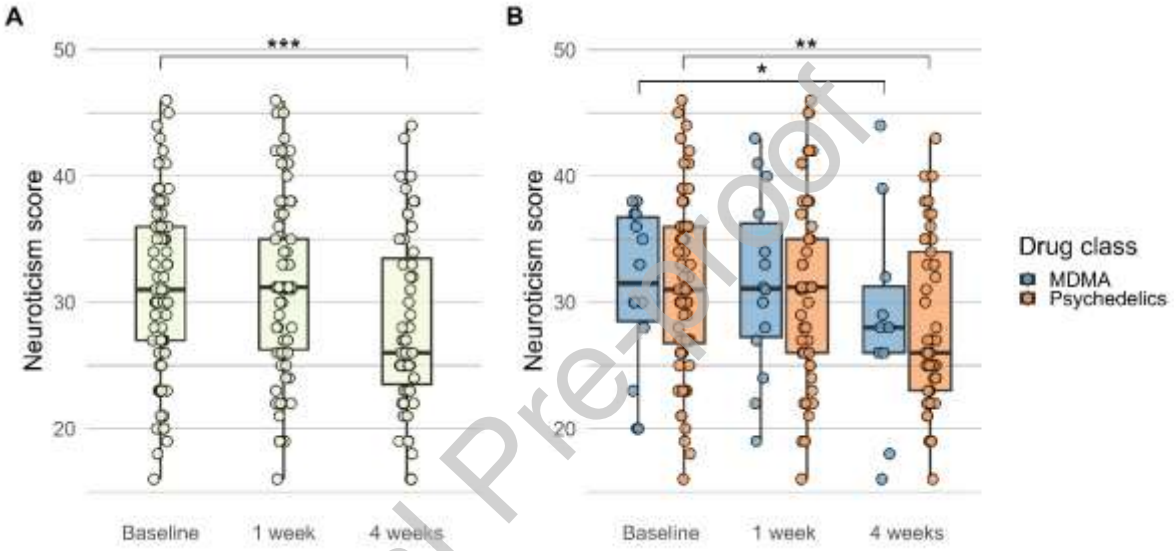

*Figure 2. Neuroticism scores at baseline and one and four weeks after the psychedelic experience in all subjects (N=74) (A) and for users of serotonergic psychedelics (N=60) and MDMA (N=14) separately (B). Box plots show the median and interquartile range. *p<.05, **p<.01, ***p<.001.*

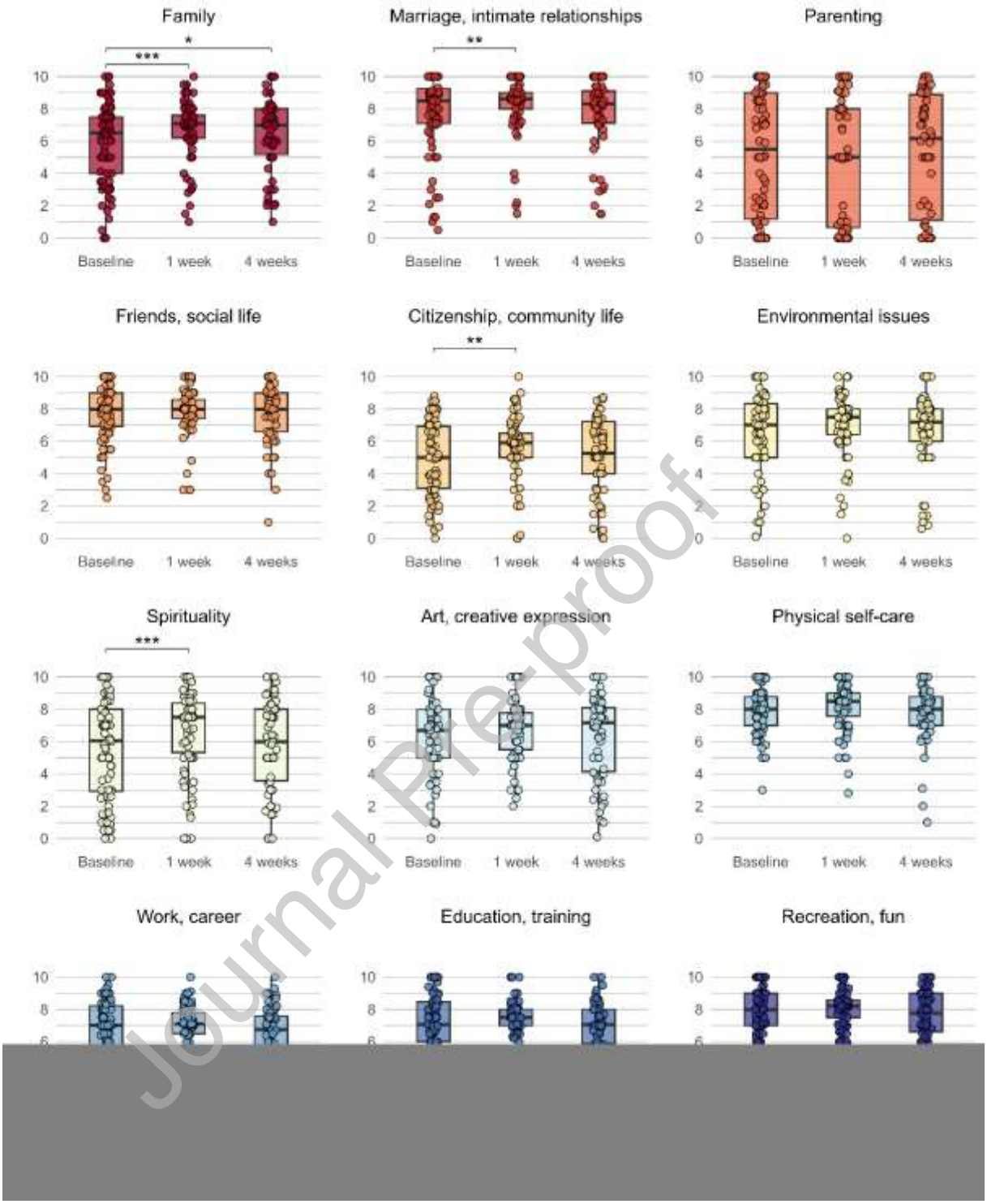

*Figure 3. Changes in the subjective importance of values from the Valued Living Questionnaire one week and four weeks after the psychedelic experience. Importance is rated on a scale from 1-10. The values of family, marriage and intimate relationships, citizenship and community life, and spirituality significantly changed from baseline. N = 74. *p < .05, **p < .01, ***p < .001.*

CRediT authorship contribution statement

AEC and GH conceptualized the study. AEC was responsible for data acquisition, analysis, and visualization. GH was the principal investigator and supervised the project. All authors contributed to the writing and editing of the final manuscript.

Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: