MASTERARBEIT | MASTER'S THESIS

Titel | Title

Psychedelics, Nature Relatedness and Pro-Environmental Behavior

verfasst von | submitted by

David Moor BSc

angestrebter akademischer Grad | in partial fulfilment of the requirements for the degree of

Master of Science (MSc)

Wien | Vienna, 2024

Studienkennzahl lt. Studienblatt | Degree programme code as it appears on the student record sheet:	UA 066 840
Studienrichtung lt. Studienblatt | Degree programme as it appears on the student record sheet:	Masterstudium Psychologie
Betreut von | Supervisor:	Univ.-Prof. Dipl.-Psych. Sabine Pahl MSc PhD
Mitbetreut von | Co-Supervisor:	Mathew White BSc MSc PhD

Acknowledgments

I would like to thank my supervisors, Mathew White and Sabine Pahl, for their support and guidance throughout this thesis project. Your passion for environmental psychology and open-mindedness inspired me to connect two fields of great personal interest, which I had not previously realized were so deeply connected.

A heartfelt thanks to all the cooperating retreat centers for sharing the study link with their guests and within their networks.

I am also deeply grateful to my parents for their encouragement and for making my studies possible. Lastly, I want to express my gratitude to my family, friends, and fellow students for their participation in the online survey, their support and genuine interest in my work, which made this journey even more fulfilling.

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Abstract (Deutsch)

Diese Studie untersuchte den Zusammenhang zwischen dem Konsum psychedelischer Substanzen, Naturverbundenheit (nature relatedness, NR) und umweltfreundlichem Verhalten (pro-environmental behavior, PEB). Frühere Studien, wie die von Forstmann & Sagioglou (2017) und Lyons & Carhart-Harris (2018), stellten einen Zusammenhang zwischen dem Konsum psychedelischer Substanzen, erhöhter NR und größerem Engagement in PEB fest. Die vorliegende Studie verwendete eine online-Querschnittserhebung mit 205 Teilnehmenden. Zu den Messinstrumenten gehörten die Nature Relatedness Scale (NR-6; Nisbet & Zelenski, 2013) , die Recurring Pro-environmental Behavior Scale (RPEBS; Brick et al., 2017) und das Big Five Inventory (BFI-10; Rammstedt et al., 2013). Der Konsum psychedelischer Substanzen (Psilocybin, DMT, Meskalin, LSD) wurde mit einer angepassten Version des Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) erhoben (Humeniuk et al., 2010). Zusätzlich wurden Daten zur Ich-Auflösung mit dem Ego-Dissolution-Inventory (EDI; Nour et al., 2017) und zum Umfeld (setting) des Konsums gesammelt. Psilocybin- und DMT-Konsum sagten signifikant höhere NR-Werte voraus. Die Persönlichkeitseigenschaft Offenheit für Erfahrung sowie das Alter erwiesen sich ebenfalls als signifikante positive Prädiktoren für NR, während NR und Gewissenhaftigkeit signifikant höhere PEB-Werte vorhersagten. Entgegen den Erwartungen erwies sich Psilocybin in der multiplen linearen Regressionsanalyse (MLR) als signifikanter negativer Prädiktor für PEB. Eine Mediationsanalyse zeigte jedoch einen statistisch signifikanten positiven indirekten Effekt von Psilocybin auf PEB, vermittelt durch NR. Die Kategorie der anderen Psychedelika zeigte einen positiven Zusammenhang mit PEB. Eine weitere Mediationsanalyse zeigte, dass die Ich-Auflösung die Beziehung zwischen dem Konsum psychedelischer Substanzen und der Naturverbundenheit teilweise erklärt, was die zentrale Bedeutung der Qualität der Erfahrung hervorhebt. Das Umfeld erwies sich nicht als signifikanter Moderator der Beziehung zwischen dem Konsum psychedelischer Substanzen und der Naturverbundenheit.

Abstract (English)

This study investigated the relationship between psychedelic substance use, nature relatedness (NR), and pro-environmental behavior (PEB). Previous studies, such as those by Forstmann & Sagioglou (2017) and Lyons & Carhart-Harris (2018), have established a link between psychedelic use, increased NR, and greater engagement in PEB. The current study employed a cross-sectional online survey and collected data from 205 participants. Measures include the Nature Relatedness Scale (NR-6; Nisbet & Zelenski, 2013), the Recurring Pro-environmental Behavior Scale (RPEBS; Brick et al., 2017), and the Big Five Inventory (BFI-10; Rammstedt et al., 2013) for personality traits. Psychedelic use, including substances like psilocybin, DMT, mescaline and LSD, was assessed with an altered version of the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST; Humeniuk et al., 2010). Additional data was collected on ego dissolution (EDI; Nour et al., 2017) and the setting of use. Results revealed that psilocybin and DMT use significantly predicted higher nature relatedness scores. The personality trait openness to experience and age were found to be significant positive predictors of NR, while NR and conscientiousness significantly predicted higher PEB scores. Contrary to expectations, psilocybin emerged as a significant negative predictor of PEB in the multiple linear regression model (MLR). However, the mediation analysis revealed a statistically significant positive indirect effect of psilocybin on PEB through NR. The category of other psychedelics showed a positive association with PEB. The mediation analysis showed that ego dissolution partially explained the relationship between psychedelic substance use and NR, highlighting the central importance of the quality of the experience. The setting did not emerge as a significant moderator in the relationship between psychedelic use and nature relatedness.

1 Introduction

In his book “Darwin's Pharmacy: Sex, Plants, and the Evolution of the Noösphere”, author Richard Doyle (2011) introduces the concept of "ecodelics" to describe the transformative nature of psychedelic substances. After analyzing thousands of reports on psychedelic substance use, Doyle observed that a recurring theme is what he calls an "ecodelic" insight. This realization involves an overwhelming sense of being deeply embedded in a complex, interconnected ecosystem. This ecosystem could be the “psychonaut's” immediate surroundings, such as a city or forest, the broader planetary environment, or a fusion of all these systems experienced simultaneously.

Despite these claims it is important to better understand the underlying mechanisms behind any such association and the extent to which they occur. Nature relatedness (NR) refers to the extent to which individuals feel emotionally and cognitively connected to the natural world. It encompasses one’s sense of belonging to nature, as well as an appreciation for the environment’s beauty, interconnectedness, and the individual’s role within it. Higher levels of NR are often associated with pro-environmental attitudes and behaviors, as individuals with stronger connections to nature tend to prioritize ecological sustainability and take actions that reflect their concern for the well-being of the environment (Forstmann & Sagioglou, 2017; Nisbet et al., 2009). While closely related to nature relatedness, nature connectedness emphasizes the emotional and experiential bond with nature, while nature relatedness incorporates a broader framework, including cognitive, emotional, and behavioral dimensions (Nisbet et al., 2009; Mayer & Frantz, 2004). Pro-environmental behavior (PEB) refers to actions individuals take with the intention of minimizing their negative impact on the environment and promoting sustainability. These behaviors can range from recycling and reducing energy consumption to supporting environmental policies and engaging in conservation efforts (Forstmann & Sagioglou, 2017). PEB is often motivated by a

combination of personal values, emotional connection to nature, and ecological awareness. Psychedelics, often referred to as hallucinogens, are a category of substances that produce altered states of consciousness, perception, and cognition. These substances often lead to profound changes in sensory experiences, thought patterns, and awareness (Nichols, 2016). Usually, four substances are considered as classical psychedelics consisting of Lysergic Acid Diethylamide (LSD), Psilocybin, Dimethyltryptamine (DMT) and Mescaline (Longo et al., 2023). In this study a category named "other psychedelics" was added to include psychedelic substances such 5-MeO-DMT, Ibogaine, NBMOe`s, 2C-B & 2C-E.

Numerous studies showed a connection between the consumption of psychedelic substances and heightened scores of NR and PEB (Forstmann & Sagioglou, 2017; Lyons & Carhart-Harris, 2018; Kettner et al., 2019; Sagioglou & Forstmann, 2022; Forstmann et al., 2023). Forstmann and Sagioglou in 2017 conducted a survey study (n=1487) and used Structural Equation Modeling (SEM) to investigate the relationship between the use of classic psychedelic substances, nature relatedness (NR), and pro-environmental behavior (PEB). Their SEM analysis revealed a statistically significant positive association between participants' lifetime experience with classic psychedelics and their self-reported NR. Additionally, the increased NR, in turn, significantly predicted self-reported engagement in PEB. This pathway, where psychedelic use fosters a stronger connection to nature, which in turn encourages pro-environmental actions, mirrors the findings of other studies (Kettner et al., 2019; Sagioglou & Forstmann, 2022).

However, some researchers have pointed out potential limitations in focusing solely on the quantity of psychedelic use. Paterniti et al. (2022) argued that Forstmann and Sagioglou's (2017) emphasis on frequency overlooks the qualitative aspects of psychedelic experiences. To address this, Paterniti et al. (2022) conducted a survey study (n=240) that incorporated the Mystical Experience Questionnaire (MEQ) to assess the depth of participants' psychedelic

experiences. Paterniti et al. (2022) found that people who met the criteria for a mystical experience scored significantly higher on the self-reported PEB measure. The use of psychedelic substances can induce mystical experiences which are often marked by deep emotional intensity, a sense of unity, profound revelations and transcendence of time and space, reshaping an individual's worldview and their relation to the universe and the natural environment (Paterniti et al., 2022; Nour et al., 2017). These experiences often foster a deep connection with nature, encouraging a protective and caring attitude toward the environment, which leads to increased nature relatedness (NR) and pro-environmental behavior (PEB) (Paterniti et al., 2022). By shifting personal values, such experiences may offer a lasting psychological effect that bridges transient altered states with enduring behavioral change, promoting openness and ecological harmony.

Another study by Lyons & Carhart-Harris (2018) used a double-blind, placebo-controlled design to investigate psilocybin's effects on individuals with treatment-resistant depression (TRD). Their results did not only show significant reductions in depressive symptoms but also lasting increases in NR scores. The placebo-controlled nature of the study strengthens its evidence for a causal link between psilocybin use and heightened NR, with effects persisting for months after administration.

In addition to the possible direct effects of psychedelics on NR, individual personality traits, particularly openness to experience, also play a critical role in shaping one's relationship with nature. Studies have shown that psychedelics can increase openness, a trait associated with higher NR (Nour et al., 2017; Forstmann & Sagioglou, 2017). Increases in openness are often long-lasting and linked to intense or mystical psychedelic experiences.

Furthermore, the concept of set and setting, referring to an individual's mindset (set) and the physical environment (setting) during psychedelic use, has been identified as an important moderator in these experiences. Kettner et al. (2019) found that natural settings significantly

increased NR scores, particularly for individuals with initially low levels of NR. This suggests that the environment in which psychedelics are consumed may influence the extent to which these substances foster connections to nature.

Overall, the current literature provides evidence for the positive impact of psychedelics on NR and PEB, with studies using both SEM and experimental designs to uncover these relationships (Forstmann & Sagioglou, 2017; Lyons & Carhart-Harris, 2018).

In this study, I aim to expand upon prior findings by incorporating robust data, adding to the existing literature on the relationship between psychedelic use and nature relatedness. A key focus of this investigation will be on the qualitative dimensions of psychedelic substance use, particularly on how the intensity and quality (ego dissolution) and the environmental setting influence outcomes in nature relatedness. Rather than merely examining the frequency of use, this study will emphasize the state of mind during the experience and how more profound experiences may lead to greater shifts in nature relatedness.

Finally, the study will explore the role of personality traits and how they interact with psychedelic use and ego dissolution. By examining these interactions, the research aims to provide a more detailed understanding of the complex dynamics between personality, psychedelic experiences, and their influence on nature relatedness.

2 Methods

2.1 Hypothesis

The study was conducted with the objective of understanding the relationship between the use of psychedelic substances, nature relatedness (NR) and pro-environmental behavior (PEB). The main research question is whether there is a significant difference in NR and PEB scores between individuals who have used psychedelics and those who have not, based on a

cross-sectional online survey. The aim was to explore if psychedelic users report significantly higher NR and PEB scores compared to non-users.

Given this research question, the hypotheses of the study are formulated as follows: The hypothesis posits that psychedelic users show significantly higher NR scores compared to non-users, even when accounting for other variables such as age, gender, personality traits or use of other substances.

Similarly, according to the hypothesis, it was expected that psychedelic users will show significantly higher PEB scores when compared to non-users.

In addition, a mediation analysis was used to assess if there is a mediating effect of ego dissolution on the relationship between psychedelic use and NR. Mediation hypothesis: The relationship between the use of psychedelic substances and nature relatedness is significantly mediated by the degree of ego dissolution while under the influence of the psychedelic substance.

Furthermore, a moderation analysis was conducted to assess whether accessibility to nature (setting) during psychedelic substance use moderates the relationship between psychedelic use and nature relatedness. Moderation hypothesis: The relationship between the use of psychedelic substances and nature relatedness is significantly moderated by accessibility to nature.

2.2 Participants & Sampling Strategy

A convenience sampling method was employed to recruit participants for the study by distributing the survey link on social media platforms like Facebook, WhatsApp as well as student groups on messaging apps. In addition, the study involved a cooperative effort with various retreat centers that facilitate sessions with ayahuasca, psilocybin, mescaline, or LSD.

Data has been collected via an online survey using the platform SoSci Survey (Leiner, 2024) and was released in the German and English language.

2.3 Measures & Study Procedure

Data on general demographics such as age, gender, country and education level were collected using the templates in SoSci Survey (Leiner, 2024). Prior use of psychedelic substances and other substances was assessed with a tailored version of the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) (Humeniuk et al., 2010) also asking for the last use of each substance and an additional question asking about the intention to use one or more psychedelic substances in the future (see Table A1 in the appendix). The NR-6 scale by Nisbet and Zelenski (2013) was used to assess individuals' nature relatedness. Participants rated their agreement on a 5-point Likert scale ranging from 1 ("Disagree strongly") to 5 ("Agree strongly") ($\alpha = .85$; e.g., "My ideal vacation spot would be a remote, wilderness area"). To measure pro-environmental behavior, 16 items from the original 21 items long Recurring Pro-environmental Behavior Scale (RPEBS) by Brick et al. (2017) were used (see Table A2 in the appendix) ($\alpha = .79$; e.g., "How often do you eat meat?"). Statements were rated on a 5-point Likert scale ranging from 1 ("Never") to 5 ("Always"). To measure the five personality traits Neuroticism (N) , Extraversion (E), Openness to Experience (O), Agreeableness (A) and Conscientiousness (C), participants responded to the 10 statements from the Big Five Inventory-10 (BFI-10) by Rammstedt et al. (2013), on a 5-point Likert scale, ranging from 1 ("Disagree strongly") to 5 ("Agree strongly") (e.g., "I see myself as someone who is generally trusting."). The Pearson correlation coefficient of the five subscales were as follows: $r_{(E)} = 0.585$, $r_{(N)} = 0.547$, $r_{(O)} = 0.352$, $r_{(C)} = 0.364$ and $r_{(A)} = 0.152$. Participants which indicated that they have used one or more psychedelic substances also filled out the 8-item long Ego dissolution questionnaire (EDI) by Nour et al. (2017) (α=.89; e.g., "I felt at one with the universe."). As recommended in the instructions of the EDI by Nour et al. (2017), items were rated using a visual analogue scale (VAS) ranging from 0 to 100, anchored by the statements: "No, not more than usual" at the lower end and "Yes, I

experienced this completely/entirely" at the upper end. Participants with prior psychedelic substance use also responded to two questions regarding the surrounding of their substance use (setting), specifically the level of access to nature and nature's influence on the quality of the experience. Similar to the study done by Kettner et al. (2019), items were rated on a VAS ranging from 0 to 100 with "low" at the lower end and "high" on the upper end. To improve the quality of the collected data, an attention check with the statement "Please tick strongly agree for this item as this helps us identify automatic "bot" responders" was added. Cases which failed to select the answer "strongly agree", were excluded from the statistical analysis.

The ASSIST, NR-6, and BFI-10 were available in both English and German. The RPEBS and EDI, originally available only in English, were translated into German for this study. Figure 1 shows the procedure of the online survey, including all administered questionnaires in the same sequence as they appeared in the survey. Questionnaires grouped within a single box were presented in a randomized order.

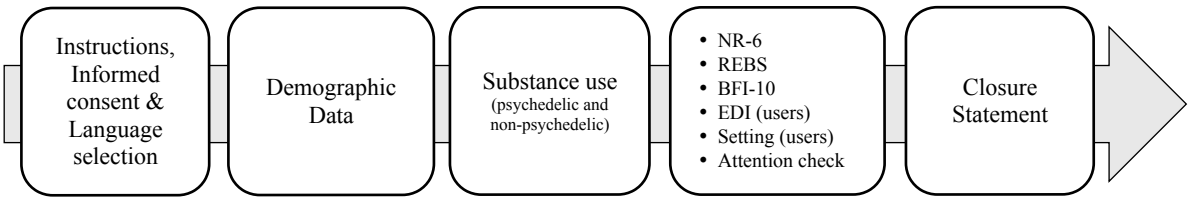

Figure 1: Survey procedure.

2.4 Statistical Analysis

The data obtained from the survey was analyzed by using the statistical tool SPSS (IBM Corp., 2021). The analytical approach included multiple linear regression analysis (MLR) for the main hypotheses while controlling for personality traits, substance use, age and gender as covariates. The mediation (ego dissolution) and moderation (setting) effects were analyzed with the PROCESS macro model number 5 by Hayes (2022).

2.5 Assumption Checks for Statistical Tests

The data on substance use, including the use of psychedelic substances, did not follow a normal distribution, showing a left-skewed pattern likely due to the type of scale used. To address this skewness, a log transformation was applied to normalize the distribution, therefore it is important to exercise caution when interpreting the outcomes, as the transformation may impact the scale and interpretability of the results.

Additionally, the analysis of the NR-6 scale revealed some degree of heteroscedasticity, as indicated by a funnel-shaped pattern in the scatterplot of predicted values against the residuals. To mitigate this issue, bootstrapping was employed with 1,000 bootstrap samples, providing more robust estimates and ensuring that the results accounted for any variance heterogeneity. All other assumptions for the applied statistical tests met the criteria.

2.6 Sample Size Calculation

An a priori power analysis was conducted using G*Power 3.1 (Faul et al., 2009) to determine the required sample size for a hierarchical multiple regression analysis. The analysis was based on detecting a medium effect size of $f^2 = 0.15$, which was found in the study by Lyons and Carhart-Harris (2018), with 5 tested predictors and 22 total predictors in the model, a significance level of $\alpha = 0.05$, and a desired power of 0.95. The results indicated that a total sample size of 139 participants would be sufficient to achieve the desired statistical power.

2.7 Use of Artificial Intelligence

ChatGPT (Version 4.0; OpenAI, 2024) was used for proofreading, translation, and grammatical refinement, providing additional support in enhancing the clarity and precision of the thesis.

3 Results

3.1 Descriptive Statistics

The study initially comprised 205 participants, with two cases excluded due to failing the attention check, leaving 203 valid cases for analysis. The age of participants ranged from 18 to 71 years, with a mean age of 30 years. The sample was evenly distributed between users (N = 105, 51.7%) and non-users (N = 98, 48.3%) of psychedelic substances.

In terms of gender, more than half of the participants were female (62.6%, N = 127), followed by male participants (34.0%, N = 69), and a smaller proportion identified as other/diverse (3.4%, N = 7). The gender distribution across the consumer and non-consumer groups was unevenly distributed with 60.6% of females in the non-user group and 39.4% in the user group compared to males with 24.6% in the non-user and 75.4% in the users group. Additionally, 42.9% of participants identifying as diverse belonged to the non-user group, while 57.1% were users. Regarding nationality, the sample was predominantly from Austria (75.4%, N = 153), followed by smaller groups from the United Kingdom (6.9%, N = 14), Germany (3.9%, N = 8), and other countries such as the USA, Australia, Italy and more accounting for 13.8% (N = 28) (see Table B1 in the appendix).

3.2 Main Hypothesis: Nature Relatedness

The hierarchical multiple linear regression analysis conducted to investigate the predictors of nature relatedness (NR-6) is documented in full length in Appendix B (Table B2). Step 5 provided the most comprehensive model and is presented in Table 1. The model explained 34% of the variance in nature relatedness (R^2 = .34). DMT use emerged as a positive predictor of NR (β = 0.18, p = 0.023, 95% CI [0.04, 0.56]). Likewise, Psilocybin use also contributed significantly to predicting higher NR scores (β = 0.29, p = 0.012, 95% CI [0.08, 0.64]). Openness to experience was a significant positive predictor on NR scores (β =

0.20, p = 0.003, 95% CI [0.07, 0.31]). Age also emerged as a robust positive predictor on NR scores (β = 0.26, p < 0.001, 95% CI [0.01, 0.04]).

Table 1. Hierarchical Multiple Linear Regression for Nature Relatedness

Variable		B	95% CI		SE	β	R^2	ΔR^2
			LL	UL				
Step 5							.34	.00
	Constant	2.17***	1.10	3.24	0.54			
Psychedelic substances								
	DMT	0.30*	0.04	0.56	0.13	.18*		
	Psilocybin	0.36*	0.08	0.64	0.14	.29*		
	LSD	0.20	-0.10	0.50	0.15	.15		
	Mescaline	-0.25	-0.70	0.20	0.23	-.09		
	Other psychedelics	-0.31	-0.65	0.04	0.18	-.15		
Other substances								
	Caffeine	-0.07	-0.50	0.36	0.22	-.02		
	Alcohol	-0.04	-0.38	0.31	0.17	-.02		
	Tobacco	-0.14	-0.40	0.11	0.13	-.11		
	Cannabinoids	0.21	-0.10	0.52	0.16	.14		
	Empathogens	-0.15	-0.54	0.24	0.20	-.09		
	Stimulants	0.02	-0.29	0.32	0.15	.01		
	Sedatives	0.14	-0.13	0.41	0.14	.08		
	Opioids	-0.11	-0.47	0.24	0.18	-.05		
	Dissociatives	-0.31	-0.68	0.06	0.19	-.17		
Personality traits								
	Extraversion	0.02	-0.09	0.13	0.06	.02		
	Neuroticism	-0.07	-0.19	0.04	0.06	-.09		
	Openness to Exp.	0.19**	0.07	0.31	0.06	0.20**		
	Conscientiousness	0.01	-0.12	0.14	0.06	.01		
	Agreeableness	0.07	-0.07	0.21	0.07	.07		
	Age	0.02***	0.01	0.04	0.01	.26***		
Gender								
	Male [a]	-0.08	-0.33	0.17	0.13	-.05		
	Others/diverse [a]	-0.09	-0.68	0.50	0.30	-.02		

Note. B = unstandardized coefficient; CI = confidence interval; LL = lower limit; UL = upper limit; SE = standard error; β = standardized coefficient; R^2 = coefficient of determination; ΔR^2 = change in coefficient of determination;
*p < .05. **p < .01. ***p < .001
[a] female as reference category

3.3 Main Hypothesis: Pro-Environmental Behavior

The hierarchical multiple linear regression analysis conducted to investigate the predictors of pro-environmental behavior (PEB) is documented in full length in Appendix B (Table B3). Step 6 provided the most comprehensive model and is presented in Table 2. The model explained 31% of the variance in pro-environmental behavior ($R^2 = .31$). The category of other psychedelics emerged as a positive predictor ($\beta = 0.20$, $p = 0.029$, 95% CI [0.02, 0.44]), suggesting that use of other psychedelics was linked to higher PEB scores. Conscientiousness was also a significant positive predictor ($\beta = 0.15$, $p = 0.026$, 95% CI [0.01, 0.16]), indicating that individuals scoring higher on conscientiousness tended to report higher PEB. Nature relatedness was the strongest predictor of PEB ($\beta = 0.47$, $p < 0.001$, 95% CI [0.18, 0.36]).

Psilocybin use showed to be a significant negative predictor of pro-environmental behavior ($\beta = -0.38$, $p = 0.002$, 95% CI [-0.44, -0.10]), indicating that more frequent psilocybin use was associated with lower PEB scores. However, in Step 5, where NR was not included in the model, psilocybin did not emerge as a significant predictor of PEB.

This finding suggests that NR may play a mediating role in the relationship between psilocybin use and PEB. The mediation analysis, conducted using PROCESS model number 4 (Hayes, 2022) and illustrated in Figure 2, revealed a significant negative direct effect of psilocybin on PEB ($B = -0.22$, $p = 0.006$, 95% CI [-0.37, -0.06]) but a positive indirect effect of psilocybin on PEB mediated by NR ($B = 0.11$, 95% CI [0.04, 0.18]). The total effect was not significant ($B = -0.11$, $p = 0.17$, 95% CI [-0.27, 0.05]). The path from psilocybin to NR was positively significant ($B = 0.42$, $p = 0.001$, 95% CI [0.17, 0.67]), as was the path from NR to PEB ($B = 0.25$, $p < 0.001$, 95% CI [0.16, 0.33]).

Table 2. Hierarchical Multiple Linear Regression for Pro-Environmental Behavior

Variable		B	95% CI		SE	β	R^2	ΔR^2
			LL	UL				
Step 6							.31	.14***
	Constant	2.22***	1.56	2.88	0.34			
Psychedelic substances								
	DMT	-0.13	-0.29	0.03	0.08	-.14		
	Psilocybin	-0.27**	-0.44	-0.10	0.09	-.38**		
	LSD	0.04	-0.14	0.22	0.09	.05		
	Mescaline	0.14	-0.13	0.41	0.14	.09		
	Other psychedelics	0.23*	0.02	0.44	0.10	.20*		
Other substances								
	Caffeine	0.13	-0.12	0.38	0.13	.07		
	Alcohol	-0.03	-0.23	0.18	0.10	-.02		
	Tobacco	-0.08	-0.23	0.08	0.08	-.10		
	Cannabinoids	0.10	-0.08	0.29	0.09	.12		
	Empathogens	0.11	-0.12	0.34	0.12	.11		
	Stimulants	-0.02	-0.20	0.16	0.09	-.03		
	Sedatives	-0.04	-0.20	0.12	0.08	-.04		
	Opioids	-0.02	-0.23	0.19	0.11	-.02		
	Dissociatives	-0.14	-0.36	0.08	0.11	-.14		
Personality traits								
	Extraversion	0.00	-0.06	0.07	0.03	.01		
	Neuroticism	-0.05	-0.12	0.01	0.04	-.11		
	Openness to Exp.	0.04	-0.04	0.11	0.04	.07		
	Conscientiousness	0.09*	0.01	0.16	0.04	.15*		
	Agreeableness	0.02	-0.06	0.11	0.04	.04		
	Age	0.00	-0.01	0.00	0.00	-.09		
Gender								
	Male [a]	-0.01	-0.15	0.14	0.07	-.01		
	Others/diverse [a]	0.15	-0.19	0.50	0.18	.06		
	Nature relatedness	0.27***	0.18	0.36	0.04	.47***		

Note. B = unstandardized coefficient; CI = confidence interval; LL = lower limit; UL = upper limit; SE = standard error; β = standardized coefficient; R^2 = coefficient of determination; ΔR^2 = change in coefficient of determination;
*p < .05. **p < .01. ***p < .001
[a] female as reference category

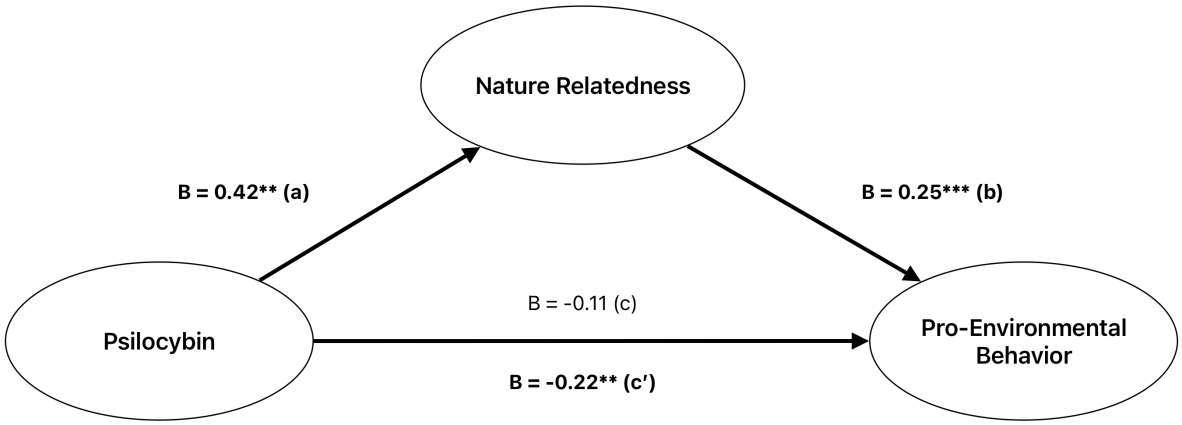

Figure 2. Mediation analysis. B represents unstandardized regression coefficients. (c) indicates the total effect. (c') indicates the direct effect when controlling for the indirect effect (a × b). **p < .01, ***p < .001

3.4 Moderation & Mediation Analysis

Since no data on ego dissolution was collected from the psychedelic-naïve group, the mediation/moderation analysis shown in Figure 3 was conducted exclusively within the group of psychedelic users. The analysis used PROCESS model number 5 (Hayes, 2022), with the frequency of psychedelic use as the independent variable, NR as the dependent variable, EDI as the mediator, and setting as the moderator.

The direct effect of psychedelic use on NR was significantly negative (B = -1.60, p = 0.03, 95% CI [-3.05, -0.16]). The conditional direct effects revealed that the effect of psychedelic use on NR was significant at the low level of the moderator (B = -0.71, p = 0.026, 95% CI [-1.33, -0.09]), but not at the moderate (B = -0.14, p = 0.509, 95% CI [-0.57, 0.29]) or high level (B = 0.13, p = 0.651, 95% CI [-0.44, 0.71]).

A significant positive indirect effect was observed (B = 0.02, 95% CI [0.01, 0.41]), suggesting that ego dissolution partially mediates the relationship between psychedelic use and nature relatedness. The path from psychedelic use to ego dissolution was significant (B = 26.61, p < 0.001, 95% CI [14.11, 39.11]), as was the path from ego dissolution to nature relatedness (B = 0.01, p = 0.019, 95% CI [0.01, 0.01]).

The moderation effect of setting on the mediation pathway was not statistically significant (B = 0.02, p = 0.057, 95% CI [0.00, 0.04]).

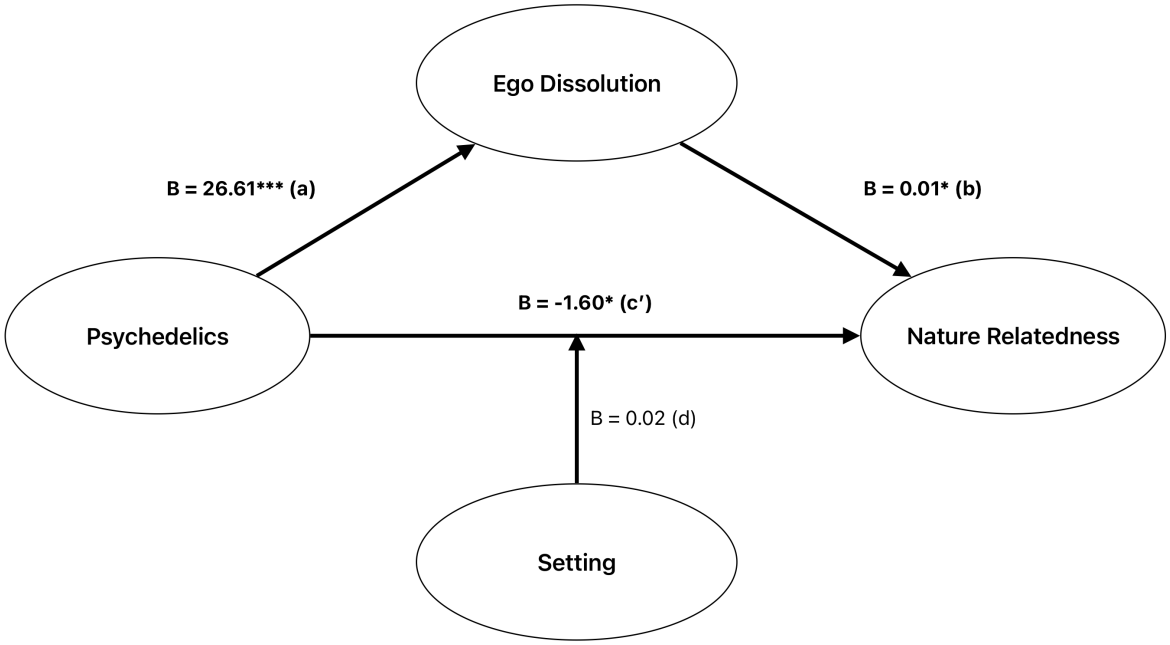

Figure 3. Mediation/moderation analysis. B represents unstandardized regression coefficients. (c') indicates the direct effect when controlling for the indirect effect (a × b). (d) indicates the mediation effect. *p < .05, ***p < .001.

3.5 Exploratory Analysis

3.5.1 Time Since Last Use and NR-6

An exploratory analysis using MLR was conducted to investigate the impact of the time since the last use of one of the psychedelic substances on nature relatedness measures. In the model, the time of last consumption did not significantly predict nature relatedness for any substance, including DMT (β = -0.12, p = 0.881, 95% CI [-7.85, 7.62]), psilocybin (β = -0.21, p = 0.769, 95% CI [-7.14, 6.73]), mescaline (β = 0.02, p = 0.991, 95% CI [-15.19, 15.23]), LSD (β = -0.26, p = 0.728, 95% CI [-7.58, 7.06]), and the category of other psychedelics (β = -0.30, p = 0.649, 95% CI [-6.60, 5.99]).

3.5.2 Intention of Non-Users and NR-6

An exploratory analysis was conducted to examine whether the intention to use psychedelic substances among non-users had any influence on nature relatedness scores, controlling for various other factors such as personality traits, substance use, age and gender. The results of the MLR analysis revealed that the intention to use psychedelic substances did not significantly predict nature relatedness scores ($\beta = -0.05$, $p = 0.764$, 95% CI [-0.78, 0.58]).

3.5.3 Substance Use, Personality Traits and Psychedelic Use

An exploratory binary logistic regression analysis was conducted to examine whether gender, age, personality traits, and the use of other substances predict participants' categorization as psychedelic users or non-users. Among the substances analyzed, only cannabinoid use (OR = 9.68, $p = 0.002$, 95% CI [2.37, 39.56]) and empathogen use (OR = 9.84, $p = 0.002$, 95% CI [2.40, 40.40]) emerged as significant positive predictors of belonging to the psychedelic user group. Age was also found to be a significant predictor (OR = 1.09, $p = 0.003$, 95% CI [1.03, 1.15]), with older participants being more likely to belong to the user group. Additionally, the analysis revealed that being male (with female as the reference category) significantly increased the likelihood of belonging to the psychedelic user group (OR = 4.88, $p = 0.003$, 95% CI [1.73, 13.78]), suggesting that male participants were more likely to use psychedelic substances.

3.5.4 Setting and Perceived Influence on Experience

The setting (access to nature) during the use of a psychedelic substance significantly predicted the perceived influence on the quality of the experience of the substance users ($\beta = 0.73$, $p < 0.001$, 95% CI [0.64, 0.92]).

3.5.5 Predictors of Ego Dissolution

Further exploratory analysis using MLR found that nature's perceived influence on the quality of the experience was a significant positive predictor of higher EDI scores (β = 0.25, p = 0.01, 95% CI [0.06, 0.40]). Frequency of psychedelic substance use (β = 0.28, p = 0.016, 95% CI [3.65, 34.56]), openness to experience (β = 0.20, p = 0.027, 95% CI [0.71, 11.43]) and conscientiousness (β = 0.20, p = 0.031, 95% CI [0.55, 11.45]) also have shown to be significant positive predictors of EDI.

Use of opioids (β = -0.83, p = 0.037, 95% CI [-102.55, -3.14]) and neuroticism (β = -0.25, p = 0.009, 95% CI [-11.79, -1.69]) were found to be significant negative predictors of EDI.

4 Discussion

4.1 Nature Relatedness

The findings of this study on nature relatedness align with existing literature (Lyons and Carhart-Harris, 2018) in showing that DMT and Psilocybin significantly predicts nature relatedness. Interestingly, not all psychedelics showed the same effect, as the substances LSD and mescaline did not significantly predict nature relatedness, highlighting the variability in the impact of different psychedelics. This finding is consistent with the literature (Forstmann & Sagioglou, 2017; Forstmann et al., 2023), who similarly noted diverse outcomes depending on the substance.

In addition to substance use, openness to experience emerged as an important predictor, suggesting that individuals who are more open to new experiences are more likely to feel connected to nature. This supports the work of Nisbet et al. (2009), which emphasizes the role of personality in shaping one's relationship with the natural world.

Age also played a significant role, with older individuals reporting stronger connections to nature, possibly due to life experiences that deepen this relationship (Knepple Carney & Patrick, 2019).

Demographic factors like gender, as well as the use of substances such as caffeine, alcohol, and tobacco, did not significantly affect nature relatedness. These results are in line with prior studies (Forstmann & Sagioglou, 2017), which found no significant associations between these variables and nature relatedness.

4.2 Pro-Environmental Behavior

The results on PEB highlight a complex and multifaceted relationship between the use of psychedelic substances and pro-environmental behavior. The mediation analysis revealed a significant positive indirect effect of psilocybin on PEB, mediated by NR. These findings align with those of Forstmann and Sagioglou (2017), who demonstrated that lifetime experience with classic psychedelics predicted PEB through an increase in NR. In contrast to the findings of Forstmann and Sagioglou (2017), the direct effect of psilocybin on PEB in the present study was significantly negative. A possible explanation for this could be a suppression effect, in which NR absorbs the positive variance of psilocybin's impact on PEB, leaving a negative direct effect visible. Complex interactions between psilocybin and unmeasured variables, such as social context, motivations for use, etc. which counteract its pro-environmental effects could be another possible explanation. However, exploring these interactions and potential confounders lies beyond the scope of this study. Future research is needed to shed light on these complexities and better understand this unexpected finding.

Among the personality traits, conscientiousness emerged as an important predictor of PEB, aligning with previous findings that more conscientious individuals tend to engage in responsible and goal-directed behavior, including pro-environmental actions (Forstmann & Sagioglou, 2017).

As expected, the strongest predictor of PEB was nature relatedness, underscoring the importance of feeling connected to nature as a driver of pro-environmental behavior. This result is consistent with prior research suggesting that a closer connection to nature increases ecological engagement (Nisbet et al., 2009).

4.3 Moderation & Mediation

A theoretical explanation for the significant negative direct effect of psychedelic use on nature relatedness in the mediation/moderation model could be the exclusion of the mediator, ego dissolution, in the calculation of the direct effect. The data indicates that the frequency of psychedelic use alone may not necessarily be associated with higher nature relatedness without the role of ego dissolution. Instead, the mediation analysis underscores that ego dissolution, as a measure of the experience's quality and intensity, plays a key role in fostering a stronger connection to nature. This may suggest that even a single, intense experience could potentially contribute to an increase in nature relatedness. The significant indirect effect observed in the mediation model supports this explanation and aligns with findings from Paterniti et al. (2022), suggesting that it is not the frequency of use but the depth of the experience that drives this relationship.

The inability to replicate the moderating effect of setting on the relationship between psychedelic use and nature relatedness, as reported by Kettner et al. (2019), could come from the lack of control over the specific environments in which participants used the psychedelic substances. Participants in this study were asked to rate the naturalness of their setting as an average across all their experiences, rather than focusing on a single event. This generalization may have diluted the potential impact of any particular natural setting, potentially masking the moderating role of the environment. However, it is worth noting that the moderation effect approached significance with a p-value of 0.057, suggesting that setting might still play a role under certain conditions.

4.4 Exploratory Analysis

The time since the last use of a psychedelic substance had no significant influence on nature relatedness scores. This finding suggests that the changes in nature relatedness may not be fleeting or limited to the immediate time after the use of a psychedelic substance. Instead, it could indicate that the effects of these intense experiences are more stable and long-lasting, as also suggested by previous research (Kettner et al., 2019; Lyons & Carhart-Harris, 2018). By demonstrating that time since last use is not a significant factor, this study adds to the evidence that the shifts in nature relatedness brought about by psychedelic experiences may persist well beyond the short-term period following use.

Intention to use psychedelics in non-users had no significant effect on nature relatedness. This finding supports the notion that the experience itself, rather than related personality traits which might be linked to an intention or openness towards using psychedelic substances, may be the driving factor for differences in nature relatedness.

People with experience using cannabinoids or empathogens were more likely to have also used psychedelic substances, a finding consistent with results from previous studies (Forstmann & Sagioglou, 2017; Sagioglou & Forstmann, 2022). For each one-year increase in age, the odds of belonging to the psychedelic users group increases by 9%.

Male participants were 4.88 times more likely than females to belong to the group of psychedelic consumers. Gender differences in substance use are well-documented in the literature, with variations in risk-taking behaviors, access to substances, and underlying motivations cited as the most common explanations (Viña, 2024; Davis et al., 2022).

Interestingly, the more access to nature people had during the use of a psychedelic substance, the greater natures influence on the quality of the experience was rated, highlighting the importance of the setting.

The finding that nature's perceived influence on the quality of the experience emerged as a significant positive predictor of higher EDI scores highlights the importance of cultivating an environment that enhances desired outcomes, such as greater ego dissolution and its associated benefits. In line with the findings of Lynn et al. (2023), higher scores on openness to experience and conscientiousness were positively associated with elevated EDI scores, while neuroticism exhibited a negative association. These results highlight the important role of personality traits and their influence on the likelihood of a person to experience altered states of consciousness (Paterniti et al., 2022).

4.5 Scientific Contribution and Limitations of the Project

Limitations of the study include the inability to control the type, purity, and dosage of the substances consumed, as well as the setting in which they were taken. Additionally, the reliance on self-reported measures introduces potential bias, as responses are subjective and may not always accurately reflect participants' use or experiences.

Another significant limitation is the lack of a before-after comparison, which would have provided more concrete evidence of changes in nature relatedness and pro-environmental behavior following psychedelic use. The original study design aimed at collecting before-and-after data in collaboration with retreat centers working with psychedelic substances. However, due to a low response rate from the retreat guests, the study was restructured and conducted as a cross-sectional online survey. The comparative approach would allow for stronger assumptions about the effects of these substances on participants.

The implementation of an unpaid online survey also presents challenges. To ensure participation, the survey needed to remain relatively short, which limited the depth of the data collected. This brevity also required the use of shorter, less reliable versions of well-established questionnaires, potentially reducing the accuracy of the measures.

Despite these limitations, the strength of the study lies in its diverse sample, which includes participants from various nationalities and a balanced gender distribution, providing a broader perspective on the relationship between psychedelics, nature relatedness and pro-environmental behavior.

4.6 Societal Relevance

As more and more countries are changing laws to allow for the legal use of psychedelic substances as therapeutic tools (European Monitoring Centre for Drugs and Drug Addiction [EMCDDA], 2024) understanding their impact on the individual and societal level becomes even more important. While the use of these substances as a direct aid for mental health problems in the form of substance-assisted psychotherapy is a highly researched topic, the impact of psychedelics on society extends beyond their use as medicine. Given the potential of changing individuals' nature relatedness, psychedelics could also indirectly contribute towards better mental and physical health by increasing individuals visits of natural spaces (Gandy et al., 2020; Kamitsis & Francis, 2013).

On another front, humanity is threatened by climate change, understanding what drives people to care for the environment is key. As shown in this study and others, psychedelics could make people feel more connected to nature and maybe also more likely to act in environmentally friendly ways. This opens the exciting possibility that psychedelics couldn't just be beneficial for individuals' mental health but could also motivate actions that help planetary health (Paterniti et al., 2022).

Furthermore, if ego dissolution holds up as a key factor influencing nature relatedness, methods and techniques known to induce ego dissolution, such as meditation and mindfulness practices (Hanley et al., 2020), could prove highly valuable. Other approaches, such as breathwork and sensory deprivation, also show promise in inducing ego dissolution but remain largely unexplored in scientific research, relying primarily on anecdotal evidence.

Albert Hofmann, known for synthesizing LSD and being the first to isolate psilocybin, believed that one of the most important properties of psychedelic substances is their ability to rekindle our bond with nature, a connection that has been fading. He found great fulfillment in stories of people who grew up in cities, disconnected to nature and after trying LSD, felt drawn back to the wilderness (Hofmann et al., 2009; Gandy et al., 2020).

5 Conclusion

In summary, psychedelic use, especially the use of psilocybin and DMT as well as the personality trait of openness have shown to predict NR, while other demographic factors and substance use appear to have a more limited impact. The findings on PEB revealed a somewhat counterintuitive result with psilocybin use associated with lower PEB scores, but closer analysis showed a positive influence on PEB through the mediating pathway of NR. Additionally, conscientiousness and nature relatedness emerged as key predictors of PEB, reinforcing the importance of personal traits and connection to nature in driving ecological behavior. The mediation-moderation analysis revealed that ego dissolution plays a significant role in the relationship between psychedelic use and nature relatedness, acting as a positive mediator. The moderating effect of setting on the relationship between psychedelic substance use and NR only approached significance.

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7 Appendix

7.1 Appendix A

7.1.1 Table A1. Substance Use Questionnaire

Have you ever consumed one or more of the following psychedelic substances? If so, how often? (Items were rated from: Never, Once or Twice, 3–4 times, 5–6 times, more than 6 times)

- DMT (e.g., Ayahuasca, Changa, etc.)
- Psilocybin (e.g., Magic Mushrooms, Truffles, etc.)
- Mescaline (e.g., Peyote Cacti, San Pedro Cacti, etc.)
- LSD
- Other Psychedelics (e.g., 5-MeO-DMT, Ibogaine, NBOMe's, 2C-B, 2C-E, etc.)

What was the last time you consumed the following substance(s)?
(Items were rated from: 1–2 weeks ago, 3–4 weeks ago, More than 1 month ago, More than 1 year ago)

- DMT (e.g., Ayahuasca, Changa, etc.)
- Psilocybin (e.g., Magic Mushrooms, Truffles, etc.)
- Mescaline (e.g., Peyote Cacti, San Pedro Cacti, etc.)
- LSD
- Other Psychedelics (e.g., 5-MeO-DMT, Ibogaine, NBOMe's, 2C-B, 2C-E, etc.)

Do you have the intention or are you interested in consuming one or more psychedelic substance(s) in the future? (Psychedelic substances include DMT (Ayahuasca, Changa), Psilocybin (Magic Mushrooms, Truffles), Mescaline (Peyote or San Pedro Cactus), LSD, etc.)

- Yes
- No
- I’m not sure

Have you ever consumed one or more of the following substances? If so, how often?

(Items were rated from: Never, Once or Twice, Occasionally, Often, Regularly)

- Caffeine (e.g., Coffee, Energy Drinks, Black Tea, Green Tea, etc.)
- Alcoholic Beverages (e.g., Beer, Wine, Hard Liquor, etc.)
- Tobacco Products (e.g., Cigarettes, Chewing Tobacco, Cigars, etc.)
- Cannabinoids (e.g., Marijuana, Grass, Weed, Hash, Synthetic Cannabinoids, etc.)
- Empathogens/Entactogens (e.g., MDMA, MDA, MDE, Mephedrone, PMA, PMMA, etc.)
- Stimulants (e.g., Ritalin, Adderall, Cocaine, Crack, Amphetamine, Methamphetamine, Speed, Crystal Meth, etc.)
- Sedatives or Sleeping Pills (e.g., Valium, Xanax, Rohypnol, GHB, Downers etc.)
- Prescription Pain Medication or Heroin (e.g., Fentanyl, Oxycodone, Hydrocodone, Vicodin, Methadone, Codeine, Morphine, etc.)
- Dissociatives (e.g., Ketamine, DXM, PCP, Salvia, Nitrous Oxide, etc.)

7.1.2 Table A2. Recurring Pro-Environmental Behavior Scale

16 items selected from the original 21-items scale by Brick et al. (2017)

Items were rated from 1 (never) - 2 (rarely) - 3 (sometimes) - 4 (often) - 5 (always)

1. How often do you eat dairy products such as milk, cheese, eggs, or yogurt? (r)
2. How often do you walk, bicycle, carpool, or take public transportation instead of driving a vehicle by yourself?
3. How often do you discuss environmental topics, either in person or with online posts (Facebook, Twitter, etc.)?
4. How often do you engage in political action or activism related to protecting the environment?
5. How often do you act to conserve water, when showering, cleaning clothes, dishes, watering plants, or other uses?
6. How often do you carry a reusable water bottle?
7. How often do you eat meat? (r)
8. When you are in PUBLIC, how often do you sort trash into the recycling?
9. How often do you educate yourself about the environment?
10. How often do you eat organic food?
11. How often do you eat local food (produced within 160 km)?
12. How often do you go on personal (non-business) air travel? (r)
13. When you are in PRIVATE, how often do you sort trash into the recycling?
14. How often do you turn your personal electronics off or in low-power mode when not in use?
15. When you visit the grocery store, how often do you use reusable bags?
16. When you buy clothing, how often is it from environmentally friendly brands?

Items 1, 7, 12 are reversed scored.

7.2 Appendix B

7.2.1 Table B1. Participants Nationality

Country	N	%
No answer	9	4,4%
Australia	2	1,0%
Austria	153	75,4%
Canada	1	0,5%
Colombia	1	0,5%
Denmark	1	0,5%
Germany	8	3,9%
Italia	2	1,0%
Norway	2	1,0%
Portugal	1	0,5%
Romania	1	0,5%
Slovakia	1	0,5%
Spain	1	0,5%
Sweden	1	0,5%
United Arab Emirates	1	0,5%
Turkey	1	0,5%
United Kingdom	14	6,9%
United States	3	1,5%

7.2.2 Table B2. Hierarchical Regression for Nature Relatedness

Variable		B	95% CI		SE	β	R^2	ΔR^2
			LL	UL				
Step 1							.17	.17***
	Constant	3.39***	3.25	3.53	0.07			
Psychedelic substances								
	DMT	0.36*	0.09	0.62	0.14	.21*		
	Psilocybin	0.43**	0.17	0.69	0.13	.34**		
	LSD	0.06	-0.22	0.33	0.14	.04		
	Mescaline	-0.06	-0.51	0.38	0.23	-.02		
	Other psychedelics	-0.42*	-0.77	-0.08	0.18	-.21*		
Step 2							.21	.04
	Constant	3.58***	2.95	4.21	0.32			
Psychedelic substances								
	DMT	0.37**	0.10	0.64	0.14	.22**		
	Psilocybin	0.53***	0.25	0.81	0.14	.42***		
	LSD	0.18	-0.13	0.49	0.16	.14		
	Mescaline	-0.24	-0.70	0.23	0.23	-.09		
	Other psychedelics	-0.32	-0.68	0.04	0.18	-.16		
Other substances								
	Caffeine	-0.03	-0.48	0.42	0.23	-.01		
	Alcohol	-0.13	-0.49	0.23	0.18	-.06		
	Tobacco	-0.02	-0.28	0.24	0.13	-.01		
	Cannabinoids	0.08	-0.24	0.40	0.16	.05		
	Empathogens	-0.04	-0.44	0.36	0.20	-.03		
	Stimulants	-0.05	-0.36	0.27	0.16	-.03		
	Sedatives	0.13	-0.15	0.41	0.14	.07		
	Opioids	-0.13	-0.50	0.25	0.19	-.05		
	Dissociatives	-0.42*	-0.79	-0.04	0.19	-.23*		
Step 3							.29	.08**
	Constant	2.44***	1.40	3.49	0.53			
Psychedelic substances								
	DMT	0.30*	0.03	0.57	0.14	.18*		
	Psilocybin	0.45**	0.17	0.73	0.14	.36**		
	LSD	0.16	-0.14	0.47	0.16	.12		
	Mescaline	-0.13	-0.59	0.32	0.23	-.05		
	Other psychedelics	-0.32	-0.68	0.03	0.18	-.16		
Other substances								

	Caffeine	0.00	-0.43	0.44	0.22	.00	
	Alcohol	-0.07	-0.42	0.28	0.18	-.03	
	Tobacco	-0.05	-0.30	0.21	0.13	-.04	
	Cannabinoids	0.10	-0.21	0.41	0.16	.07	
	Empathogens	0.01	-0.38	0.40	0.20	.01	
	Stimulants	-0.02	-0.32	0.29	0.16	-.01	
	Sedatives	0.16	-0.12	0.43	0.14	.09	
	Opioids	-0.17	-0.53	0.19	0.18	-.07	
	Dissociatives	-0.47*	-0.83	-0.10	0.19	-.26*	
Personality traits							
	Extraversion	0.04	-0.08	0.15	0.06	.05	
	Neuroticism	-0.07	-0.19	0.04	0.06	-.09	
	Openness to Exp.	0.12**	0.08	0.32	0.06	.22**	
	Conscientiousness	0.05	-0.08	0.17	0.06	.05	
	Agreeableness	0.08	-0.06	0.22	0.07	.08	
Step 4							.34 .05***
	Constant	2.08***	1.04	3.11	0.52		
Psychedelic substances							
	DMT	0.30*	0.05	0.56	0.13	.18*	
	Psilocybin	0.35*	0.07	0.62	0.14	.28*	
	LSD	0.18	-0.12	0.48	0.15	.14	
	Mescaline	-0.26	-0.70	0.19	0.23	-.09	
	Other psychedelics	-0.31	-0.65	0.04	0.17	-.15	
Other substances							
	Caffeine	-0.06	-0.48	0.37	0.22	-.02	
	Alcohol	-0.05	-0.38	0.29	0.17	-.02	
	Tobacco	-0.14	-0.39	0.11	0.13	-.11	
	Cannabinoids	0.21	-0.10	0.51	0.16	.14	
	Empathogens	-0.13	-0.51	0.25	0.19	-.08	
	Stimulants	0.02	-0.27	0.32	0.15	.02	
	Sedatives	0.15	-0.12	0.42	0.14	.08	
	Opioids	-0.10	-0.45	0.25	0.18	-.04	
	Dissociatives	-0.33	-0.69	0.04	0.18	-.18	
Personality traits							
	Extraversion	0.02	-0.09	0.13	0.06	.03	
	Neuroticism	-0.06	-0.18	0.05	0.06	-.08	
	Openness to Exp.	0.18**	0.07	0.30	0.06	.20**	
	Conscientiousness	0.02	-0.11	0.14	0.06	.02	
	Agreeableness	0.07	-0.06	0.21	0.07	.07	
	Age	0.02***	0.01	0.04	0.01	.26***	
Step 5							.34 .00

	Constant	2.17***	1.10	3.24	0.54	
Psychedelic substances						
	DMT	0.30*	0.04	0.56	0.13	.18*
	Psilocybin	0.36*	0.08	0.64	0.14	.29*
	LSD	0.20	-0.10	0.50	0.15	.15
	Mescaline	-0.25	-0.70	0.20	0.23	-.09
	Other psychedelics	-0.31	-0.65	0.04	0.18	-.15
Other substances						
	Caffeine	-0.07	-0.50	0.36	0.22	-.02
	Alcohol	-0.04	-0.38	0.31	0.17	-.02
	Tobacco	-0.14	-0.40	0.11	0.13	-.11
	Cannabinoids	0.21	-0.10	0.52	0.16	.14
	Empathogens	-0.15	-0.54	0.24	0.20	-.09
	Stimulants	0.02	-0.29	0.32	0.15	.01
	Sedatives	0.14	-0.13	0.41	0.14	.08
	Opioids	-0.11	-0.47	0.24	0.18	-.05
	Dissociatives	-0.31	-0.68	0.06	0.19	-.17
Personality traits						
	Extraversion	0.02	-0.09	0.13	0.06	.02
	Neuroticism	-0.07	-0.19	0.04	0.06	-.09
	Openness to Exp.	0.19**	0.07	0.31	0.06	0.20**
	Conscientiousness	0.01	-0.12	0.14	0.06	.01
	Agreeableness	0.07	-0.07	0.21	0.07	.07
	Age	0.02***	0.01	0.04	0.01	.26***
Gender						
	Male [a]	-0.08	-0.33	0.17	0.13	-.05
	Others/diverse [a]	-0.09	-0.68	0.50	0.30	-.02

Note. B = unstandardized coefficient; CI = confidence interval; LL = lower limit; UL = upper limit; SE = standard error; β = standardized coefficient; R^2 = coefficient of determination; ΔR^2 = change in coefficient of determination;
*p < .05. **p < .01. ***p < .001
[a] female as reference category

7.2.3 Table B3. Hierarchical Regression for Pro-Environmental Behavior

Variable		B	95% CI		SE	β	R^2	ΔR^2
			LL	UL				
Step 1							.02	.02
	Constant	3.49***	3.41	3.58	0.05			
Psychedelic substances								
	DMT	-0.02	-0.19	0.15	0.09	-.02		
	Psilocybin	-0.13	-0.29	0.03	0.08	-.18		
	LSD	0.05	-0.13	0.22	0.09	.06		
	Mescaline	0.14	-0.14	0.41	0.14	.08		
	Other psychedelics	0.06	-0.16	0.27	0.11	.05		
Step 2							.06	.04
	Constant	3.45***	3.05	3.85	0.20			
Psychedelic substances								
	DMT	-0.01	-0.18	0.16	0.09	-.01		
	Psilocybin	-0.10	-0.28	0.08	0.09	-.14		
	LSD	0.09	-0.10	0.28	0.10	.12		
	Mescaline	0.07	-0.22	0.36	0.15	.04		
	Other psychedelics	0.13	-0.10	0.36	0.12	.11		
Other substances								
	Caffeine	0.11	-0.18	0.39	0.14	.06		
	Alcohol	-0.07	-0.30	0.16	0.11	-.05		
	Tobacco	-0.08	-0.24	0.09	0.08	-.10		
	Cannabinoids	0.09	-0.11	0.29	0.10	.11		
	Empathogens	0.04	-0.21	0.29	0.13	.04		
	Stimulants	-0.04	-0.24	0.16	0.10	-.04		
	Sedatives	-0.04	-0.22	0.14	0.09	-.04		
	Opioids	-0.04	-0.27	0.20	0.12	-.03		
	Dissociatives	-0.20	-0.43	0.04	0.12	-.19		
Step 3							.16	.10***
	Constant	2.80***	2.15	3.46	0.33			
Psychedelic substances								
	DMT	-0.06	-0.22	0.11	0.08	-.06		
	Psilocybin	-0.16	-0.34	0.01	0.09	-.23		
	LSD	0.08	-0.11	0.27	0.10	.11		
	Mescaline	0.09	-0.19	0.38	0.14	.06		
	Other psychedelics	0.14	-0.08	0.36	0.11	.12		
Other substances								
	Caffeine	0.12	-0.16	0.39	0.14	.07		

	Alcohol	-0.04	-0.26	0.18	0.11	-.03	
	Tobacco	-0.10	-0.26	0.06	0.08	-.13	
	Cannabinoids	0.14	-0.06	0.33	0.10	.16	
	Empathogens	0.07	-0.17	0.32	0.12	.08	
	Stimulants	-0.01	-0.20	0.18	0.10	-.01	
	Sedatives	0.00	-0.17	0.17	0.09	.00	
	Opioids	-0.05	-0.27	0.18	0.11	-.03	
	Dissociatives	-0.24*	-0.47	-0.01	0.12	-.23*	
Personality traits							
	Extraversion	0.01	-0.06	0.08	0.04	.03	
	Neuroticism	-0.07	-0.14	0.00	0.04	-.15	
	Openness to Exp.	0.09*	0.02	0.17	0.04	.179*	
	Conscientiousness	0.09*	0.01	0.17	0.04	.161*	
	Agreeableness	0.04	-0.05	0.12	0.05	.06	
Step 4							.16 .00
	Constant	2.78***	2.11	3.45	0.34		
Psychedelic substances							
	DMT	-0.06	-0.22	0.11	0.09	-.06	
	Psilocybin	-0.17	-0.35	0.01	0.09	-.24	
	LSD	0.08	-0.11	0.28	0.10	.11	
	Mescaline	0.08	-0.21	0.37	0.15	.05	
	Other psychedelics	0.14	-0.08	0.36	0.11	.12	
Other substances							
	Caffeine	0.11	-0.16	0.39	0.14	.06	
	Alcohol	-0.04	-0.26	0.18	0.11	-.03	
	Tobacco	-0.10	-0.27	0.06	0.08	-.13	
	Cannabinoids	0.15	-0.05	0.34	0.10	.17	
	Empathogens	0.07	-0.18	0.31	0.13	.07	
	Stimulants	-0.01	-0.20	0.18	0.10	-.01	
	Sedatives	0.00	-0.18	0.17	0.09	.00	
	Opioids	-0.04	-0.27	0.19	0.12	-.03	
	Dissociatives	-0.23	-0.47	0.00	0.12	-.22	
Personality traits							
	Extraversion	0.01	-0.06	0.08	0.04	.02	
	Neuroticism	-0.07	-0.14	0.00	0.04	-.15	
	Openness to Exp.	0.09*	0.02	0.17	0.04	.18*	
	Conscientiousness	0.09*	0.01	0.17	0.04	.16*	
	Agreeableness	0.04	-0.05	0.12	0.05	.06	
	Age	0.00	-0.01	0.01	0.00	.03	
Step 5							.17 .00
	Constant	2.80***	2.10	3.49	0.35		

Psychedelic substances							
	DMT	-0.05	-0.22	0.12	0.09	-.05	
	Psilocybin	-0.17	-0.36	0.01	0.09	-.24	
	LSD	0.09	-0.11	0.29	0.10	.12	
	Mescaline	0.07	-0.22	0.36	0.15	.04	
	Other psychedelics	0.15	-0.08	0.37	0.11	.13	
Other substances							
	Caffeine	0.11	-0.17	0.39	0.14	.06	
	Alcohol	-0.04	-0.26	0.19	0.11	-.03	
	Tobacco	-0.11	-0.28	0.05	0.08	-.15	
	Cannabinoids	0.16	-0.04	0.36	0.10	.18	
	Empathogens	0.07	-0.19	0.32	0.13	.07	
	Stimulants	-0.02	-0.21	0.18	0.10	-.02	
	Sedatives	0.00	-0.18	0.17	0.09	.00	
	Opioids	-0.05	-0.28	0.18	0.12	-.04	
	Dissociatives	-0.22	-0.46	0.02	0.12	-.22	
Personality traits							
	Extraversion	0.01	-0.06	0.08	0.04	.02	
	Neuroticism	-0.07	-0.15	0.00	0.04	-.15	
	Openness to Exp.	0.09*	0.01	0.16	0.04	.17*	
	Conscientiousness	0.09*	0.01	0.17	0.04	.16*	
	Agreeableness	0.04	-0.05	0.13	0.05	.07	
	Age	0.00	-0.01	0.01	0.00	.04	
Gender							
	Male [a]	-0.03	-0.19	0.13	0.08	-.03	
	Others/diverse [a]	0.13	-0.25	0.51	0.19	.05	
Step 6						.31	.14***
	Constant	2.22***	1.56	2.88	0.34		
Psychedelic substances							
	DMT	-0.13	-0.29	0.03	0.08	-.14	
	Psilocybin	-0.27**	-0.44	-0.10	0.09	-.38**	
	LSD	0.04	-0.14	0.22	0.09	.05	
	Mescaline	0.14	-0.13	0.41	0.14	.09	
	Other psychedelics	0.23*	0.02	0.44	0.10	.20*	
Other substances							
	Caffeine	0.13	-0.12	0.38	0.13	.07	
	Alcohol	-0.03	-0.23	0.18	0.10	-.02	
	Tobacco	-0.08	-0.23	0.08	0.08	-.10	
	Cannabinoids	0.10	-0.08	0.29	0.09	.12	
	Empathogens	0.11	-0.12	0.34	0.12	.11	
	Stimulants	-0.02	-0.20	0.16	0.09	-.03	
	Sedatives	-0.04	-0.20	0.12	0.08	-.04	

	Opioids	-0.02	-0.23	0.19	0.11	-.02
	Dissociatives	-0.14	-0.36	0.08	0.11	-.14
Personality traits						
	Extraversion	0.00	-0.06	0.07	0.03	.01
	Neuroticism	-0.05	-0.12	0.01	0.04	-.11
	Openness to Exp.	0.04	-0.04	0.11	0.04	.07
	Conscientiousness	0.09*	0.01	0.16	0.04	.15*
	Agreeableness	0.02	-0.06	0.11	0.04	.04
	Age	0.00	-0.01	0.00	0.00	-.09
Gender						
	Male [a]	-0.01	-0.15	0.14	0.07	-.01
	Others/diverse [a]	0.15	-0.19	0.50	0.18	.06
	Nature relatedness	0.27***	0.18	0.36	0.04	.47***

Note. B = unstandardized coefficient; CI = confidence interval; LL = lower limit; UL = upper limit; SE = standard error; β = standardized coefficient; R^2 = coefficient of determination; ΔR^2 = change in coefficient of determination;
*p < .05. **p < .01. ***p < .001
[a] female as reference category