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Lifetime experience with (classic) psychedelics predicts pro-environmental behavior through an increase in nature relatedness

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Matthias Forstmann[1] and Christina Sagioglou[2]

Abstract

In a large-scale (N = 1487) general population online study, we investigated the relationship between past experience with classic psychedelic substances (e.g. LSD, psilocybin, mescaline), nature relatedness, and ecological behavior (e.g. saving water, recycling). Using structural equation modeling we found that experience with classic psychedelics uniquely predicted self-reported engagement in pro-environmental behaviors, and that this relationship was statistically explained by people's degree of self-identification with nature. Our model controlled for experiences with other classes of psychoactive substances (cannabis, dissociatives, empathogens, popular legal drugs) as well as common personality traits that usually predict drug consumption and/or nature relatedness (openness to experience, conscientiousness, conservatism). Although correlational in nature, results suggest that lifetime experience with psychedelics in particular may indeed contribute to people's pro-environmental behavior by changing their self-construal in terms of an incorporation of the natural world, regardless of core personality traits or general propensity to consume mind-altering substances. Thereby, the present research adds to the contemporary literature on the beneficial effects of psychedelic substance use on mental wellbeing, hinting at a novel area for future research investigating their potentially positive effects on a societal level. Limitations of the present research and future directions are discussed.

Keywords

Psychedelics, nature relatedness, pro-environmental behavior, ecology

Although clinical research conducted in the 1950s and 1960s hinted at the vast therapeutic potential of psychedelic (i.e. "mind-manifesting") substances, regulatory restrictions resulting from a combination of political pragmatism and sensationalized media coverage brought research on their effects on the human mind to an abrupt and unfortunate halt (Nutt et al., 2013). In 1971, most classic psychedelics (i.e. LSD, mescaline, psilocybin, etc.) were classified as Schedule 1 substances by the UN Convention on Psychotropic Substances, creating administrative hindrances and disproportionate costs for academic institutions that made human trials effectively impossible (Nutt et al., 2013). Despite the fact that experts consider psychedelics to be among the least harmful and least addictive recreationally used substances (Nutt et al., 2013), research was for the most part confined to neuroscientific investigations into their effects on rodents, leaving the therapeutic potential they revealed—for example in treatment of alcohol dependency disorder (e.g. Smith, 1958)—largely untapped. As a result, research on the intricate effects of psychedelic substances on human cognition and behavior is still in its infancy. This shortcoming comes as a surprise, considering that—despite their illegal status—about 14% of all adults in the United States report to have had at least some experience with psychedelic drugs (Johansen and Krebs, 2015). Moreover, indigenous peoples have sacramentally used hallucinogenic plants for more than 5000 years, predating all major contemporary religious belief systems. How these experiences affect individuals in the short and long term, however, is not yet entirely understood, and remains an important question to attend to.

Following a gradual political shift, the last two decades saw a resurgence of psychedelic research, culminating in the first experimental study involving LSD administration in 40 years (Gasser et al., 2014). First and foremost, many of these new research programs focus on clinical applications of psychedelic substances in the treatment of anxiety and mood disorders. Although oftentimes limited to small sample sizes, preliminary results of these studies indicate that administration of psychedelics can considerably benefit psychotherapeutic interventions, revealing marked reduction of anxiety in patients who suffer from various life-threatening conditions (Gasser et al., 2014), as well as reduction of depressive symptoms and anhedonia in patients with treatment-resistant depression (e.g. Carhart-Harris et al., 2016). A different line of research investigated the potential of psychedelics in aiding the treatment of addiction and dependence disorders. While the rarely used psychedelic compound ibogaine was found to effectively attenuate addiction and withdrawal symptoms in opiate and cocaine addicts, other psychedelics revealed broad anti-addictive qualities in the treatment of various dependence disorders, having positive effects on patients'

[1]Yale University, New Haven, CT, USA
[2]University of Innsbruck, Innsbruck, Tirol, Austria

Corresponding author:
Matthias Forstmann, Yale University, Department of Psychology, 2 Hillhouse Avenue, New Haven, CT 06511, USA.
Email: matthias.forstmann@yale.edu

self-efficacy and motivation to change (Bogenschutz and Pommy, 2012; Sessa and Johnson, 2015, for a review). In fact, a recent meta-analysis by Krebs and Johansen (2012) confirmed a substantial positive effect of LSD in the treatment of alcohol dependence, comprising a total sample of 536 participants.

Psychedelics' mechanism of action

The reasons for why psychedelics, most of which act as serotonin 2A (5-HT_{2A}) receptor agonists (Vollenweider and Kometer, 2010), have such a profound effect on mental wellbeing are manifold. For one, psilocybin may foster processing of traumatic events by enhancing autobiographical memory recall in trauma patients (Carhart-Harris et al., 2012b). Specifically, exposure to psilocybin was found to enhance recall of personal memories and emotions, especially increasing the vividness of these memories, underlined by an activation of the visual association cortex during the recall process (Carhart-Harris et al., 2012b). On the other hand, LSD was found to decrease the tendency to engage in mental time travel to the past, which is often associated with rumination and depressive thoughts (Speth et al., 2016). Psychedelics may further aid psychotherapeutic efficiency by enhancing suggestibility in patients. In an administration study, LSD was found to increase the subjective intensity of suggested psychobiological states, such as that one's arm was becoming heavier, or that water tasted especially refreshing (Carhart-Harris et al., 2015). In addition, psilocybin fosters "unconstrained cognition" in that it triggers a decrease in cerebral blood flow in brain regions that serve as structural "hubs" for information transmission between different brain regions and as systems for cognitive integration and constraint of external stimuli (Carhart-Harris et al., 2012a).

Apart from these basic cognitive and perceptual effects, the primary reason for the remarkable therapeutic efficiency of psychedelics seems to be their phenomenological effect on the user. In one of the rare cases of experimental research into the effects of psychedelics on healthy subjects—involving the double-blind administration of either an effective dose or a placebo/control substance—Griffiths and colleagues (2006) found that psilocybin reliably induced self-reported "mystical experiences" in hallucinogen-naïve participants. A large portion of the participants rated the experience as "having substantial personal meaning and spiritual significance" (p. 279), and a staggering 67% considered it to be among the top five meaningful experiences of their life. Two months after their treatment, 79% of participants reported increases in life satisfaction, and community observers rated participants' overall behavior to have changed for the better. Further indicating long-lasting effects of the experience, a 14-month post-treatment follow-up revealed positive changes in participants' self-reported attitudes about life, mood, (altruistic) social effects, general behavior, and life satisfaction (Griffiths et al., 2008). A follow-up study replicating these findings produced initial evidence that psilocybin administration produces dose-dependent persisting increases in life satisfaction, spirituality, and overall happiness (Griffiths et al., 2011). In particular, the mystical experience seems to have affected participants' core personality, as suggested by increased self-reported openness to experience after participating in the study (MacLean et al., 2011). Such lasting effects on core personality traits—which are usually thought of as comparably stable—may help explain some of the aforementioned promising effects of psychedelics in the treatment of addiction and mood disorder, two classes of clinical conditions which were theorized to be rooted in the rigid maintenance of certain maladaptive personality traits (Ball, 2005; Swendsen et al., 2002).

These results are further supported by a large-scale population survey, which, despite the widely held belief that psychedelic substances have negative effects on mental and physical health (Johansen and Krebs, 2015), established a positive relation between lifetime experience with psychedelics and mental wellbeing, manifesting in reduced psychological distress and suicidality (Hendricks et al., 2015). Experience with other classes of substances, the survey found, was more likely to have a negative effect on these variables. Importantly, this effect cannot be fully explained by hedonistic experiences caused by these substances, as psychedelics can acutely heighten anxiety, paranoia, and confusion (Griffiths et al., 2011). Yet, although psychedelic experiences can be unpleasant and challenging, a recent survey found that 84% of users who did experience such a "bad trip" endorsed benefiting from it in the long run (Carbonaro et al., 2016). In fact, the more difficult the challenging experience was, the more it predicted self-reported enduring increases in life satisfaction resulting from the experience.

Psychedelics and nature

One common mystical experience encountered by many during the psychedelic state is a profound feeling of connectedness or unity—a presumed consequence of a loss of self-awareness or ego-dissolution (Tagliazucchi et al., 2016). Specifically, psychedelics were found to decrease integrity *within* brain networks while simultaneously increasing functional connectivity *between* different brain networks, which correlate with self-reported experiences of ego-dissolution (Carhart-Harris et al., 2012a). Primarily, increased connectivity between brain networks associated with self-awareness and introspection—for example, the default mode network—was found to attenuate the functional identity of these networks, causing the lines between self and environment to blur (Tagliazucchi et al., 2016). In fact, in recent psilocybin administration studies, participants reported experiencing, for example, a "feeling of no boundaries, where I did not know where I ended and where my surroundings began" or that they felt "with every sense and fiber of my being that all things are connected" (Griffiths et al., 2008, p. 629). In accordance, administration of psilocybin produced dose-dependent increases on a questionnaire assessing the construct of *external unity*, that is, feelings of interconnectedness with some objects from the external world.

According to a considerable number of anecdotal reports, ranging from Aldous Huxley to Albert Hofmann, such experiences of unity oftentimes manifest in a sense of connectedness with all living beings, certain plants and animals, or nature as whole. Notably, Masters and Houston (1966) observed their subjects to actively seek out natural settings for their psychedelic experiences.[1] Natural environments, the authors argue, facilitate a unique empathic connection with one's surroundings, the kind of which is not typically encountered in artificial environments. In fact, the authors' reasoning is supported by contemporary evolutionary psychologists' perspective on the human–environment

fit. Specifically, although not explicitly mentioning psychedelic substances, the biophilia hypothesis argues that because humans have evolved in the Savannah, they now have an innate preference for such natural environments (Kellert and Wilson, 1995). This hypothesis is supported by abundant findings showing that perceptual exposure to nature has substantial physical and mental health benefits (for a review, see Maller, et al., 2006), and that people have aesthetic preferences for natural environments—be it in art, such as the picture of a landscape, or in real life, such as a park in an urban area (Orians and Heerwagen, 1992). Thus, the intuitive appreciation of natural environments may contribute to the fact that many people anecdotally choose such settings for psychedelic experiences (cf. Erowid Experience Vaults, 2017, for a large selection of such anecdotal reports), which may in turn explain the frequency of reports about feelings of "profound levels of identification or merging with the natural world" (Strassman et al., 2008, p. 277) during the psychedelic state.[2]

This substance-induced self–nature overlap can potentially be understood as a consequence of the ego-dissolution experienced under the influence of psychedelics (Tagliazucchi et al., 2016), and may have unique cognitive and behavioral consequences for the person experiencing it. Social psychological research shows that self–other overlap can be understood as an embodiment of a close relationship, and that it is intimately linked to empathic concern (Aron et al., 1991). Moreover, it typically causes an incorporation of the target's features into the self (Aaron et al., 1991), and conversely, an ascription of one's own characteristics to the target (Galinsky et al., 2005). In case of non-human entities (such as objects found in nature), the latter allows the ascription of uniquely human properties such as mental states (e.g. goals, intentions, desires, emotions) to these entities—a process referred to as anthropomorphism. This could explain why typical experiences by users of classic psychedelics, who took these substances in natural environments, include self-reported encounters with an "earth soul", mother nature, or spirits associated with the hallucinogenic plants themselves (e.g. Kjellgren et al., 2009; Luke, 2011). Such notions can also be frequently encountered in cultures with animist belief systems that have a history of hallucinogenic plant use. These cultures often ascribe a spirit to plants and consider them embodiments of deities that communicate with human beings through their visions (e.g. Luna, 1984; Shanon, 2002, p. 14).

Attributing a mind and feelings to an entity is a process commonly referred to as mind perception. As put by Gray et al. (2012), mind perception can be considered the "essence of morality", in that it enables empathic concern for any given entity. Acknowledging that an entity has emotions and feelings is a prerequisite for considering it a moral patient, that is, something that can feel pain and that should hence not be harmed. In line with this reasoning, anthropomorphizing certain elements of nature was found to foster an empathic connection with the natural world (Tam et al., 2013). An evocation of empathy, in turn, is one of the central causes for altruistic behavior, which—in the case of nature—would manifest in increased pro-environmental behavior.

In fact, some indigenous cultures that anthropomorphize natural elements in their religious beliefs indeed engage in more pro-environmental behavior than do neighboring cultures that do not share such an animist belief system (Atran et al., 2002). Tam and colleagues (2013) were among the first to examine this relationship in more detail. They found that anthropomorphism positively predicts conservation behavior and that this relationship is indeed partially explained by empathic feelings towards nature. A similar effect was found for children in Western societies: those children who tended to ascribe mental and emotional qualities to natural entities showed heightened concern for their wellbeing (Gebhard et al., 2003). Likewise, adults with a general tendency to anthropomorphize non-human entities were also more likely to report to engage in pro-environmental behavior (Waytz et al., 2010). Lastly, there are findings showing that inducing people to take the perspective of an animal—thereby increasing self–other overlap with that animal—increased pro-environmental concern and behavior (Berenguer, 2007).

In sum, there is an empirical connection from psychedelics to experiencing unity and connection with one's environment to empathy-related phenomena and pro-environmental behavior. Based on this indirect link, we designed the present research to test the hypothesis that lifetime experience with classic psychedelics uniquely predicts nature relatedness—specifically, an internal identification with nature—and engagement in pro-environmental behavior. We expect the perceived unity with nature that people typically experience during the psychedelic state to have lasting effects on their personality that persist even after the experience ended. We further contend that the variables have a linear relationship: Frequency of the psychedelic experience, we theorized, would predict degree of engagement in pro-environmental behaviors.

There are two main reasons why observing this direct connection would be of great societal relevance. Firstly, there are manifold benefits on the individual level. Research finds positive relationships between connectedness to nature and happiness as well as other forms of wellbeing (for a recent meta-analysis, see Capaldi et al., 2014). Secondly, at a time when the "warming of the climate system is unequivocal" and the "human influence on the climate system is clear" (IPCC, 2014, p. 40), behaviors aimed at the protection of our environment are undeniably crucial. As Roszak et al. (1995) suggested, it should be a common goal to heal the fundamental alienation between humans and nature, thereby aiding in the conservation of our planet, by highlighting the reciprocity of their relationship, that is, to increase awareness and acceptance of people's "ecological self". Identifying factors that contribute to this process is therefore an important scientific endeavor—for individual wellbeing as well as for our planet's future.

Methods and results

Variables included in theoretical model

Lifetime experiences with psychedelic substances. Various substances have been classified as "psychedelics" or "hallucinogens" in the past, although pharmacology and psychological effects of these substances can be vastly different (Masters and Houston, 1966; Nichols, 2004). In line with Johnson et al. (2008) we focused on four separate classes of substances:

Classic Psychedelic substances. In the present research, we were interested in the unique effects of experience with classic psychedelic substances—or hallucinogens (Nichols, 2004)—on nature relatedness and pro-environmental behavior. These

substances are usually characterized by their action as 5-HT_{2A} receptor agonists (Nichols, 2004; Vollenweider and Kometer, 2010). In addition to the effects described above, they cause a long list of somatic (e.g. dizziness, nausea), perceptual (altered shapes and colors, synesthesia), and psychological symptoms (alterations in mood, depersonalization, dreamlike states, hallucinations) (Hollister, 1984; Nichols, 2004). Classic psychedelic substances can be broadly divided into two sub-classes of compounds—tryptamines and phenethylamines.

Classic psychedelic tryptamines include psilocybin, found in various species of the *Psilocybe* genus of mushrooms, dimethyltryptamine (either N,N-DMT or 5-MeO DMT), found in hundreds of species in the plant and animal kingdom, d-lysergic acid diethylamide (LSD), a semi-synthetical ergotamine derivate, and ibogaine—an alkaloid found in the *Tabernathe iboga* plant native to West-Central Africa. Ibogaine also acts as a N-methyl-D-aspartate (NMDA) receptor antagonist and weak κ-opioid receptor agonist, and can therefore induce symptoms typical of dissociative anesthetics. We decided, however, to group ibogaine with the classic psychedelic substances, as its primary phenomenological effects are believed to be rooted in 5-HT_{2A} receptor affinity (Brown, 2013).

Phenethylamines include mescaline, a compound primarily found in the *Lophophora* and *Echinopsis* genera of cacti (such as Peyote or San Pedro), as well as synthetic compounds such as 2C-B, 2C-E, DOx, or DOM (Shulgin and Shulgin, 1991), which also primarily act upon the 5-HT_{2A} receptor.

Dissociative Anesthetics. The class of dissociatives primarily comprises the atypical anesthetic ketamine (an NMDA receptor antagonist), the over-the-counter cough suppressant dextromethorphan (DXM), phencyclidine (PCP), and newer research chemicals such as methoxetamine (MXE) (Corazza et al., 2012). Some of their effects are comparable to the ego-dissolving effects of classic psychedelics. Dissociatives can distort proprioception and sensory perception, and can cause a detachment from one's physical body and the external environment—symptoms referred to as depersonalization and derealization (Curran and Morgan, 2000). In higher doses, dissociatives can cause a "state of wildly dissociated experiences in which other worlds or dimensions that are difficult to describe in words are said to be perceived, all the while being completely unaware of one's individual identity or the outside world" (Pai and Heining, 2007: 62–63). We thus included experience with dissociatives in our model, as they are likely to correlate with frequency of psychedelic experiences and because of their potential effect on self–nature overlap as a function of self-expansion.

Empathogens—sometimes also referred to as entactogens (Nichols, 1986). Chemically related to both classic psychedelics and stimulants, empathogens are a class of substances characterized by their effects on emotional openness, "empathic resonance", and personal relatedness to other human beings. Prominent exemplars include the widely used recreational substances MDMA (or "Ecstasy") and MDA. We included empathogens in our model, since—as outlined above—pro-environmental behavior can be framed as an empathic reaction towards nature, that may be strengthened by experiences with empathogens. In fact, one of MDMA's features that makes it especially suitable in aiding the treatment for post-traumatic stress disorder (PTSD; Mithoefer et al., 2011) is its increase in empathic social interaction (Sessa, 2016; Vollenweider et al., 1998) and pro-social feelings (Dumont et al., 2009) that may in theory similarly extend to encompass the entirety of the natural world.

Natural deliriants. This class of substances comprises anticholinergic tropane alkaloids such as atropine, hyoscyamine, and scopolamine, commonly found in plants such as datura, belladonna, mandrake, or henbane. As their psychotropic effects—characterized by vivid hallucinations and confusion—are frequently described as extremely unpleasant and consumption can have fatal consequences (e.g. Boumba et al., 2004), most people nowadays refrain from recreationally consuming natural deliriants. However, their historic use as natural hallucinogens and dissociatives (Rudgley, 1995) qualifies them for inclusion in our model. Further included in this category are $GABA_A$ agonists such as muscimol and ibotonic acid, typically found in mushrooms of the *Amanita* genus.

Control variables. In addition to the various classes of psychedelic substances listed above, we included a selection of covariates in our model for which we had direct predictions with regard to their relation to psychedelic drug consumption and nature relatedness. These covariates include experience with two other classes of psychoactive substances as well as three personality traits.

Cannabinoids. This class of substances comprises tetrahydrocannabinol (THC), the principal psychoactive compound found in cannabis, and synthetic variants of it. Cannabis was included in the model because of its historical entheogenic use in religious ceremonies (Courtwright, 2001), and the fact that it is the most commonly consumed illicit substance in the United States (Center for Behavioral Health Statistics and Quality, 2015). Further, it is strongly associated with counterculture and liberal politics (e.g. Bachman et al., 1980), both of which are positively related to pro-environmental behavior (Feinberg and Willer, 2013). In fact, research found that adolescents prefer to consume cannabis in natural settings, and reported increased feelings of reconnection with the natural world (Moffat et al., 2009).

Popular legal drugs. To assess whether a mere appreciation of mind-altering substances could explain a potential effect of psychedelics on nature relatedness in our model, we included a class of substances comprising the three most-consumed legal psychoactive substances in the United States—and probably the world—namely caffeine, nicotine, and alcohol (Center for Behavioral Health Statistics and Quality, 2015).

Conscientiousness. Lastly, we added to three personality variables to our model. The personality trait of conscientiousness, one of the so-called "Big 5" personality traits, describes individual differences in propensity to follow socially prescribed norms and rules (Gosling et al., 2003). In our model, we included this variable both as a predictor of nature relatedness and pro-environmental behavior. In line with the literature, we expected conscientiousness to be negatively correlated with consumption of unhealthy or illegal substances (as one is not "supposed to" engage such behaviors) (Bogg and Roberts, 2004), and positively associated with pro-environmental behavior and ecological concern (Nisbet et al., 2009).

Openness to experience. As a second covariate, we decided to include the personality trait of openness to experience in our theoretical model (Gosling et al., 2003). Openness was found to be positively associated with non-conformity and positive attitude towards psychoactive drugs (e.g. Mabry and Khavari, 1986),

as well as with positive attitudes towards nature (Nisbet et al., 2009). We therefore theorized that this variable would predict both consumption of psychedelic substances and nature relatedness.

Political conservatism. Lastly, we included political conservatism as covariate in the model, using it to predict both nature relatedness and pro-environmental behavior. Political conservatism was found to be negatively correlated with recreational drug attitudes (Kurzban et al., 2010), and is historically related to drug prohibition and to authoritarianism rather than liberal worldviews. Right-wing authoritarianism was similarly found to be highly negatively correlated with environmental concern (Schultz and Stone, 1994). We thus expect this personality variable to negatively predict both experience with psychedelic substances and pro-environmental behavior, thereby potentially accounting for any effect we might find between those two constructs.

Nature relatedness. As a potential mediating process, we included Nisbet and colleagues' (2009) construct of nature relatedness in our model. Nature relatedness is a considerably stable personality trait that captures people's ecological self-construal, or *ecological identity*, and thus centers around their perceived connectedness with the natural world. Unlike past constructs, it includes people's affective, cognitive, as well as physical relationship with nature, and therefore involves both people's concrete feelings towards outdoor environments, as well as their abstract understanding of their interconnectedness with all living beings on this planet. According to the authors, the construct of nature relatedness (NR) can be separated into three sub-dimensions, labeled NR-Self, NR-Perspective, and NR-Experience, representing different facets of a person's relationship with the natural world (Nisbet et al., 2009).

NR-Self. This dimension represents people's internalized identification with nature, and therefore most closely describes their ecological identity. It reflects feelings and thoughts about one's personal relationship with nature, exemplified by agreement to questionnaire items such as "I feel very connected to all living things and the earth" or "I am not separate from nature, but a part of nature". In line with our hypothesis outlined above, we expected this factor to be primarily affected by experience with classic psychedelic substances, as they seem to broaden people's self-construal and to facilitate incorporate of external objects and entities into the self.

NR-Perspective. This second sub-dimension captures people's external, nature-related attitudes and behaviors, and revolves around the environmental impact of individual human actions as well as humanity's general negative impact on the planet. This sub-dimension is exemplified by questionnaire items such as "Humans have the right to use natural resources any way we want" (reverse-coded) or "The state of nonhuman species is an indicator of the future for humans". Although this dimension is conceptually closest to pro-environmental behavior, we expected it to be affected by experience with classic psychedelics to a lesser extent, when accounting for its intercorrelation with the other two sub-dimensions.

NR-Experience. The third sub-dimension of the nature relatedness construct is NR-Experience. It captures people's affect-based attitudes towards actual nature-related experiences, and revolves around people's attraction to nature and their desire of being in a natural environment. According to Nisbet and colleagues (2009), this aspect of nature relatedness can be found, for example, in people who are "drawn to the wilderness, and who are aware of and fascinated with nature all around them". It is exemplified by questionnaire items such as "My ideal vacation spot would be a remote, wilderness area" or "I enjoy digging in the earth and getting dirt on my hands". As this sub-dimension is based on feelings of familiarity—or a close relationship—with nature, we expected it to be similarly affected by experience with classic psychedelic substances.

Pro-environmental behavior. As our main dependent variable, we included self-reported pro-environmental behavior in our theoretical model. Because we were interested in a broad range of pro-environmental behaviors, we followed an approach by Whitmarsh and O'Neill (2010), and focused on 12 so-called "headline behaviors" (some of them assessed by multiple items) that were established by the UK DEFRA (2008). These behaviors comprise actions that have both low and high impact on the environment. In addition, some of them are one-off, while others need to be performed on a regular basis. According to Whitmarsh and O'Neill (2010), these actions tap into four general areas of pro-environmental concern: domestic energy/water use (e.g. more responsible water use), waste behavior (e.g. more recycling), transport (e.g. less flying), and eco-friendly shopping (e.g. buying more environmentally friendly products). We decided on following this approach of assessing pro-environmental concern, as we wanted to focus on everyday pro-environmental behavior that is (for the most part) not immediately related to the nature relatedness construct outlined above. That is, our goal was to capture behaviors that affect nature more indirectly, rather than behaviors that are directly aimed at protecting nature, such as saving the rainforest or planting trees.

In our model we expected pro-environmental behavior to be affected by the different sub-dimensions of nature relatedness (Nisbet et al., 2009). That is, any effect that experience with psychoactive substances may have on pro-environmental behavior, we expected to be mediated by one of these sub-dimensions.

Participants and design. In total, 1501 participants, recruited from Amazon.com's Mechanical Turk website, completed the study in exchange for modest financial compensation. Out of these participants, 14 were excluded from data analysis, as they indicated that they responded to one or more items randomly or in a purposefully wrong manner. This left us with a final sample of 1487 participants (913 female, 566 male, 8 other), with a mean age of 35.77 years (SD = 11.88), and an age-range from 18 to 78 years (Table 1).

Mechanical Turk is a so-called crowdsourcing website, on which users can complete minor tasks, such as participating in a research survey, in exchange for small monetary incentives. It allows for rapid collection of data from a sample that is surprisingly representative of the US population—oftentimes more so than samples obtained through census-representative web-panels (Redmiles et al., 2017)—especially when it comes to gender and ethnicity of participants. Participants on Mechanical Turk, however, tend to be younger and more educated than the general population (Pew Research Center, 2017). Although participants take part in these studies using their own electronic devices (e.g. PCs, mobile phones), data quality matches (and sometimes exceeds) that achieved through traditional means of data

Table 1. Demographics.

Sample characteristics (n = 1487)		Frequency (Percentages)
Gender		
	Male	566 (38.1%)
	Female	913 (61.4%)
	Other	8 (0.5%)
Age		
	18 – 30	599 (40.3%)
	31 – 40	462 (31.1%)
	41 – 50	219 (14.7%)
	51 – 60	146 (9.9%)
	> 60	60 (4.0%)
Ethnicity		
	White	1206 (81.1%)
	Black	101 (6.8%)
	Hispanic	75 (5.0%)
	Native American	9 (0.6%)
	Asian	67 (4.5%)
	Other	29 (2.0%)
Sexuality		
	Straight	1340 (90.1%)
	Gay/Lesbian	60 (4.0%)
	Other/None	76 (5.1%)
Native speaker		
	Yes	1440 (96.8%)
	No	47 (3.2%)
Education (highest)		
	School	5 (0.3%)
	High School	308 (20.7%)
	College	410 (27.6%)
	Bachelor	574 (38.6%)
	Master	156 (10.5%)
	PhD/MD	34 (2.3%)
Socio-economic status: 1 (very low) to 10 (very high)		
	Low (1 to 3)	291 (19.6%)
	Medium-Low (4 to 5)	491 (33.0%)
	Medium-High (6 to 7)	589 (39.6%)
	High (8 to 10)	116 (7.8%)
Political preference: 1 (strongly liberal) to 7 (strongly conservative)		
	Liberal (1 to 2)	496 (33.4%)
	Moderate (3 to 5)	782 (52.6%)
	Conservative (6 to 7)	208 (14.0%)
Drug attitudes: 1 (extremely negative) to 7 (extremely positive)		
	Very negative (1 to 2)	644 (43.3%)
	Moderate (3 to 5)	723 (48.6%)
	Very positive (6 to 7)	120 (8.1%)

collection, such as laboratory studies (Buhrmester et al., 2011; Goodman et al., 2013; for a review see Paolacci and Chandler, 2014), despite the fact that participants are highly experienced in participating in psychological surveys (Rand et al., 2014). Past research has already made use of Mechanical Turk to collect data from clinical populations (Shapiro et al., 2013), and it was successfully used in drug-related surveys, for example in a study of daily alcohol consumption (Boynton and Richman, 2014). Although the sample is to some extend self-selected (as is the case for most panel data), increased anonymity of the respondents may actually foster more honest and less socially desirable responding, especially when it comes to sensitive topics such as consumption of illicit substances (see Krumpal, 2013 for an overview).

Materials and procedure. First, participants completed a newly developed questionnaire, assessing their lifetime experience with 30 psychoactive substances. For each substance, participants were asked to indicate on a binary measure whether they "ever took it for recreational purposes—that is, when [it was] not taken for treatment of a medical condition". If they answered "yes" they were prompted to indicate on a scale ranging from 1 (*very rarely*) to 5 (*very often*) how often they took the respective substance in the past. If a participant indicated that he or she had no experience with a given substance, they received a score of "0" (see Supplementary Information for the entire list of substances).

Subsequently, participants worked on the Nature Relatedness Questionnaire by Nisbet and colleagues (2009), assessing their individual relationship with nature on three unique dimensions. Specifically, participants were asked to indicate their agreement with 21 statements using a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Items included statements such as "My ideal vacation spot would be a remote, wilderness area" or "Animals, birds and plants should have fewer rights than humans" (reverse-coded).

Subsequently, all participants proceeded to work on a second questionnaire assessing their self-reported frequency of engaging in various pro-environmental actions. To that end, they were asked to indicate for a selection of 17 pro-environmental actions, taken from Whitmarsh and O'Neill (2010), how often (if at all) they take each action, using a 4-point scale labeled 1 (*never*), 2 (*occasionally*), 3 (*often*), and 4 (*always*).[3]

At the end of the survey, participants responded to the Ten-Item Personality Inventory (Gosling et al., 2003) as a short assessment of the "Big Five" personality traits. Specifically, participants were presented with 10 statements, each beginning with "I see myself as ____", followed by two adjectives related to personality (e.g. "Anxious, easily upset"). For each statement, participants were asked to indicate their agreement using a Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Lastly, we assessed a set of demographic variables. Participants indicated their age, gender (*male, female, other*), ethnicity (*Black, White, Hispanic, Native American, Asian, other*), sexuality (*straight, gay/lesbian, other/none*), whether English was their first language (*yes, no*), their highest level of education (*school, high school, college, bachelor, master, PhD/MD*) including which subject they majored in, their self-assessed socio-economic status (i.e. "your or your family's economic and social position in relation to others"), from 1 (*very low*) to 10 (*very high*), their general attitude towards psychoactive substances, from 1 (*extremely negative*) to 7 (*extremely positive*), and their political orientation, from 1 (*strongly liberal*) to 7 (*strongly conservative*). As a data exclusion criterion, we asked participants on a binary item, whether they answered one or multiple questions in a random (or purposefully wrong) manner.

Results

Experience with psychedelic drugs. Of all participants, 26.9% indicated previous experience with at least one classic psychedelic substance (Figure 3). Notably, this number is substantially greater than the approximately 13.6% found in the NSDUH study of the Substance Abuse and Mental Health Services Administration of the United States Department of Health and Human Services for the years 2008 to 2012 (Hendricks et al., 2015).

Post-hoc modifications to the model. We modified our theoretical model in two noteworthy ways. First, we had to drop the latent variable for natural deliriants from the model, as less than 1% of our sample had experience with any of the three substance groups that comprise it (i.e. 3, 5, and 11, people, respectively). That is, overall experience with these substances was too low to interpret any potential results. Second, we analyzed modification indices of the model and found that additional covariation between the indicator variables "other psychedelics" and "other dissociatives", $\beta = 0.251$, $SE = 0.025$, $p < .0000001$, 95%CI = [0.201; 0.300], as well as "other psychedelics" and "other empathogens", $\beta = 0.329$, $SE = 0.024$, $p < .0000001$, 95% CI = [0.282; 0.376], meaningfully improved model fit (Figure 1). Theoretically, this covariation could be explained by a personality variable that fosters interest in rare psychoactive substances, a tendency to consume unknown substances, or forgetfulness with regard to consumed substances.

Structural equation model. To keep the number of indicators in our model at a minimum and thereby reduce the chance for estimation errors, indicators for the three nature relatedness subscales were parceled once, while the 17 indicators for pro-environmental behavior were parceled twice, following the procedure recommended by Little et al. (2002). Data analysis was performed in R 3.2.3 (R Core Team, 2015), using the LAVAAN Package for structural equation modeling (Rosseel, 2012). Models fit estimates were obtained through full information maximum likelihood estimations (FIML). The overall model fit turned out to be acceptable, indicated by comparative fit index (CFI) = .889, Tucker–Lewis Index (TLI) = .869, and root mean square error of approximation (RMSEA) = .052, 90% CI = [.050; .054].

All indicators significantly contributed to their respective latent variables. As predicted, all exogenous variables were highly intercorrelated (Figure 1). That is, lifetime experience with a given substance class always covaried with experience with a different substance class (all p values < .001). As further predicted, the personality dimensions of conservatism (all p values < .001) and conscientiousness (all p values < .01) were negatively related to experience with each substance class, while openness to experience was positively related to these experiences (all p values < .0001). In a similar manner, the three subscales of nature relatedness significantly covaried with one another: NR-Experience with NR-Perspective, $\beta = 0.356$, $SE = 0.033$, $p < .0000001$, 95% CI = [0.291; 0.422], NR-Experience with NR-Self, $\beta = 0.724$, $SE = 0.020$, $p < .0000001$, 95% CI = [0.685; 0.763], as well as NR-Perspective with NR-Self, $\beta = 0.746$, $SE = 0.021$, $p < .0000001$, 95% CI = [0.704; 0.788].

Importantly, in this model, 14 significant and three marginally significant regression paths emerged (see Figure 1). In line with our main hypothesis, lifetime experience with classic psychedelic substances positively predicted two subscales of nature relatedness, NR-Self, $\beta = 0.303$, $SE = 0.081$, $p < .001$, 95% CI = [0.144; 0.462], and NR-Experience, $\beta = 0.256$, $SE = 0.087$, $p = .003$, 95% CI = [0.086; 0.427]. In other words, participants who had more experience with classic psychedelics were more inclined to see nature as a part of their selves, and had a greater propensity to enjoy being in a natural environment, independent of their history with other (related or unrelated) classes of psychoactive substances, their core personality traits, or their political orientation. Our data thus suggest that classic psychedelics have a unique effect on how people perceive themselves in relation to nature that persists long after the experience ended.

While none of the other substance classes significantly predicted any of the three nature relatedness subscales, three marginally significant regression paths emerged. First, in addition to the significant paths reported above, lifetime experience with classic psychedelics also positively predicted the third NR subscale, that is, NR-Perspective, hinting at a broader effect of experience with classic psychedelics on various facets of nature relatedness, $\beta = 0.150$, $SE = 0.087$, $p = .085$, 95% CI = [–0.021; 0.321]. In addition, two unpredicted pathways emerged. For one experience with dissociative anesthetics *negatively* predicted NR-Perspective, $\beta = -0.210$, $SE = 0.110$, $p = .056$, 95% CI = [0.426; 0.006], while experience with popular legal drugs positively predicted the experience dimension of nature relatedness, $\beta = 0.145$, $SE = 0.077$, $p = .059$, 95% CI = [–.006; 0.296]. Notably, though, these marginally significant paths turn non-significant when the model is slightly altered (see below).

As further hypothesized, the three nature relatedness subscales were each significantly predicted by all three of our personality-related control variables (all p values < .017). While conscientiousness and openness to experience both positively predicted all three sub-dimensions of nature relatedness, political conservatism had a more complex relationship with the construct: It was (expectedly) negatively related to NR-Perspective and NR-Self, yet positively related to NR-Experience (Figure 1). Importantly, when accounting for the intercorrelation of the nature relatedness subscales, the NR-Self dimension exclusively predicted pro-environmental behavior. That is, the more people perceived nature to be an integral part of their selves, the more they reported engaging in various pro-environmental behaviors, $\beta = 0.638$, $SE = 0.086$, $p < .0000001$, 95% CI = [0.470; 0.806]. The two other sub-dimensions of nature relatedness did not predict engagement in these behaviors. That is, despite their interrelation, only the dimension of nature relatedness associated with people's self-construal ultimately affected their self-reported ecological behavior in our model.

Finally, both conscientiousness, $\beta = 0.070$, $SE = 0.023$, $p = .002$, 95% CI = [0.026; 0.114], and political conservatism, $\beta = -0.064$, $SE = 0.028$, $p = .025$, 95% CI = [–0.119; –0.008], directly predicted self-reported engagement in pro-environmental behavior in the hypothesized directions.

Mediation analysis. As lifetime experience with classic psychedelics exclusively predicted the NR-Self dimension, and this dimension uniquely predicted participants' self-reported pro-environmental behavior, we tested whether this indirect path would explain any direct effect of experience with psychedelics on pro-environmental behavior. We therefore added an additional direct path from the latent variable for classic psychedelics to

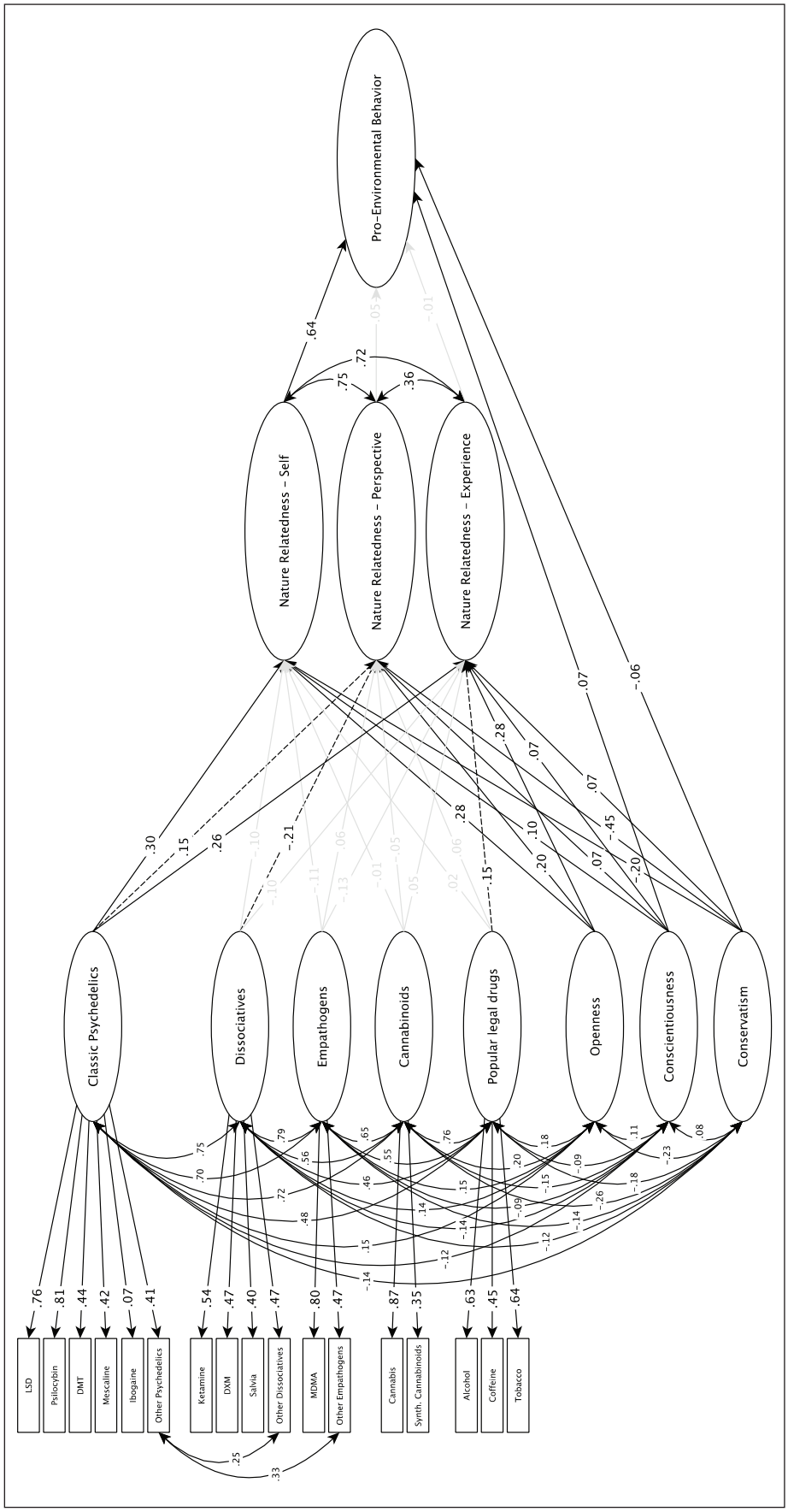

Figure 1. Structural equation model for Model 1. All values indicate standardized regression coefficients. Significant paths ($p < .05$) are displayed in black, marginally significant paths ($p < .10$) are displayed stroked, non-significant paths are displayed in gray.

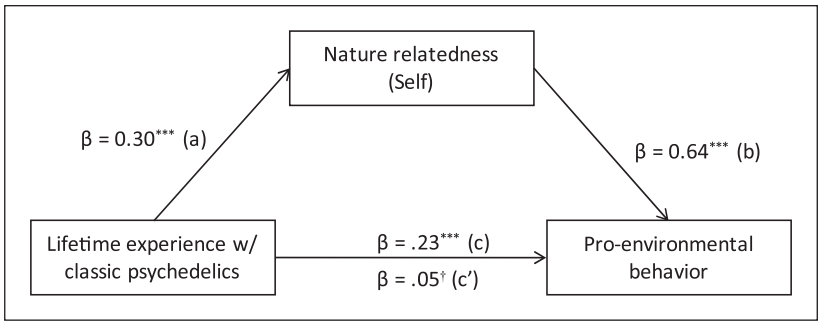

Figure 2. Mediation analysis. βs represent standardized regression coefficients. (c) indicates the total effect, (c') indicates the direct effect when controlling for the indirect effect (a × b). Other variables in the structural equation model are not displayed, but statistically accounted for. *** = $p < .001$, † = $p < .10$.

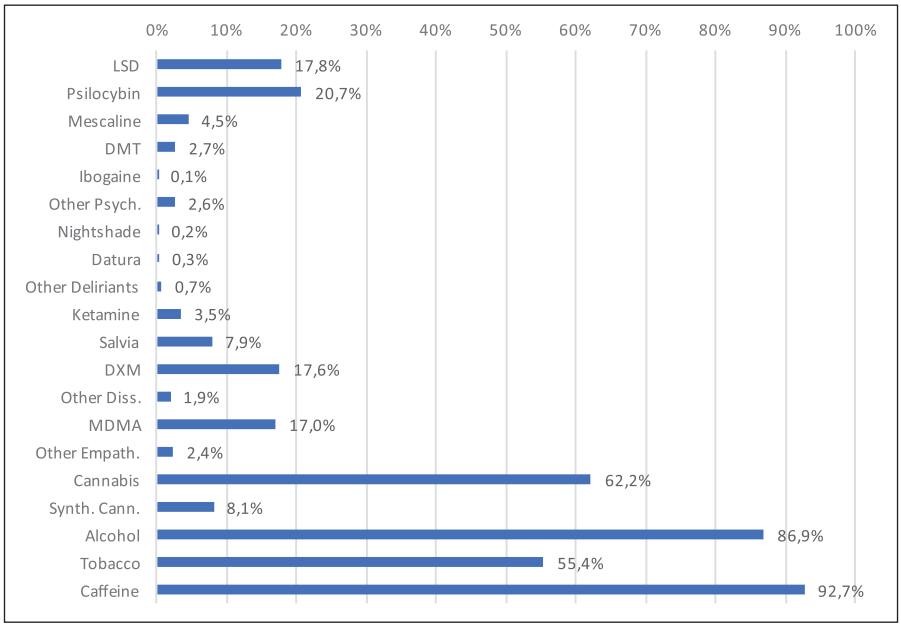

Figure 3. Lifetime experience with psychoactive substances included in the theoretical model.

pro-environmental behavior to our model, in order to test for statistical mediation. Inclusion of this additional path affected neither the overall model fit nor the significance of any of the regression paths in the model.

As depicted in Figure 2, we found that increases in NR-Self indeed mediated the effect of experience with classic psychedelics on pro-environmental behavior. The total effect of lifetime experience with psychedelics on this variable was highly significant, β = 0.231, *SE* = 0.056, $p < .001$, 95% CI = [0.114; 0.347]. Importantly, however, we found a statistically significant indirect effect, β = 0.182, *SE* = 0.056, $p = .001$, 95% CI = [0.073; 0.292]. Controlling for this indirect effect substantially weakened the direct effect and turned it marginally significant, β = 0.048, *SE* = 0.026, $p = .061$, 95% CI = [–0.002; 0.099]. In other words, the effect of lifetime experience with classic psychedelics on pro-environmental behavior is partially accounted for by the extent to which people's self-construal incorporates the natural world.

Alternative models. See Table 2 for additional model comparisons. In Model 2 we included demographic covariates, using them to predict both the three subscales of nature relatedness and pro-environmental behavior. Model 3 was identical to Model 2 with the addition of the three remaining personality variables from the "Big 5". In general, inclusion of additional variables and regression paths decreases model fit, but we found no change in (non) significance of the paths. As a notable exception, the marginally significant paths from Model 1 (see above), turn non-significant with the inclusion of additional covariates. Lastly, Model 4 was identical to Model 1, but replaced the three NR-Subscales with a single overall NR-Score (cf. Nisbet et al., 2009). Here, too, classic psychedelics remained the only significant predictor of nature relatedness. In all alternative models, we found a statistically significant mediation of the NR-Self dimension (or in Model 4 the overall NR-Score) in the relationship between lifetime experience with classic psychedelics and pro-environmental behavior.

Summary. We found a linear relationship between lifetime experience with classic psychedelic substances and scores on two sub-dimensions of nature relatedness, NR-Self and NR-Experience. The more people had experience with classic psychedelics,

Table 2. Model comparisons.

#	Model	Model Fit	Significant Paths[A]			Coefficients[B]
1	Basic Model	CFI = .889	C. Psych.	→	NR-Self	β = 0.303***
		TLI = .869	C. Psych.	→	NR-Exp.	β = 0.256**
		RMSEA = .052,	C. Psych.	→	NR-Persp.	β = 0.256**
		90% CI: [.050; .054]	Disso.	→	NR-Persp.	β = –0.210†
			PopDrug	→	NR-Exp.	β = 0.145†
			NR-Self	→	ProEnv.	β = 0.638****
2	Model 1 +	CFI = .830	C. Psych.	→	NR-Self	β = 0.225**
	Demographic	TLI = .803	C. Psych.	→	NR-Exp.	β = 0.180*
	covariates:	RMSEA = .050,	NR-Self	→	ProEnv.	β = 0.673****
		90% CI: [.048; .051]				
	Age, SocEco-Status, Drug Attitudes, Education, Gender, Language, Sexuality, Ethnicity					
3	Model 2 +	CFI = .822	C. Psych.	→	NR-Self	β = 0.212**
	personality	TLI = .791	C. Psych.	→	NR-Exp.	β = 0.175*
	covariates:	RMSEA = .049,	NR-Self	→	ProEnv.	β = 0.657****
		90% CI: [.048; .051]				
	Extraversion, Em. Stab., Agreeableness					
4	Model 1	CFI = .812	C. Psych.	→	NR-All	β = 0.301***
	with single overall	TLI = .787	NR-All	→	ProEnv.	β = 0.663****
	NR-Score	RMSEA = .066,				
		90% CI: [.065; .068]				

NR: Nature Relatedness (Exp. = Experience, Per. = Perspective); ProEnv: Pro-Environmental Behavior; Em.Stab.: Emotional Stability; SocEco-Status: Socio-Economic Status; C. Psych.: Classic Psychedelics; Disso: Dissociatives; PopDrugs: Popular legal drugs.

[A]Only (marginally) significant paths from substance experience to NR, and from NR to pro-environmental behavior are listed. Paths from covariates to mediator or DV are not listed.

[B]Significance levels: **** = $p < .00001$, *** = $p < .001$, ** = $p < .01$, * = $p < .05$, † = $p < .10$.

the more they enjoyed spending time in nature, and the more they construed their self as being a part of nature. None of the other substance classes included in our model significantly predicted any of the nature relatedness dimensions individually.

NR-Self, in turn, was the only dimension of nature relatedness that positively predicted self-reported engagement in pro-environmental behavior, and significantly mediated the relation between experience with classic psychedelics and pro-environmental behavior. That is, the perception of being part of the natural world—rather than being separate from it— that is heightened for people who have experience with classic psychedelics, is largely responsible for the increased pro-environmental behavior that these people report. Notably though, as the direct effect of experience with psychedelics on pro-environmental behavior remains marginally significant after controlling for the indirect effect, it is likely that it is not entirely driven by the mediating variable we identified. Which other factors may contribute to this effect, however, is for future research to determine.

General discussion

In the present research, we identified a novel predictor of nature relatedness and pro-environmental behavior. Results of our study tentatively suggest that experience with classic psychedelic substances may have lasting effects on the way people perceive nature and how strongly they engage in ecological behavior. Specifically, results show that lifetime experience with psychedelic substances (as opposed to other recreationally consumed substance classes) uniquely predicts self-reported nature relatedness, specifically the degree to which people incorporate nature into their self-construal, which in turn predicts self-reported engagement in pro-environmental behavior.

There are, however, a few shortcomings to our study. First and foremost, we did not gather causal evidence for the proposed link between the psychedelic experience and increased nature relatedness. Future studies may address this concern by testing how administration of some of these substances may affect nature relatedness and pro-environmental behavior in the short and long term. Correlational designs—such as the one employed in this research project—suffer from the disadvantage that the directionality of the effect observed is unknown. That is, from an empiric standpoint, it may equally be the case that people who feel greater nature relatedness have a greater propensity to take psychedelic drugs. Because of the correlational nature of our study, we can only argue against this proposition on a theoretical level. As stated in the introduction of this article, there is strong reason to

believe that psychedelic substances increase nature relatedness as a function of their ego-dissolving effects (Tagliazucchi et al., 2016), with a multitude of anecdotal reports pointing in this direction. For the reversed link, however, this is not the case. There is no reason to believe that people who see nature as an integral part of their selves are more prone to taking psychedelic substances, but show no greater affinity to take other classes of psychoactive substances. For example, while many of the classic psychedelic compounds can be found in nature—thereby potentially explaining a correlation with nature relatedness—the same is true for cannabis, some opiates, tobacco, or deliriants, which did not have significant explanatory power in our study. Thus, the idea that natural substances are more likely to be consumed by people who feel a stronger relatedness to nature cannot explain the present results. In addition, it would be theoretically difficult to explain how specifically the NR-Self dimension—that is, the inclusion of nature in people's self-construal—would cause people to consume more psychedelic drugs, whereas this would not be the case for their general appreciation of being outdoors (NR-Experience) or strong political views with regards to environmental issues (NR-Perspective). Lastly, as the relationship we found remained significant after controlling for demographic variables and personality traits such as openness to experience, conscientiousness, or political attitudes, it is unlikely that the association we found can be entirely explained by a collection of personality traits stereotypically associated with psychedelic users (e.g. being of the "hippie" type).

Still, while theoretically less plausible, the present data cannot entirely rule out reverse causality or a hidden influence by a third variable that was not assessed in this study. Therefore, future research should focus on determining whether the effects reported here can be causally validated through experimental means. For example, in addition to administration studies, one way to rule out some of the concerns inevitably present in correlational designs is to test the hypothesis in more elaborate within-subject designs based on longitudinal data. Thereby it would be possible to track people's views on nature and their ecological behavior over time while investigating how consumption of psychedelic substances affects these trends.

Similarly, it would make sense to more thoroughly investigate whether the settings in which psychedelics are consumed potentially influence the degree to which they have an effect on people's nature relatedness. As argued above, the ego-dissolution and simultaneous merging of the self with the outside world that people typically experience under higher doses of psychedelic substances may constitute general, unspecific phenomena that only relate to people's perception of nature when the respective substance is taken in a naturalistic setting. In other words, potential administration or longitudinal studies should assess and manipulate where the substances are consumed, and whether this has an effect on the degree to which the natural world is incorporated into people's self-construal. In the same vein, it would be crucial for future research endeavors to further investigate the moderating role that degree of experienced ego-dissolution plays in the association between past experience with psychedelics and nature relatedness. As we found a linear relationship between both constructs, one could hypothesize that greater experience with psychedelics caused subjects to also consume higher doses of these substances, which in turn could have increased the likelihood of experiencing instances of severe ego-dissolution.

A second shortcoming concerns our main dependent variable in this study, that is, pro-environmental behavior. As we were working with an online sample, we were only able to assess this construct via participants' self-reports. Thus, one alternative interpretation to our findings could be that people who are open to taking psychedelic substances only *say* that they engage in more pro-environmental behavior without actually doing so. This is not to say that these people are more likely to exaggerate or claim falsehoods. It is possible that people who frequently take classic psychedelic substances cultivate a certain lifestyle that views eco-friendly behavior as ideal behavior. Both pro-environmental behavior as well as consumption of psychedelic substances may therefore be two aspects of a culturally propagated stereotype with which users of psychedelics may identify and respond to accordingly. In other words, what may be captured by our measure of pro-environmental behavior could be attributed to participants' ideal-self rather than their true self. Assessing true ecological behavior, however, is an empirically daunting task. One could implement tasks in which—for example—participants are given the opportunity to donate a certain percentage of their compensation to a pro-environmental cause, thereby assessing an actual behavior that has direct consequences for the environment. Hence, future research is needed to investigate actual effects on ecological behavior in more detail. Regardless, in order to investigate any real effects of psychedelic substances in this domain, it would be reasonable to not artificially reinforce these stereotypes and to evaluate use of psychedelic substances outside of their subcultural niches.

In sum, while correlational in nature, the present research tentatively suggests that experience with classic psychedelic substances may uniquely and positively affect people's relationship with nature, especially their self-construal with regard to how strongly they see themselves as being part of nature rather than being separate from it. This, in turn, seems to positively affect their everyday behavior, in that they report to make more ecology-friendly decisions in the domains of energy consumption, waste management, or shopping behavior. Should future studies investigating the causal relationship between psychedelics and nature relatedness confirm the present findings, it would suggest that certain unique experiences can alter people's perceived relationship with nature in a lasting manner. Specifically, such additional findings would confirm that psychedelic experiences can indeed contribute to a behavioral change fostering the caretaking of our environment, which—in light of the continuing destruction of our planet—is of critical importance. Abundant previous findings have suggested that psychedelic experiences can be physiologically and psychologically beneficial, while only very few negative consequences have been observed (e.g. Nutt et al., 2013). The present research aims at expanding this literature by providing initial support for the idea that psychedelic substances may positively affect people's perceived relationship with nature. Recent research revealed a growing trend of society's disconnection from nature, as becomes evident in cultural products (Kesebir and Kesebir, 2017). Reversing this trend would be beneficial for both the individual's mental and physical wellbeing and the environment (van den Bosch and Depledge, 2015). In fact, a recent meta-analysis revealed a positive relationship between perceived nature relatedness and positive affect, vitality, and life satisfaction (Capaldi et al., 2014). In addition, nature exposure was found to reduce rumination, a maladaptive pattern of self-referential thought associated with depression, thought to

partially account for the correlation between urbanization and prevalence for mood-related mental illnesses (Bratman et al., 2015). Therefore, a potential increase in nature relatedness as a consequence of experience with psychedelics may constitute a second pathway by which psychedelic experiences could exert their positive effects on mood and happiness, as demonstrated by recent work on their efficiency in the treatment of mood disorders (e.g. Carhart-Harris et al., 2016). In light of these findings, the present results once more raise the question whether a continuing prohibition of these experiences is indeed a worthwhile pursuit.

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Notes

1. Although empirical evidence for these claims is scarce, some research shows that about 40% of adolescents have a general propensity to consume (for unspecified reasons) illicit substances outdoors (Hussong, 2000). Further, many adolescent cannabis users similarly report to prefer consuming this substance in outdoor settings, partly in order to establish a connection with the natural world (Moffat et al., 2009).
2. In addition, other reasons for consuming psychedelics outdoors could be participants' desire to avoid disruption by sober individuals, avoid contact with law enforcement, or because some of the substances (such as psilocybin-containing mushrooms or peyote-containing cacti) can only be naturally encountered in the countryside, which may thereby indirectly foster their consumption in these settings.
3. Following these measures, we assessed two additional questionnaires for a different research project, fully unrelated to nature relatedness or pro-environmental behavior.

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