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Matthew M. Nour B.M., B.Ch., M.A., Lisa Evans M.Sc. & Robin L. Carhart-Harris B.Sc., M.A., Ph.D.

To cite this article: Matthew M. Nour B.M., B.Ch., M.A., Lisa Evans M.Sc. & Robin L. Carhart-Harris B.Sc., M.A., Ph.D. (2017): Psychedelics, Personality and Political Perspectives, Journal of Psychoactive Drugs, DOI: [10.1080/02791072.2017.1312643](https://doi.org/10.1080/02791072.2017.1312643)

To link to this article: <http://dx.doi.org/10.1080/02791072.2017.1312643>



Published online: 26 Apr 2017.



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## Psychedelics, Personality and Political Perspectives

Matthew M. Nour, B.M., B.Ch., M.A.<sup>a</sup>, Lisa Evans, M.Sc.<sup>b</sup>, and Robin L. Carhart-Harris, B.Sc., M.A., Ph.D.<sup>c</sup>

<sup>a</sup>NIHR Academic Clinical Fellow, King's College London, Department of Psychosis Studies, Institute of Psychiatry, Psychology and Neuroscience, London, UK; <sup>b</sup>Masters Student, Imperial College London, Centre for Neuropsychopharmacology, Division of Brain Sciences, Faculty of Medicine, London, UK; <sup>c</sup>Head of Psychedelic Research, Imperial College London, Centre for Neuropsychopharmacology, Division of Brain Sciences, Faculty of Medicine, London, UK

### ABSTRACT

The psychedelic experience (including psychedelic-induced ego dissolution) can effect lasting change in a person's attitudes and beliefs. Here, we aimed to investigate the association between naturalistic psychedelic use and personality, political perspectives, and nature relatedness using an anonymous internet survey. Participants (N = 893) provided information about their naturalistic psychedelic, cocaine, and alcohol use, and answered questions relating to personality traits of openness and conscientiousness (Ten-Item Personality Inventory), nature relatedness (Nature-Relatedness Scale), and political attitudes (one-item liberalism-conservatism measure and five-item libertarian-authoritarian measure). Participants also rated the degree of ego dissolution experienced during their "most intense" recalled psychedelic experience (Ego-Dissolution Inventory). Multivariate linear regression analysis indicated that lifetime psychedelic use (but not lifetime cocaine use or weekly alcohol consumption) positively predicted liberal political views, openness and nature relatedness, and negatively predicted authoritarian political views, after accounting for potential confounding variables. Ego dissolution experienced during a participant's "most intense" psychedelic experience positively predicted liberal political views, openness and nature relatedness, and negatively predicted authoritarian political views. Further work is needed to investigate the nature of the relationship between the peak psychedelic experience and openness to new experiences, egalitarian political views, and concern for the environment.

### ARTICLE HISTORY

Received 1 October 2016  
Revised 21 January 2017  
Accepted 8 February 2017

### KEYWORDS

Conscientiousness; ego dissolution; liberalism; nature relatedness; openness; psychedelic

## Introduction

The transpersonal or mystical experience is perhaps the most powerful in the human psychological repertoire (James 1985), and is considered to be a catalyst for positive psychological change in both religious and secular contexts (Emerson 2003; Haidt 2013; James 1985; Piff et al. 2015). In addition, serotonergic "classical" psychedelic drugs have been used to occasion mystical-type experiences, including "ego dissolution," in many cultures around the world for centuries (Nichols 2016; Sessa 2012).

In recent years, there has been an increased interest in the scientific study of self-transcendent emotions, such as awe (Darbor et al. 2015; Haidt and Morris 2009; Piff et al. 2015; Rudd, Vohs, and Aaker 2012). This has been paralleled by a renewed scientific interest in psychedelic drugs (serotonin-2A receptor agonists), including psilocybin (the active ingredient in "magic mushrooms"), lysergic acid diethylamide (LSD), and N,N-dimethyltryptamine (DMT, the active ingredient in the South American decoction ayahuasca), with a particular emphasis on the

psychological, behavioral, and therapeutic consequences of the mystical (or "peak") psychedelic experience (Bogenschutz et al. 2015; Carhart-Harris et al. 2016a, 2016b; Doblin 1991; Grob et al. 2011; Grof 1980; Haidt 2013; Johnson et al. 2014; Lebedev et al. 2016; MacLean, Johnson, and Griffiths 2011; Moreno et al. 2006; Nichols 2016; Unger 1963).

Large population studies have shown that naturalistic psychedelic use is associated with reduced rates of suicidality and psychological distress in the general population (Hendricks, Johnson, and Griffiths 2015; Hendricks et al. 2015; Johansen and Krebs 2015; Krebs and Johansen 2013). There is also evidence that, within certain communities, individuals who use classical psychedelics may score higher in assessments of confidence and optimism than those who do not (Grob et al. 1996), and may place increased value on spiritual/mystical beliefs, as well as concern for others and nature/the environment compared with individuals who use cannabis, amphetamine, or heroin (Lerner and Lyvers 2006).

Nature relatedness, in particular, may be associated with reduced anxiety and increased personal well-being (Capaldi, Dopko, and Zelenski 2014; Martyn and Brymer 2016; Zelenski and Nisbet 2014), and exposure to awe-inspiring nature has been shown to increase pro-social attitudes and behavior (Piff et al. 2015).

In experimental settings, there is evidence that even one dose of the classical psychedelic drugs psilocybin and LSD, when given in a supportive environment, may cause increases in the personality trait of “openness,” which in some cases can persist for many months (Carhart-Harris et al. 2016b; MacLean, Johnson, and Griffiths 2011; Schmid et al. 2015). Increases in trust, optimism, and subjective well-being were also noted in these studies. Moreover, in recent years, a number of small studies have demonstrated the therapeutic potential of psilocybin to improve symptoms of anxiety, depression, and addiction when administered in a psychologically supportive setting (Bogenschutz et al. 2015; Carhart-Harris et al. 2016a; Griffiths et al. 2016; Grob et al. 2011; Johnson et al. 2014; Moreno et al. 2006; Ross et al. 2016). Together, these results suggest that classical psychedelics may cause lasting changes in personality traits, beliefs, and attitudes.

The purpose of the present study was to investigate the association between lifetime naturalistic psychedelic use and political perspectives, nature relatedness, and the personality traits of openness and conscientiousness in a large, anonymous Internet survey. We constrained our analysis of personality to trait openness and conscientiousness, as these are the “Big Five” personality domains that have been most consistently associated with political orientation (Carney et al. 2008; Sibley, Osborne, and Duckitt 2012; Xu, Mar, and Peterson 2013), and in which changes have been reported after psychedelic use (Carhart-Harris et al. 2016b; MacLean, Johnson, and Griffiths 2011; Schmid et al. 2015). In addition to collecting information on lifetime psychedelic use, we also collected information on naturalistic use of cocaine and alcohol, allowing us to test the specificity of the relationship between psychedelic use and political perspectives, personality traits, and nature relatedness. Given the proposed link between “peak” psychedelic experiences and persisting effects on personality and outlook (Doblin 1991; Haidt 2013; Lebedev et al. 2016; MacLean, Johnson, and Griffiths 2011; Unger 1963), we also investigated the relationship between psychedelic-induced ego dissolution and personality traits and attitudes.

## Method

### Survey structure

The present study used a large, anonymous internet survey to collect data. A subset of the data collected in this survey has recently been published (Nour et al. 2016).

Participants completing the survey first answered questions on demographic details (age, sex, and educational background) and personal drug use (lifetime use of psychedelic drugs, lifetime use of cocaine, and weekly alcohol consumption). Response options for educational attainment and drug and alcohol use are presented in Table 1). Participants then answered a series of questions designed to measure political perspectives, personality traits, and nature relatedness.

We assessed political perspectives of participants using two measures. To assess political views on the dimension of liberalism to conservatism, we used a one-item measure, similar to previous studies (Carney et al. 2008; Graham, Haidt, and Nosek 2009; Sibley, Osborne, and Duckitt 2012). This consisted of the question: “What is your political orientation?”, with possible answers ranging from “1 = very conservative” to “7 = very liberal” on a 7-point scale.

**Table 1.** Demographic information for full sample (n = 893).

Total	893	
Female	320 (35.8%)	
Age at time of survey		
Median	28.0	
Inter-quartile range	13.0	
Skewness	1.40	
Education		
Left school before age 16 (no qualifications)	5 (0.6%)	
Left school at 16/GCSE (UK)	33 (3.7%)	
High school diploma/A-Level (UK)	92 (10.3%)	
Some university (or equivalent)	231 (25.9%)	
Bachelor's degree (or equivalent)	278 (31.1%)	
Post-graduate degree (or equivalent)	254 (28.4%)	
Lifetime illicit drug use	Psychedelic	Cocaine
Never	155 (17.4%)	312 (34.9%)
Once only	38 (4.3%)	85 (9.5%)
2–5 times	136 (15.2%)	122 (13.7%)
6–10 times	120 (13.4%)	69 (7.7%)
11–15 times	85 (9.5%)	43 (4.8%)
16–25 times	87 (9.7%)	61 (6.8%)
26–50 times	114 (12.8%)	64 (7.2%)
51–100 times	78 (8.7%)	63 (7.1%)
>100 times	80 (9.0%)	74 (8.3%)
Weekly alcohol consumption		
No alcohol	227 (25.4%)	
1–6 units	278 (31.1%)	
7–12 units	167 (18.7%)	
13–18 units	83 (9.3%)	
19–24 units	44 (4.9%)	
25–30 units	29 (3.3%)	
31–36 units	20 (2.2%)	
37–42 units	14 (1.6%)	
43–48 units	9 (1.0%)	
49–54 units	9 (1.0%)	
55–60 units	5 (0.6%)	
> 60 units	8 (0.9%)	

The liberal-conservative political dimension is concerned with the value placed on social and economic equality, whereas the libertarian-authoritarian dimension emphasizes personal freedoms and limited government (Evans, Heath, and Lalljee 1996; Iyer et al. 2012). To assess political views on the dimension of libertarianism to authoritarianism, we used a subset of questions from a previously published questionnaire (Evans, Heath, and Lalljee 1996) in which participants rated the degree to which they agreed with statements on a 5-point scale from “1 = strongly disagree” to “5 = strongly agree.” The questionnaire included the following items: “Young people today don’t have enough respect for traditional values,” “People who break the law should be given stiffer sentences,” “Schools should teach children to obey authority,” “The law should always be obeyed, even if a particular law is wrong,” and “Organizing public meetings to protest against the government should not be allowed.” The mean score over all five items was used as a measure of authoritarianism. As this measure was based on a subset of questions from another questionnaire, we first confirmed that it had a uni-dimensional factor structure and adequate psychometric properties.

To assess nature relatedness, we used the validated 6-item Nature-Relatedness Scale (Nisbet and Zelenski 2013), in which participants rated the degree to which they agreed with six statements on a 5-point scale from “1 = disagree strongly” to “5 = agree strongly.” The six items were: “My ideal vacation spot would be a remote, wilderness area,” “I always think about how my actions affect the environment,” “My connection to nature and the environment is a part of my spirituality,” “I take notice of wildlife wherever I am,” “My relationship to nature is an important part of who I am,” and “I feel connected to all living things and the earth.” The mean of the answers to each item was used as a measure of “nature relatedness.”

To assess the personality traits of openness and conscientiousness, we used items from the Ten-Item Personality Inventory (TIPI) (Gosling, Rentfrow, and Swann 2003), which has been widely used by other studies (Carney et al. 2008; Gosling, Rentfrow, and Swann 2003; Sibley, Osborne, and Duckitt 2012). Participants expressed the degree to which they endorsed each statement on a 7-point scale from “1 = disagree strongly” to “7 = agree strongly.” Our measure of “openness” was the mean of the participant’s score for the statement “I see myself as open to new experiences,” and the reverse-marked score for the statement “I see myself as conventional, uncreative.” Our measure of “conscientiousness” was the mean of the participant’s score for the statement “I see myself as

dependable, self-disciplined,” and the reverse-marked score for the statement “I see myself as disorganized, careless.” Despite consisting of only two items for each Big Five trait, the TIPI has been shown to have adequate construct validity, test–retest reliability, and patterns of external correlates when compared to more time-consuming measures (Gosling, Rentfrow, and Swann 2003).

Finally, all participants were asked to retrospectively rate the degree of ego dissolution experienced for their “most intense” psychedelic experience, using the validated Ego-Dissolution Inventory (EDI) (Nour et al. 2016). The eight items of the EDI are as follows: “I experienced a dissolution of my ‘self’ or ego,” “I felt at one with the universe,” “I felt a sense of union with others,” “I experienced a decrease in my sense of self-importance,” “I experienced a disintegration of my ‘self’ or ego,” “I felt far less absorbed by my own issues and concerns”, “I lost all sense of ego,” “All notion of self and identity dissolved away.” Items were rated using a visual analogue scale (0–100, with incremental units of 1) with 0 defined as “No, not more than usually,” and 100 defined as “Yes, entirely or completely.” We have recently shown that ego dissolution is a paradigmatic feature of the psychedelic experience (Nour et al. 2016). Participants were also asked, “Do you believe that the experience and your contemplation of that experience have led to a change in your current sense of personal well-being or life satisfaction?” using a 7-point rating scale from “–3 = decreased very much” to “+3 = increased very much,” as used in previous psychedelic research (Barrett, Johnson, and Griffiths 2015).

### **Dissemination of the survey**

This study was approved by the Imperial College Research Ethics Committee, Imperial College London. The full survey was implemented and hosted by the online service Survey Gizmo (<http://www.surveygizmo.eu/>), and was estimated to take 38 minutes to complete. Survey Gizmo has comprehensive privacy policies and security features that maintain the anonymity of responses in line with ethics requirements.

Participants were recruited to the online survey via web-link advertisements posted on Facebook groups, Twitter pages, email newsletters, and online drug forums with a short request (“Please participate in our anonymous online questionnaire designed to learn more about experiences with classical psychedelics, cocaine, and alcohol”). Recruitment targeted online communities interested in psychoactive substances and altered states of consciousness (e.g., Psychedelic Society: <http://www.psychedelicsociety.org.uk>, and

Multidisciplinary Association for Psychedelic Studies: <http://www.maps.org>), as well as websites visited by more diverse populations (e.g., Reddit: <https://www.reddit.com/>, and Mumsnet: <http://www.mumsnet.com/>). The collection of IP addresses and geographical locations of participants was disabled and participants were informed of the anonymity of their responses. After reading a summary of the inclusion criteria and instructions, participants provided informed consent by clicking “next” on the first page of the questionnaire.

Inclusion criteria for participants were (1) at least 18 years of age; and (2) had had at least one experience with a classical psychedelic (LSD, psilocybin, DMT, ayahuasca; or mescaline), cocaine, and/or alcohol. Data collection occurred over a four-week period in 2015.

### Statistical analysis

#### *Relationship between psychedelic use and personality traits, political perspectives, and nature relatedness*

Multivariate linear regression was used to assess the relationship between lifetime psychedelic use and each dependent variable of interest, while controlling for potentially relevant covariates, similar to previous population studies of psychedelic use (Hendricks et al. 2015). Specifically, separate multivariate linear regression analyses were used to identify the independent variables that predicted the five dependent variables of interest (authoritarianism, liberalism, nature relatedness, openness, and conscientiousness). For each multivariate regression, independent variables were “sex” (coded as female = 1, male = 0), “age” (mean-centered), “highest educational attainment” (quantified from 1 = “Left school before age 16 (no qualifications)” to 6 = “Post-graduate degree (or equivalent)”), “lifetime psychedelic use (number of occasions)” (quantified as the middle value in the selected range), “lifetime cocaine use (number of occasions)” (quantified as the middle value in the selected range), and “weekly alcohol-consumption (units)” (quantified as the middle value in the selected range).

#### *Relationship between ego dissolution and personality traits, political perspectives, and nature relatedness*

We assessed whether the degree of ego dissolution experienced during the most intense psychedelic experience predicted authoritarianism, liberalism, nature relatedness, openness, or conscientiousness using multivariate linear regression. Similar to the previous analysis, five separate multivariate linear regression

models were used for the five dependent variables of interest (authoritarianism, liberalism, nature relatedness, openness, and conscientiousness). For each multivariate regression, independent variables were “ego dissolution experienced during most intense psychedelic experience,” “sex” (coded as female = 1, male = 0), “age” (mean-centered), and “highest educational attainment” (quantified from 1 = “left school before age 16 (no qualifications)” to 6 = “post-graduate degree (or equivalent)”).

Spearman’s rho is used to quantify all bivariate correlations. Statistical significance is defined as  $p < 0.05$  (2-tailed). All statistical analysis was performed using MatLab (MathWorks, Version 2015b including Statistics and Machine Learning Toolbox).

## Results

### *Baseline demographics of survey responders*

Eight hundred and ninety-three participants answered all questions relating to demographic details, drug use, political perspectives, nature relatedness, and personality traits. Table 1 summarizes the demographic information for these participants. The within-subject correlations between authoritarianism, liberalism, nature relatedness, openness, and conscientiousness are shown in Table 2. Our participants identified as politically liberal (median was “6 = somewhat liberal,” skewness =  $-1.4$ , on a 7-point scale), scored low on authoritarianism (median 1.8, skewness =  $0.8$ , on a scale of 1 to 5), and highly on nature relatedness (median 4.2, skewness =  $-0.8$ , on a scale of 1 to 5), openness (median 6.0, skewness =  $-1.0$ , on a scale of 1 to 7), and conscientiousness (median 5.5, skewness =  $-0.6$ , on a scale of 1 to 7).

### *Psychometric properties of the liberalism-authoritarianism questionnaire*

As predicted, the subset of questions chosen for this study was found to have a one-factor psychometric structure, as determined by Cattell’s scree-plot criterion (Cattell 1966) and Parallel Analysis for principle com-

**Table 2.** Bivariate Spearman’s rank correlations between authoritarianism (Authorit), liberalism, nature relatedness (NR), openness, and conscientiousness (Conscien) within subjects.

	Authorit	Liberalism	NR	Openness	Conscien
Authorit	1	$-0.44^{**}$	$-0.12^{**}$	$-0.16^{**}$	$0.14^{**}$
Liberalism		1	$0.16^{**}$	$0.20^{**}$	$-0.09^*$
NR			1	$0.34^{**}$	$0.06$
Openness				1	$0.09^*$
Conscien					1

$^{**}$ statistically significant at  $p < 0.001$ ;  $^*$ statistically significant at  $p < 0.01$ .

ponents (1000 random draws) (Horn 1965; O'Connor 2000). Parallel Analysis observed and 95% confidence-interval simulated eigenvalues for the second component were 0.89 and 1.07, respectively. The first component explained 51.3% of the variance in the questionnaire responses. All other components explained <20% of the variance. The questionnaire had acceptable internal consistency (Cronbach's alpha = 0.70) (Cronbach 1951).

**Relationship between psychedelic use and personality traits, political perspectives, and nature relatedness**

Five multivariate linear regression models, with authoritarianism, liberalism, nature relatedness, openness, and conscientiousness as the dependent variables, found that lifetime psychedelic use negatively predicted authoritarianism but positively predicted liberalism, nature relatedness, and openness, after controlling for the influence of confounding variables. Conversely, weekly alcohol consumption positively predicted authoritarianism and negatively predicted openness and nature relatedness. Lifetime cocaine use also positively predicted openness. Results from these models are shown in Table 3.

Openness was predicted both by lifetime psychedelic use and lifetime cocaine use. In an exploratory analysis, we investigated the relationship between “preferential psychedelic use (vs. cocaine use)” and openness in the subset of individuals who had reported exclusive use of one or the other substance (n = 235). This variable was coded “1” for cocaine-naïve individuals who had used psychedelics on at least one occasion, and “0” for psychedelic-naïve individuals who had used cocaine on at least one occasion. “Preferential psychedelic use (vs. cocaine use)” was predictive of openness in a

multivariate linear regression within this subgroup (unstandardized regression coefficient = 0.50, SE = 0.15, *p* < 0.001) (sex, age, and education included as other independent variables in the model).

**Relationship between ego dissolution and personality traits, political perspectives, and nature relatedness**

A subset of participants (n = 604) provided additional information on the degree of “ego dissolution” experienced during their most intense psychedelic experience by completing the eight-item Ego-Dissolution Inventory (Nour et al. 2016). The median time elapsed between this experience and survey completion was “1–5 years.” The median reported “intensity” of this experience (on a visual analogue scale from 1–100, with “0 = Not at all” and “100 = The most intense imaginable”) was 76 (skewness = –0.8, interquartile range = 23).

Five multivariate linear regression models, with authoritarianism, liberalism, nature relatedness, openness, and conscientiousness as the dependent variables, found that the degree of ego dissolution experienced during one’s most intense psychedelic experience significantly negatively predicted authoritarianism and positively predicted liberalism, nature relatedness, and openness, after controlling for the influence of confounding variables. Full results from these models are shown in Table 4.

Participants were also asked to what extent the psychedelic experience in question affected their subjective well-being on a 7-point scale from –3 (“decreased very much”) to +3 (“increased very much”). The median answer to this question was +2 (“moderately increased,” skewness = –1.1). Reported positive change in well-being was positively correlated with ratings of

**Table 3.** Naturalistic psychedelic use and subject variables.

	Authoritarianism			Liberalism			Nature relatedness			Openness			Conscientiousness		
	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p
Intercept	2.016	0.108	0.000	5.027	0.228	0.000	3.809	0.142	0.000	5.775	0.148	0.000	3.746	0.219	0.000
Sex (F)	<b>0.128</b>	<b>0.047</b>	<b>0.006</b>	0.051	0.099	0.605	0.116	0.062	0.062	–0.018	0.064	0.779	0.098	0.095	0.304
Age	<b>0.007</b>	<b>0.002</b>	<b>0.000</b>	0.002	0.004	0.620	0.005	0.003	0.085	–0.005	0.003	0.071	<b>0.014</b>	<b>0.004</b>	<b>0.001</b>
Education	<b>–0.066</b>	<b>0.020</b>	<b>0.001</b>	<b>0.130</b>	<b>0.042</b>	<b>0.002</b>	–0.027	0.026	0.304	<b>0.060</b>	<b>0.027</b>	<b>0.028</b>	<b>0.181</b>	<b>0.041</b>	<b>0.000</b>
Psychedelic use	<b>–0.002</b>	<b>0.001</b>	<b>0.002</b>	<b>0.004</b>	<b>0.001</b>	<b>0.001</b>	<b>0.005</b>	<b>0.001</b>	<b>0.000</b>	<b>0.003</b>	<b>0.001</b>	<b>0.000</b>	0.001	0.001	0.414
Cocaine use	0.001	0.001	0.158	<u>0.001</u>	<u>0.001</u>	<u>0.678</u>	0.000	<u>0.001</u>	<u>0.918</u>	<b>0.002</b>	<b>0.001</b>	<b>0.021</b>	–0.000	0.001	0.772
Alcohol use	<b>0.004</b>	<b>0.002</b>	<b>0.014</b>	–0.003	0.004	0.445	<b>–0.010</b>	<b>0.002</b>	<b>0.000</b>	<b>–0.005</b>	<b>0.002</b>	<b>0.031</b>	–0.006	0.004	0.089

Results from multivariate linear regression models. Each model contains six independent variables: sex (coded as female = 1), age (mean-centered), highest educational attainment (quantified from 1 = “Left school before age 16 (no qualifications)” to 6 = “Post-graduate degree (or equivalent)”), lifetime psychedelic use (number of occasions), lifetime cocaine use (number of occasions), and weekly alcohol consumption (units). Results from five models are shown, one for each of five dependent variables: authoritarianism (model adjusted R-square = 0.042), liberalism (model adjusted R-square = 0.022), nature relatedness (model adjusted R-square = 0.071), openness (model adjusted R-square = 0.032), and conscientiousness (model adjusted R-square = 0.043). Values in **bold** represent statistically significant associations (underlined values for positive associations, non-underlined values for negative associations). All five model fits were highly significant vs. a constant model (*p* < 0.001). B = unstandardized regression coefficient, SE = standard error, *p* = P-value.

**Table 4.** Ego dissolution and subject variables.

	Authoritarianism			Liberalism			Nature relatedness			Openness			Conscientiousness		
	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p
Intercept	2.090	0.126	0.000	4.899	0.253	0.000	3.393	0.168	0.000	5.570	0.175	0.000	3.969	0.285	0.000
Sex (F)	0.078	0.051	0.128	0.025	0.103	0.812	<b>0.154</b>	<b>0.068</b>	<b>0.025</b>	<b>0.199</b>	<b>0.071</b>	<b>0.006</b>	0.172	0.116	0.140
Age	<b>0.009</b>	<b>0.002</b>	<b>0.000</b>	0.003	0.004	0.465	<b>0.008</b>	<b>0.003</b>	<b>0.003</b>	0.000	0.003	0.950	<b>0.019</b>	<b>0.005</b>	<b>0.000</b>
Education	<b>-0.074</b>	<b>0.022</b>	<b>0.001</b>	<b>0.169</b>	<b>0.044</b>	<b>0.000</b>	<b>-0.037</b>	0.029	0.202	0.039	0.030	0.200	0.083	0.049	0.094
Ego Dissolution	<b>-0.003</b>	<b>0.001</b>	<b>0.005</b>	<b>0.004</b>	<b>0.002</b>	<b>0.026</b>	<b>0.009</b>	<b>0.001</b>	<b>0.000</b>	<b>0.005</b>	<b>0.001</b>	<b>0.000</b>	0.001	0.002	0.636

Results from multivariate linear regression models. Each model contains four independent variables: sex (coded as female = 1), age (mean-centered), highest educational attainment (quantified from 1 = "left school before age 16 (no qualifications)" to 6 = "post-graduate degree (or equivalent)"), and ego dissolution experienced during most intense psychedelic experience. Results from five models are shown, one for each of five dependent variables: authoritarianism (model adjusted R-square = 0.05), liberalism (model adjusted R-square = 0.030), nature relatedness (model adjusted R-square = 0.092), openness (model adjusted R-square = 0.031), and conscientiousness (model adjusted R-square = 0.033). Values in **bold** represent statistically significant associations (underlined values for positive associations, non-underlined values for negative associations). All five model fits were highly significant vs. a constant model ( $p < 0.001$ ). B = unstandardized regression coefficient, SE = standard error, p = P-value.

ego dissolution for this experience ( $\rho = 0.37$ ,  $p < 0.001$ ).

## Discussion

In this study, psychedelic use (but not cocaine or alcohol use) was associated with liberal and anti-authoritarian political views, openness to new experiences, and nature relatedness, using a large, anonymous Internet survey. Furthermore, the degree of ego dissolution experienced during the most intense recalled psychedelic experience was positively associated with these same four variables, providing evidence for the predictive validity of the Ego-Dissolution Inventory (Nour et al. 2016) and the potential impact of ego-dissolution experiences on attitudes and beliefs.

Political perspectives, openness, and nature relatedness showed significant associations within individuals, suggesting that common causal factors may underlie inter-individual variability in these domains. By extension, the nature of the relationships between psychedelic use (or ego dissolution) and these participant variables may also be related.

The Big Five personality trait of openness encompasses aesthetic appreciation, tolerance of others' viewpoints, and permeability to new experiences (DeYoung, Peterson, and Higgins 2005; MacLean, Johnson, and Griffiths 2011). There is increasing evidence that openness may be particularly affected by psychedelic drug use (Carhart-Harris et al. 2016b; Lerner and Lyvers 2006; MacLean, Johnson, and Griffiths 2011; Studerus et al. 2011). MacLean and colleagues, for example, measured the Big Five personality domains in 52 hallucinogen-naïve healthy participants before and after taking psilocybin (between one and four psilocybin sessions, one of which was with a high dose of 30 mg/70 kg). They reported increases in trait openness over one year after psilocybin, which were associated

with participant-reported mystical experiences during the psilocybin session (MacLean, Johnson, and Griffiths 2011). No other personality traits were significantly altered after psilocybin.

Our results are consistent with these findings in two ways. Firstly, in our sample, psychedelic use was predictive of trait openness, and not trait conscientiousness. Secondly, the degree of ego dissolution experienced during a participant's most intense psychedelic experience was predictive of trait openness. In our sample, cocaine use also predicted trait openness; however, our finding of a positive relationship between preferential psychedelic use (but not preferential cocaine use) and openness is supportive of the hypothesis that psychedelic use, rather than illicit substance use *per se*, is associated with high trait openness.

We found a significant association between psychedelic use and both liberal (or left-leaning) and libertarian (or anti-authoritarian) values. Liberal (or left-leaning) individuals place emphasis on social justice and equality, and are wary of unregulated capitalistic practices (Evans, Heath, and Lalljee 1996). To our knowledge, no recent study has explicitly evaluated the association between psychedelic drug use and political orientation. An early study reported that individuals who used LSD in "non-medical" settings scored higher on attitudes of "personal liberty" and "foreign policy liberalism" than control participants (McGlothlin and Arnold 1971). Another study found that psychedelic users score higher on concern for others, and placed lower value on financial prosperity, compared with people who do not use illicit substances, or those who use amphetamine, cannabis, or heroin (Lerner and Lyvers 2006). Furthermore, a well-established positive association exists between openness and liberalism within individuals (Carney et al. 2008; Sibley, Osborne, and Duckitt 2012; Xu, Mar, and Peterson 2013), a result replicated in the present study.

In our sample, psychedelic use and ego dissolution were more strongly predictive of nature relatedness than any other dependent variable. Very few studies have investigated the relationship between psychedelic use and nature relatedness or environmental concern. One study found that psychedelic users scored higher on concern for environment (as measured by the Life Values Inventory), compared with those who use other illicit substances (amphetamine, cannabis, or heroin) (Lerner and Lyvers 2006). One experimental study found that 38% of participants reported positive changes in their relationship to nature and the environment 8–16 months following 1–4 experimental psilocybin sessions (Studerus et al. 2011). Previous studies suggest that nature relatedness is associated with reduced anxiety (Martyn and Brymer 2016) and increased personal well-being (Capaldi, Dopko, and Zelenski 2014; Zelenski and Nisbet 2014), and that exposure to awe-inspiring nature may increase pro-social behavior (Piff et al. 2015).

Our results indicate that the degree of ego dissolution experienced during an individual's most intense psychedelic experience is associated with inter-individual differences in openness, liberalism, and nature relatedness, and is negatively predictive of authoritarianism. Clearly, our results are not able to answer the question of whether this relationship is a causal one; nor can they determine the direction of any causality. In support of the hypothesis that ego-dissolution experiences cause changes in personality traits and attitudes, several recent experimental studies have reported that the increases in openness following psilocybin or LSD experiences are related to the degree of mystical experience/ego dissolution experienced (Lebedev et al. 2016; MacLean, Johnson, and Griffiths 2011).

The experience of psychedelic-induced ego dissolution encompasses feelings of unity with others and the universe and a reduction in personal self-importance (Nour et al. 2016). Previous work suggests that this experience is highly correlated with the intensity of the psychedelic experience and particularly with the “unitive” aspects of the mystical experience, as measured by a subset of items from the Mystical Experience Questionnaire (Barrett, Johnson, and Griffiths 2015; Nour et al. 2016). The precise relationship between the ego-dissolution experience and the mystical experience remains unknown, and will be an important focus of future experimental studies.

Ego dissolution is related to the experience of awe, which occurs in response to “stimuli that are vast, that transcend current frames of reference, and that require new schemata to accommodate what is being perceived” (Piff et al. 2015). It has been suggested that

self-transcendental experiences such as awe have the potential to catalyze psychological change within an individual (Haidt 2013; James 1985; Lebedev et al. 2016; Majić, Schmidt, and Gallinat 2015; Unger 1963), and may increase pro-social behavior and ethical decision making by shifting attention away from one's individual concerns and towards the larger entities that an individual is part of (Piff et al. 2015; Rudd, Vohs, and Aaker 2012). This shift in attention, if sustained, naturally resonates with egalitarian political views, increased feelings of connectedness with the natural world, and increased tolerance for others' viewpoints.

Hypotheses on the neurobiological basis of “unitive experiences” induced by psychedelic drugs have recently been proposed (Carhart-Harris et al. 2013; Roseman et al. 2014; Tagliazucchi et al. 2016). These have focused on findings of decreased functional differentiation or segregation between brain “resting state” networks concerned with internal and external processing (e.g., the Default Mode Network and Dorsal Attention Network, respectively) (Carhart-Harris et al. 2016c; Roseman et al. 2014). This biological phenomenon has been linked to the blurring of boundaries between “self/ego” and “object,” also referred to as disturbed “ego boundaries” (Nour et al. 2016). Increased global integration is a natural corollary of decreased modular differentiation in the brain (Tagliazucchi et al. 2016). It has been suggested that psychedelic-induced global integration in the brain mirrors the subjective sense of “oneness” that is reported in association with ego dissolution (Nour et al. 2016) and mystical experiences (Stace 1960). Future work is needed to test these hypotheses further, and to address knowledge gaps about potential long-term changes in brain function after psychedelics, and how these relate to long-term psychological changes, such as those discussed here.

This study has some limitations. First, although we demonstrate several significant associations between psychedelic use and personal attitudes and personality traits, these cross-sectional results cannot be viewed as evidence that psychedelic use causes increases in liberalism, nature relatedness, or openness. Second, our sample is skewed in many ways. The majority of participants were under 30 years old, male, and well-educated. Half had used psychedelics on over 10 occasions, and a third had used cocaine on over 10 occasions. Most participants identified as politically liberal, and scored highly on trait openness, conscientiousness, and nature relatedness, while scoring low on authoritarianism. Although we did not collect information on the ethnicity, it is likely that our sample was predominated

by English-speaking participants from Europe and North America. These considerations limit generalizability.

Third, the use of retrospective and unverified ratings of drug use, and retrospective ratings of previous psychedelic experiences, introduce a potential source of inaccuracy into our results. Fourth, we used short validated scales to reduce questionnaire length and maximize the diversity of information collected. The use of short scales, however, limits the accuracy with which certain constructs can be measured. Finally, the terms “ego” and “self,” which feature in the Ego-Dissolution Inventory, were undefined in this survey. Previous work, however, supports the hypothesis that these terms have a relatively uniform understood meaning in the context of the psychedelic experience, as demonstrated by the uni-dimensional factor structure of the Ego-Dissolution Inventory (Nour et al. 2016). These final three limitations, however, would be predicted to weaken any associations found in this study.

Our results support the conclusion that naturalistic psychedelic use is associated with increased liberalism, nature relatedness and openness, and decreased authoritarianism, in the study sample. This pattern of associations is unlikely to be driven by illicit drug use in general, as it did not extend to cocaine use. Moreover, this pattern of associations also existed between the same four participant variables and the degree of ego dissolution experienced under psychedelics, indicating that the associations are related to a paradigmatic aspect of the psychedelic experience itself. This also provides evidence for the predictive validity of the Ego-Dissolution Inventory (EDI), a recently developed measure of ego dissolution (Nour et al. 2016). Future experimental studies are required to determine whether these associations are causal in nature. Such studies should also endeavor to recruit samples that are more representative of the general population.

## Acknowledgments

MMN, LE, and RLC-H conceived of and designed this study and interpreted the results, contributed to drafting the work, and revised it critically for important intellectual content. All authors approved the final version of this manuscript to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work be appropriately investigated and resolved. MMN undertook statistical analysis of the data. LE managed the implementation of the questionnaire and subsequent data collection. MMN wrote the article, with editing from RLC-H.

## Funding

MMN is funded by the National Institute for Health Research, UK. RLC-H is funded by Mosley Foundation.

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