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Opening to Awe: Psychedelic-Assisted Self-Transcendence and Positive Adult Development

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Abstract
Recent studies implicate the use of psychedelic substances in the treatment of psychiatric conditions. However, this literature also suggests that the psychedelics may have utility in the promotion of positive adult development. Accordingly, this paper outlines a study exploring this premise. An online sample ($n = 684$) of psychedelic users and non-users (age range: 18–24 to 75–84; median = 25–34) was recruited. Conditional process analysis was used to assess whether the relationship between psychedelic use and two facets of adult development, adjustment and growth, would be mediated by openness to experience, awe-proneness, and mystical experiences, and whether these relationships would be moderated by drug-use reflection/integration. Results show that the direct relationship between psychedelic use and growth was moderated by drug-use reflection/integration. In addition, the indirect relationship between psychedelic use and adjustment was mediated through awe-proneness, while the indirect relationships between psychedelic use and growth were mediated via awe-proneness and openness to experience; drug-use reflection/integration moderated these mediated relationships. In addition, drug-use reflection/integration directly predicted openness, awe-proneness, and growth. These findings suggest that, when used with self-expansive intentions and actively reflected upon and integrated post use, psychedelics may augment positive adult development.

Keywords Psychedelics · Awe · Self-transcendence · Adult development · Personality growth · Entheogens

Although psychedelic substances have seen use for millennia (Nichols, 2016), clinical and experimental research in the mid-twentieth century came to regard these drugs as therapeutic agents and tools to explore psychological processes (Grinspoon & Bakalar, 1979). Given their success in catalyzing psychotherapy, early research suggested that psychedelics might augment adult development (Masters & Houston, 1966). However, concerns about their dangers as well as burgeoning recreational use culminated in severe legal restrictions, which greatly curtailed further study. However, with loosening restrictions, recent studies have revealed that psychedelic use is frequently linked to psychological and spiritual benefits (Carhart-Harris & Nutt, 2010; Lerner & Lyvers, 2006; Lyvers & Meester, 2012; Móró et al., 2011; Prepeliczay, 2002; Stasko et al., 2012). Although this literature suggests that psychedelics may have relevance for adult development (Gandy, 2019; Jungaberle et al., 2018), few studies have examined this premise.

Positive Adult Development and Self-Transcendence

Current research suggests that there are two overarching facets of positive adult development: *personality adjustment* and *personality growth* (Staudinger & Kessler, 2009; Staudinger & Kunzmann, 2005). Personality adjustment considers the degree to which an individual masters the demands of their environment, achieves adaptive functioning, meets societal expectations, and experiences life-satisfaction and hedonic well-being (Diener et al., 1985; Staudinger & Kunzmann, 2005). In comparison, personality growth is characterized by deep insight into self, others, and

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the world, complex emotion regulation, eudaimonic well-being, self-transcendence, and personal wisdom (Staudinger & Kessler, 2009).

Humanistic psychologists were among the first to note that advanced development entails a *transhumanistic* or transpersonal quality. For example, Maslow (1971) identified a tier of development beyond self-actualization he termed *self-transcendence*. Similarly, Tornstam (1989) described the development of self-transcendence as a characteristic of maturity—regardless of chronological age—entailing a shift from a materialistic perspective toward a cosmic and transcendent one. Research has shown that self-transcendence is associated with various indices of adjustment and growth (Levenson et al., 2005; Mickler & Staudinger, 2008).

The term *self-transcendence* has also been applied to states of consciousness entailing a decreased sense of self and enhanced connectedness (Yaden et al., 2017). These *self-transcendent* or *hypo-egoic* experiences, which include flow, awe, and mystical states, have garnered the attention of psychologists due to research showing their association with well-being, prosociality, and spirituality (Leary & Guadagno, 2011). Self-transcendent experiences are associated with changes in beliefs about the meaning of life, selflessness, and a sense of the oneness of all things—features that suggest growth (Leary & Guadagno, 2011). Similarly, self-transcendent emotions, such as awe, have been shown to evoke curiosity, creativity, and exploration and are thus believed to encourage development (Van Cappellen & Rimé, 2014). Awe evokes a "need for accommodation" (Keltner & Haidt, 2003, p. 304) which requires the expansion of mental schemes to integrate the experience. Awe thus "broaden[s] and build[s]" (Fredrickson, 2001, p. 219), one's mindset, promoting growth through the reshaping of one's worldviews. When accommodation is successful, awe is felt as a sense of renewed meaning, coherence, and unity (Bonner & Friedman, 2011; Ihm et al., 2020). Experiences of awe, and dispositional awe-proneness, are associated with various indices of adjustment and growth, including self-insight, gratitude, well-being, life-satisfaction, humility, prosocial motivations, and mindfulness (see Hendricks, 2018).

As the most potent self-transcendent state, mystical experiences are also believed to foster development. For example, Maslow (1971) believed that peak and plateau experiences might facilitate self-actualization and self-transcendence. Similarly, Kohlberg and Ryncarz (1990) proposed that an advanced stage of development may be awakened through experiencing, and reflecting upon, self-transcendent states, while Trowbridge (2011) argued that mystical states may contribute to the development of wisdom. Empirical studies indicate that mystical experiences are indeed associated with indices of adjustment and growth (Klein et al., 2016; Van Dierendonck & Mohan, 2006). Accordingly, an intervention designed to promote self-transcendent experiences may catalyze adult development (Levenson et al., 2005; Maslow, 1971). Given that the classic psychedelics can reliably evoke such states (Griffiths et al., 2006), self-transcendence may function as a bridge between the use of these substances and adult development.

Classic Psychedelics

Although many drugs hold psychedelic properties, the *classic psychedelics,* such as psilocybin and lysergic acid diethylamide (LSD), are distinguished by their action as potent serotonin (5-HT2A) agonists (Nichols, 2016). These substances are among the safest known psychoactive drugs, as they exhibit low toxicity, are non-addictive, and are not associated with societal harms (see Nichols, 2016; Nutt et al., 2007). However, they can increase pulse rate and blood pressure, thus contraindicating their use by individuals with cardiovascular disease. In addition, prescription and over-the-counter drugs that modulate serotonin—as well as lithium and haloperidol—may potentiate their effects (Johnson et al., 2008). However, despite their limited physiological adverse effects, psychedelics may produce anxiety, paranoia, confusion, and psychotic-like reactions (Griffiths et al., 2006; Johnson et al., 2008). Such experiences can be not only incredibly harrowing, but also potentially dangerous. Although highly distressing psychedelic experiences are typically transient, such states *may* precipitate mental health problems in predisposed individuals, such as those with psychotic disorders (Nichols, 2016; Vardy & Kay, 1983 Accordingly, these substances should be approached with great caution.

Classic Psychedelics and Positive Psychology

Although the classic psychedelics have clear relevance for psychiatry (Hendricks, 2018), their potential to enhance wellness is believed to be at least as substantial as their effectiveness as therapeutic tools (Gandy, 2019; Jungaberle et al., 2018). In the initial era of psychedelic research, it was noted that beneficial outcomes could occur when psychedelics were used under non-medical conditions, and it was argued that they held legitimate uses beyond the therapeutic context (Masters & Houston, 1966). However, despite the proposal that these drugs may hold benefit as developmental tools, little research has examined this premise. In one study, Walsh (1982) investigated five individuals judged exemplars of self-actualization who used psychedelics for developmental purposes. Based on this research, Walsh concluded that psychedelics could be used to augment growth and well-being. In a similar study, Prepeliczay (2002) found that psychedelic users reported that their use had relevance for their process of individuation. Similarly, Marko (2011) reported

that psychedelic use was associated with ego development, while Stasko et al. (2012) found an enhanced sense of meaning and purpose among psychedelic users. Recreational classic psychedelic use is also associated with mysticism, concern for others, and spirituality (Lerner & Lyvers, 2006; Móró et al., 2011)—attributes which suggest adjustment and growth (Klein et al., 2016; Wayment et al., 2015).

Conceptualizing Psychedelic-Assisted Positive Adult Development

Based on the extant literature, it is plausible that psychedelics may hold utility to enhance positive adult development. However, the use of these drugs in and of itself is likely insufficient to promote growth and adjustment. Rather, to understand the outcome of drug use, one must understand various non-pharmacological factors—the *set* and *setting* of the user (Nichols, 2016).

Intentions for Psychedelic Use

One's intention for using a substance is a central factor shaping the nature of a drug experience and the outcomes of use (Móró et al., 2011). Using factor analysis, Haijen et al. (2018) found three broad intentions for using psychedelics among recreational users (*spiritual connection*, *recreation*, and *emotional* purposes), and noted that use for *spiritual connection* was related to well-being. Similarly, Móró et al. (2011) found that using psychedelics with *autognostic* intentions (e.g., self-insight, growth) was associated with intrinsic spirituality. Comparably, Simons et al. (1998) reported that psychedelics may be used for *expansion*, while Prochazkova et al. (2018) found that psychedelics may enhance creativity. Deliberate spiritual, autognostic, expansive, or creative psychedelic use may thus augment adult development.

Openness to Experience

Openness to experience may also be relevant to understanding the impact of psychedelics on adult development, as recent experimental studies have suggested that psychedelics may increase this trait. Carhart-Harris et al. (2016) and Lebedev et al. (2016) found increases in openness following LSD but not placebo, while MacLean et al. (2011) found that a single dose of psilocybin was associated with increases in openness persisting for at least one year. Given that openness is a predictor of growth (Staudinger & Glück, 2011) and adjustment (Steel et al., 2008), it is plausible that psychedelic-enhanced openness may contribute to adult development.

Self-Transcendent Experiences

One of the most robust research findings in the psychedelic literature is the capacity for these substances to foster self-transcendent experiences with lasting positive effects (e.g., Griffiths et al., 2006). Profoundly transformative feelings of awe are frequently reported by individuals who have taken a psychedelic in experimental or clinical settings (Hendricks, 2018), and even a single dose of psilocybin can induce mystical experiences with lasting positive effects on personality, values, and spirituality (Griffiths et al., 2006; MacLean et al., 2011).

Drug-Use Reflection and Integration

Aldwin et al. (2019) have argued that although psychedelics can evoke powerful self-transcendent experiences, their lasting impact may be ephemeral. Indeed, it has long been suggested that psychedelic experiences must be reflected upon and integrated to have a lasting impact (Walsh, 2003). Comparably, deliberate self-reflection is central to adult development (Staudinger, 2001). Thus, deliberately integrating one's psychedelic experiences into daily life may be associated with development. Moreover, reflecting upon one's drug experiences may amplify any insights, openness, or self-transcendence experienced as a function of use, thus magnifying this association. In other words, intentional psychedelic use *paired* with drug-use reflection/integration may interact to further augment their respective benefits on development.

The Present Study

The present study sought to examine the relationships between judicious (spiritual, autognostic, expansive, creative) psychedelic use, openness, awe, mystical experiences, and development. Three hypotheses were proposed: (1) psychedelic use, openness, awe-proneness, mystical experiences, adjustment, and growth will be correlated; (2) the relationships between psychedelic use and adjustment and growth will be mediated by openness, awe-proneness, and mystical experiences; (3) the relationships between psychedelic use and adjustment and growth will be moderated by drug-use reflection such that the association between psychedelic use and development is expected to be stronger among those who engage in drug-use reflection.

Methods

Participants

Participants were recruited from online communities of drug users (e.g., MAPS, Erowid, Bluelight), and general forums to recruit a sample of non-drug users (e.g., Reddit, Facebook). The survey was administered using REDCap, an online survey tool compliant with privacy requirements. In total, 684 surveys were completed. As less than 0.5% of data were missing, expectation maximization was used for imputation (Gold & Bentler, 2000). Maximum-likelihood strategies have demonstrated superiority to deletion, non-stochastic, and stochastic regression imputation methods (Schlomer et al., 2010). The Research Ethics Office at the University of Alberta approved the study; data were collected from September 2018 to April 2019.

Measures

The survey included questions assessing age, sex, education, location, financial stability, spirituality, and meditation practice. Participants could respond to demographic questions with "prefer not to say." Sex was measured with three categories (*female*, *male*, and *other*). Education was quantified on an eight-point scale from *less than a high school diploma* to *doctoral degree*. Location assessed continent of residence. Financial stability was assessed on a five-point scale from *very poor* to *very secure*. Spirituality was assessed with a single item, "Spirituality is important in my life", on a seven-point scale from *strongly disagree* to *strongly agree*. Meditation practice was assessed with a single item, "How often do you engage in a formal meditation practice?" using a five-point scale from *never* to *daily*.

Psychedelics Use Parameters

The *Alcohol, Smoking, and Substance Involvement Screening Test* (ASSIST) was used to measure psychedelic use parameters (World Health Organization, 2022). Participants were asked about life-time use, frequency of use, typical dosage, and group use. Twelve non-exclusive use intentions were assessed: boredom, spiritual, socializing, to enjoy the sensation, to understand things differently, creativity, to fit in with a group, curiosity, to forget my worries, introspection, relaxation, and to party. Participants were asked to rate how often they use psychedelics with *each* intention on a six-point scale (0 = *I don't use psychedelics*; 1 = *never or almost never*; 2 = *some of the time*; 3 = *half of the time*; 4 = *most of the time*; 5 = *always or almost always*).

Congruent with Haijen et al. (2018), an exploratory factor analysis (principal axis factoring, promax rotation) of the 12 use intentions was conducted. Three factors (Kaiser's eigenvalue greater than one rule) were found, with items loading greater than 0.30 retained. These three factors are consistent with Haijen et al. (2018) and Móró et al. (2011). The first factor, *self-expansion,* accounted for 18.95% of variance, and comprised four items: spiritual, creativity, to understand things differently, and introspection ($\alpha = 0.72$). The second factor, *social/recreational,* accounted for 16.68% of the variance, and comprised four items: boredom, socializing, to fit in with the group, and to party ($\alpha = 0.69$). The third factor, *coping with negative affect,* accounted for 4.5% of the variance, and comprised two items: to forget my worries and relaxation ($\alpha = 0.61$).

Self-Expansive Psychedelic Use

A *Self-Expansive Psychedelic Use Scale* was created by taking the average of spiritual, creative, to understand things differently, and introspective intentions. Internal consistency was $\alpha = 0.72$.

Drug-Use Reflection/Integration

A drug-use reflection/integration scale comprised three items: (1) Overall, I try to reflect on my drug experiences, (2) Overall, I try to integrate new perspectives gained through my drug experiences into my day-to-day life, (3) Overall, I try to learn from my drug experiences. Each item used a six-point scale (0 = *I don't use psychedelics*; 1 = *never or almost never*; 2 = *some of the time*; 3 = *half of the time*; 4 = *most of the time*; 5 = *always or almost always*). The average of these items formed a drug-use reflection/integration scale; internal consistency was $\alpha = 0.88$.

Openness to Experience

The 10-item openness to experience subscale of the *Big Five Inventory-44 (BFI-44)* was used to assess openness (John & Srivastava, 1999). Items begin with the stem "I see myself as someone who…" and are responded to with a seven-point scale from *strongly disagree* to *strongly agree.* An example item is "likes to reflect, play with ideas". The average of these 10 items was used to form an openness scale score with an internal consistency of $\alpha = 0.78$.

Awe-Proneness

Shiota and colleagues (2006) developed the 38-item *Dispositional Positive Emotion Scale* to measure one's tendency to six positive emotions. In the present study, the six-item *awe subscale* was used to assess the degree to which participants experience awe in daily life. Items were responded to on a seven-point scale from *strongly disagree* to *strongly agree*.

An example item is "I feel wonder every day". The average of the six awe items was used to form an awe-proneness scale with an internal consistency of $\alpha = 0.80$.

Mystical Experiences

Hood's 12-item *Mysticism Scale-Short Form* (Anthony et al., 2010) assessed participants' mystical experiences. Each item is rated on a five-point scale, from *definitely not* to *definitely yes*. An example is "I have had an experience which I knew to be sacred". The average of these 12 items was used to form a mystical experiences scale with an internal consistency of $\alpha = 0.90$.

Personality Adjustment

Personality adjustment was assessed as a composite of one scale and three subscales. The *Satisfaction with Life Scale* (Diener et al., 1985) includes five items rated on a seven-point scale ranging from *strongly disagree* to *strongly agree*. An example item reads "In most ways my life is close to my ideal". The average of these five items was used to form a satisfaction with life score with an internal consistency of $\alpha = 0.90$. The *Scales of Psychological Well-Being* (Ryff & Keyes, 1995) includes six, three-item subscales. Each item is rated on a seven-point scale ranging from *strongly disagree* to *strongly agree*. Three subscales measure adjustment: environmental mastery, positive relations with others, and self-acceptance. The average of the three environmental mastery items was used to form a scale score with an internal consistency of $\alpha = 0.70$. An example item is "I am quite good at managing the responsibilities of my daily life". The average of the three positive relations with others items was used to form a scale score with an internal consistency of $\alpha = 0.59$. An example item is "Maintaining close relationships has been difficult and frustrating for me". The average of three self-acceptance items was used to form a scale score with an internal consistency of = 0.77. An example item is "I like most aspects of my personality". Similar to previous research (Mickler & Staudinger, 2008; Wink & Staudinger, 2016), the *Satisfaction with Life Scale* and the *Environmental Mastery, Positive Relations with Others,* and *Self-Acceptance* scale scores were combined to create an adjustment scale. To ensure equal weighting, the average of these scales was used to form a personality adjustment scale with an internal consistency of $\alpha = 0.86$. Confirmatory factor analysis found that the four subscales were well associated with the latent variable (adjustment) and statistically significant. Model fit was excellent: $\chi^2(2) = 0.334$, $p = 0.846$, NFI = 1, CFI = 1, RMSEA = 0.000 (Hu & Bentler, 1999).

Personality Growth

Personality growth was assessed as a composite of two scales and three subscales. The *Quiet Ego Scale* (Wayment et al., 2015) includes 14 items rated on a seven-point scale from *strongly disagree* to *strongly agree*. An example item reads "I try to look at everybody's side of a disagreement before I make a decision". The average of these 14 items was used to form a quiet ego scale score with an internal consistency of $\alpha = 0.81$. The *Adult Self-Transcendence Inventory* (Koller et al., 2017) includes 24 items rated on a seven-point scale from *strongly disagree* to *strongly agree*. An example item reads "I feel that my individual life is a part of a greater whole". The average of these 24 items was used to form a self-transcendence scale score with an internal consistency of $\alpha = 0.89$. As noted, the *Scales of Psychological Well-Being* (Ryff & Keyes, 1995) includes six, three-item subscales. Three subscales measure personality growth: purpose in life, personal growth, and autonomy. The average of the three purpose in life items was used to form a scale score with an internal consistency of $\alpha = 0.55$. An example is "I sometimes feel as if I've done all there is to do in life". The average of the three personal growth items was used to form a scale score with an internal consistency of $\alpha = 0.66$. An example is "For me, life has been a continuous process of learning, changing, and growth". The average of the three autonomy items was used to form a scale score with an internal consistency of $\alpha = 0.53$. An example is "I have confidence in my own opinions, even if they are contrary to the general consensus".

Expanding on previous research (Bauer & Wayment, 2008; Glück et al., 2013; Mickler & Staudinger, 2008; Wayment et al., 2015; Wink & Staudinger, 2016), the *Quiet Ego Scale*, the *Adult Self-Transcendence Inventory*, and the *Purpose in Life, Personal Growth,* and *Autonomy* subscales were combined to create a personality growth measure. To ensure equal weighting, the average of these scales was used to form a scale score with an internal consistency of $\alpha = 0.77$. However, confirmatory factor analysis showed poor model fit: $\chi^2(5) = 65.51$, $p < 0.001$. NFI = 0.939, CFI = 0.943, RMSEA = 0.133 (see Hu & Bentler, 1999). Given that autonomy showed the weakest factor loading and some research suggests only personal growth and purpose in life are indicators of personality growth (Staudinger & Glück, 2011; Staudinger et al., 2005), autonomy was dropped from the scale. Internal consistency of this personality growth index was $\alpha = 0.79$, and model fit was acceptable $\chi^2(2) = 13.16$, $p < 0.001$, NFI = 0.985, CFI = 0.987, RMSEA = 0.09.

Social Desirability Bias

The *Marlowe–Crowne Social Desirability Scale—Short* (Vésteinsdóttir et al., 2017) was used to measure social

Table 1 Participant characteristics

Characteristic	*n*	%
Age		
18–24	270	39.5
25–34	247	36.1
35–44	86	12.6
45–54	34	5.0
55–64	25	3.7
65–74	15	2.2
75–84	3	0.4
Prefer not to say	4	0.6
Sex		
Female	261	38.2
Male	394	57.5
Other	25	3.7
Prefer not to say	4	0.6
Education		
Less than high school	18	2.6
High school or equivalent	103	15.1
Some college	206	30.1
Associate degree/two-year diploma	57	8.3
Bachelor's degree	195	28.5
Master's degree	63	9.2
Professional degree	19	2.8
Doctorate	13	1.9
Prefer not to say	8	1.2
Location		
Africa	3	0.4
Asia	9	1.3
Australia/Oceania	20	2.9
Europe	109	15.9
North America	530	77.5
South America	10	1.4
Prefer not to say	3	0.4
Financial Stability		
Very poor	28	4.1
Poor	141	20.6
Average	260	38
Secure	207	30.3
Very secure	48	7.0

desirability bias. This scale contains 10 *true/false* items. The average of these 10 items was used to form a social desirability score with internal consistency of $\alpha = 0.60$.

Results

All analyses were performed using SPSS (Statistical Package for the Social Sciences) Version 26. The analysis included three phases. Phase 1 examined descriptive statistics. Phase 2 examined correlations. Phase 3 examined the moderated-mediation.

Participant Characteristics

Participant characteristics can be viewed in Table 1. The sample ranged from 18–24 to 75–84, with a median age of 25–34. In total, 38.2% of participants identified as female, and 57.3% as male. Participants came from all inhabited continents, with most (77.5%) in North America. The sample ranged from less than a high school diploma to a doctoral degree, with most (81%) having at least some college education. Most rated their financial stability as average (38%) followed by secure (30.6%). Of the 684 participants, 511 reported using psychedelics.

Correlation Analysis

Means, standard deviations, and correlations among the study variables are presented in Table 2. Self-expansive psychedelic use, openness to experience, awe-proneness, mystical experiences, adjustment, and growth had moderate to strong positive intercorrelations.

Moderated-Mediation Analysis

Analyses examined (1) whether openness, awe-proneness, and mystical experiences mediate the relationships between self-expansive psychedelic use and adjustment and growth, and (2) whether drug-use reflection moderates these relationships. The PROCESS macro, with Model 8 (Hayes, 2018), was used for the path analyses. Due to multicollinearity between self-expansive psychedelic use, drug-use reflection, and their interaction, these variables were mean-centered. Age, sex (dummy variables—"male" excluded as the reference category), education, financial stability, spirituality, meditation, and social desirability were included as covariates.

Self-Expansive Psychedelic Use and Openness to Experience

Analysis revealed a statistically significant model, $F(12, 660) = 9.03$, $p < 0.001$, $R^2 = 0.14$. Self-expansive use ($\beta = 0.11$, $p = 0.045$), drug-use reflection ($\beta = 0.23$, $p < 0.001$), and their interaction ($\beta = 0.13$, $p = 0.012$; Table 3) predicted openness. Simple slopes showed the relationship between self-expansive use and openness was not significant for those with low drug-use reflection (one standard deviation below the mean; $B = -0.01$, $p = 0.862$). However, the

Table 2 Bivariate correlations of study variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	*M*	*SD*	*n*
1. Personality Adjustment	—												4.38	1.23	684
2. Personality Growth	.73**	—											5.24	.78	684
3. Self-Expansive Psychedelic Use	.22**	.37**	—										2.78	1.84	684
4. Drug-Use Reflection/Integration	.19**	.35**	.68**	—									3.65	1.45	684
5. Openness to Experience	.27**	.46**	.29**	.27**	—								5.43	.79	684
6. Awe-Proneness	.52**	.67**	.35**	.36**	.47**	—							5.27	1.13	684
7. Mystical Experiences	.30**	.45**	.53**	.46**	.36**	.49**	—						4.06	.88	684
8. Age	.11**	.07	.04	−.03	.10**	.04	.09*	—					2.05	1.23	680
9. Education	.24**	.18**	.01	−.01	.06	.07	.01	.39**	—				3.95	1.55	676
10. Financial Stability	.42**	.27**	.01	.03	.06	.19**	.06	.07	.22**	—			3.15	.96	684
11. Spirituality	.33**	.42**	.33**	.25**	.23**	.38**	.46**	.16**	.12**	.06	—		4.47	2.16	684
12. Meditation Frequency	.24**	.37**	.35**	.30**	.25**	.30**	.37**	.10**	.11**	.10**	.44**	—	2.68	1.43	684
13. Social Desirability Bias	.26**	.30**	.08*	.08*	.07	.22**	.09*	.08	.07	.12**	.17**	.06	.36	.20	684

*p < 0.05; **p < 0.01

relationship was significant for those with average (at the mean; B = 0.05, $p = 0.044$), and high (one standard deviation above the mean; B = 0.09, $p = 0.001$) drug-use reflection (Fig. 1).

Self-Expansive Psychedelic Use and Awe-Proneness

Analysis revealed a statistically significant model, $F(12, 660) = 24.20$, $p < 0.001$, $R^2 = 0.31$ Self-expansive use (β = 0.13, $p = 0.005$), drug-use reflection (β = 0.32, $p < 0.001$), and their interaction (β = 0.19, $p < 0.001$; see Table 3) predicted awe-proneness. Simple slopes showed the relationship between self-expansive use and awe-proneness was not statistically significant for those with low drug-use reflection (one standard deviation below the mean; B = -0.04, $p = 0.368$), though it was statistically significant for those with average (at the mean; B = 0.08, $p = 0.005$) and high (one standard deviation above the mean; B = 0.19, $p < 0.001$) drug-use reflection (Fig. 2).

Self-Expansive Psychedelic Use and Mystical Experiences

Analysis revealed a statistically significant model, $F(12, 660) = 37.29$, $p < 0.001$, $R^2 = 0.40$.

Self-expansive use (β = 0.32, $p < 0.001$) and drug-use reflection (β = 0.15, $p = 0.005$) predicted mystical experiences, but their interaction effect did not (β = 0.01, $p = 0.763$; see Table 3).

Self-Expansive Psychedelic Use and Personality Adjustment with no Mediators

The adjustment model was first run without mediators and was statistically significant, $F(12, 660) = 26.41$, $p < 0.001$, $R^2 = 0.32$. Self-expansive use did not predict adjustment (β = 0.08, $p = 0.085$), but drug-use reflection (β = 0.12, $p = 0.032$) and their interaction did (β = 0.11, $p = 0.015$). Simple slopes showed the relationship between self-expansive use and adjustment was not statistically significant for those with low (one standard deviation below the mean; B = -0.01, $p = 0.749$) or average (at the mean; B = 0.05, $p = 0.085$) drug-use reflection, though it was significant for those with high (one standard deviation above the mean; B = 0.12, $p = 0.003$) drug-use reflection.

Self-Expansive Psychedelic Use and Personality Growth with no Mediators

The growth model first was run without mediators and was statistically significant, $F(12, 660) = 34.31$, $p < 0.001$, $R^2 = 0.38$. Self-expansive use (β = 0.12, $p = 0.005$), drug-use reflection (β = 0.27, $p < 0.001$), and their interaction (β = 0.18, $p < 0.001$) predicted growth. Simple slopes showed the relationship between self-expansive use and growth was not statistically significant for those with low drug-use reflection (one standard deviation below the mean; B = -0.02, $p = 0.351$). The relationship was significant for those with average (at the mean; B = 0.05, $p = 0.006$) and high (one standard deviation above the mean; B = 0.12, $p < 0.001$) drug-use reflection (Fig. 3).

Table 3 Moderated-Mediation Analyses

Effect	B	*SE*	β	95% CI		*p*
				LL	*UL*	
Openness to Experience						
Intercept	4.97	.13	—	4.71	5.22	< .001
Self-Expansive Psychedelic Use	.05	.02	.11	.001	.09	.045
Drug-Use Reflection/Integration	.13	.03	.23	.06	.19	< .001
Interaction Effect	.04	.01	.13	.01	.06	.012
Age	.05	.03	.08	.002	.10	.042
Female	−.08	.06	−.05	−.20	.04	.186
Other	.09	.16	.02	−.22	.40	.587
Prefer Not to Say	1.16	.53	.08	.12	2.20	.029
Education	.004	.02	.01	−.04	.04	.861
Financial Stability	.01	.03	.01	−.06	.07	.859
Spirituality	.02	.02	.06	−.01	.05	.152
Meditation Frequency	.06	.02	.11	.02	.11	.009
Social Desirability Bias	.01	.15	.02	−.21	.36	.596
Awe-Proneness						
Intercept	3.78	.17	–	3.45	4.11	< .001
Self-Expansive Psychedelic Use	.08	.03	.13	.02	.14	.005
Drug-Use Reflection/Integration	.25	.04	.32	.17	.34	< .001
Interaction Effect	.08	.02	.19	.05	.12	< .001
Age	−.02	.03	−.03	−.09	.04	.478
Female	.21	.08	.09	.06	.37	.007
Other	.26	.20	.04	−.14	.65	.204
Prefer Not to Say	1.26	.67	.06	−.07	2.58	.063
Education	−.01	.03	−.01	−.06	.05	.805
Financial Stability	.15	.04	.13	.07	.22	< .001
Spirituality	.11	.02	.21	.07	.15	< .001
Meditation Frequency	.05	.03	.07	−.01	.11	.072
Social Desirability Bias	.68	.19	.12	.32	1.04	< .001
Mystical Experiences						
Intercept	3.36	.12	—	3.12	3.60	< .001
Self-Expansive Psychedelic Use	.15	.02	.32	.11	.20	< .001
Drug-Use Reflection/Integration	.09	.03	.15	.03	.15	.005
Interaction Effect	.004	.01	.01	−.02	.03	.763
Age	.04	.02	.05	−.01	.08	.136
Female	.04	.06	.02	−.07	.16	.468
Other	.35	.15	.08	.06	.64	.017
Prefer Not to Say	.16	.49	.01	−.81	1.13	.742
Education	−.03	.02	−.06	−.07	.004	.082
Financial Stability	.03	.03	.03	−.03	.08	.329
Spirituality	.11	.01	.28	.08	.14	< .001
Meditation Frequency	.06	.02	.09	.02	.10	.008
Social Desirability Bias	−.04	.14	−.01	−.30	.23	.792
Personality Adjustment						
Intercept	−.18	.33	—	−.82	.46	.577
Self-Expansive Psychedelic Use	.01	.03	.02	−.05	.07	.674
Drug-Use Reflection/Integration	−.01	.04	−.01	−.09	.08	.872
Interaction Effect	.01	.02	.03	−.02	.05	.452
Openness to Experience	.04	.05	.03	−.06	.15	.441
Awe-Proneness	.39	.04	.36	.31	.48	< .001

Table 3 (continued)

Effect	B	*SE*	β	95% CI		*p*
				LL	*UL*	
Mystical Experiences	.05	.06	.04	−.06	.16	.374
Age	.002	.03	.002	−.06	.07	.956
Female	.04	.08	.02	−.12	.19	.636
Other	−.39	.20	−.06	−.79	.01	.053
Prefer Not to Say	−.84	.68	−.04	−2.17	.48	.213
Education	.09	.03	.11	.03	.14	.001
Financial Stability	.38	.04	.30	.31	.46	< .001
Spirituality	.06	.02	.11	.02	.10	.003
Meditation Frequency	.0001	.03	.0001	−.06	.06	.998
Social Desirability Bias	.64	.19	.11	.28	1.01	.001
Personality Growth						
Intercept	1.76	.18	—	1.41	2.11	< .001
Self-Expansive Psychedelic Use	.01	.02	.03	−.02	.05	.418
Drug-Use Reflection/Integration	.05	.02	.10	.01	.10	.029
Interaction Effect	.03	.01	.09	.01	.04	.014
Openness to Experience	.15	.03	.15	.09	.21	< .001
Awe-Proneness	.28	.02	.40	.23	.33	< .001
Mystical Experiences	.06	.03	.07	−.001	.12	.055
Age	−.03	.02	−.04	−.07	.01	.09
Female	.02	.04	.01	−.06	.11	.618
Other	−.13	.11	−.03	−.35	.09	.241
Prefer Not to Say	−.21	.37	.02	−.52	.94	.537
Education	.05	.01	.09	.02	.08	.001
Financial Stability	.10	.02	.13	.06	.15	< .001
Spirituality	.03	.01	.09	.01	.06	.004
Meditation Frequency	.05	.02	.08	.01	.08	.006
Social Desirability Bias	.53	.10	.14	.33	.734	< .001

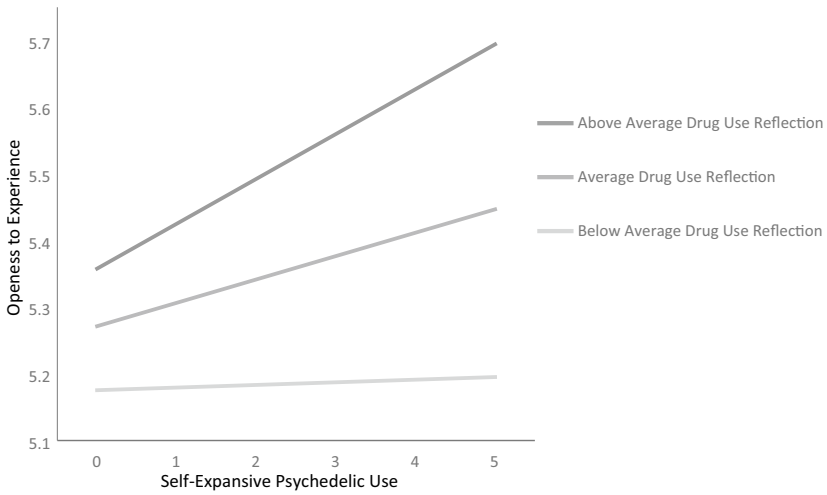


Fig. 1 Self-Expansive Psychedelic Use and Openness to Experience Moderated by Drug-Use Reflection/Integration**.** Below average (-1SD), average (M), and above average (+1SD) drug-use reflection/integration, respectively: 2.21, 3.65, and 5.00

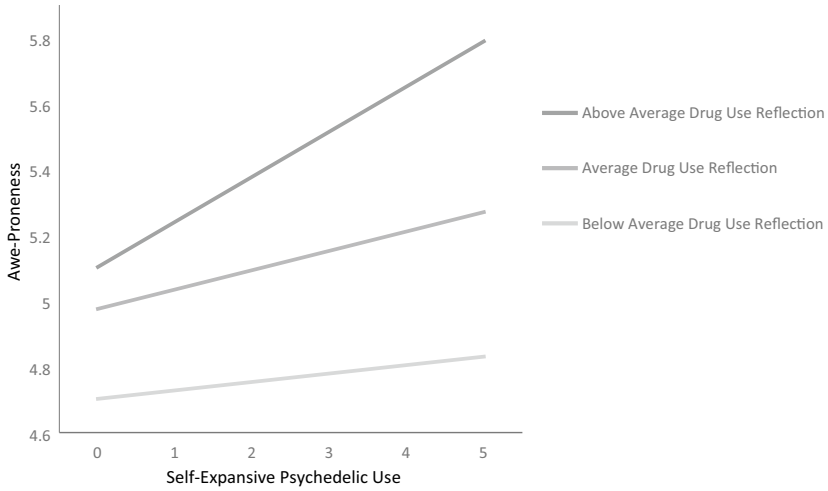


Fig. 2 Self-expansive psychedelic use and awe-proneness moderated by drug-use reflection/integration. Below average (-1*SD*), average (*M*), and above average (+1*SD*) drug-use reflection/integration, respectively: 2.21, 3.65, and 5.00

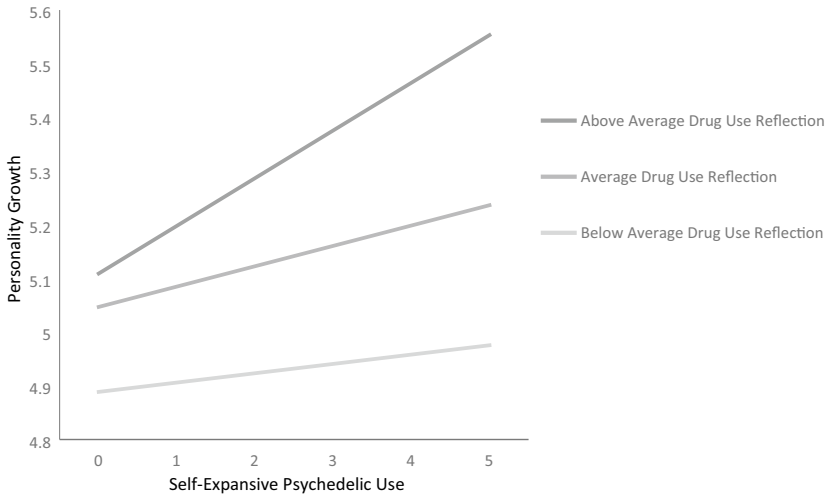


Fig. 3 Self-Expansive Psychedelic Use and Personality Growth Moderated by Drug-Use Reflection/Integration**.** Below average (-1*SD*), average (*M*), and above average (+1*SD*) drug-use reflection/integration, respectively: 2.21, 3.65, and 5.00

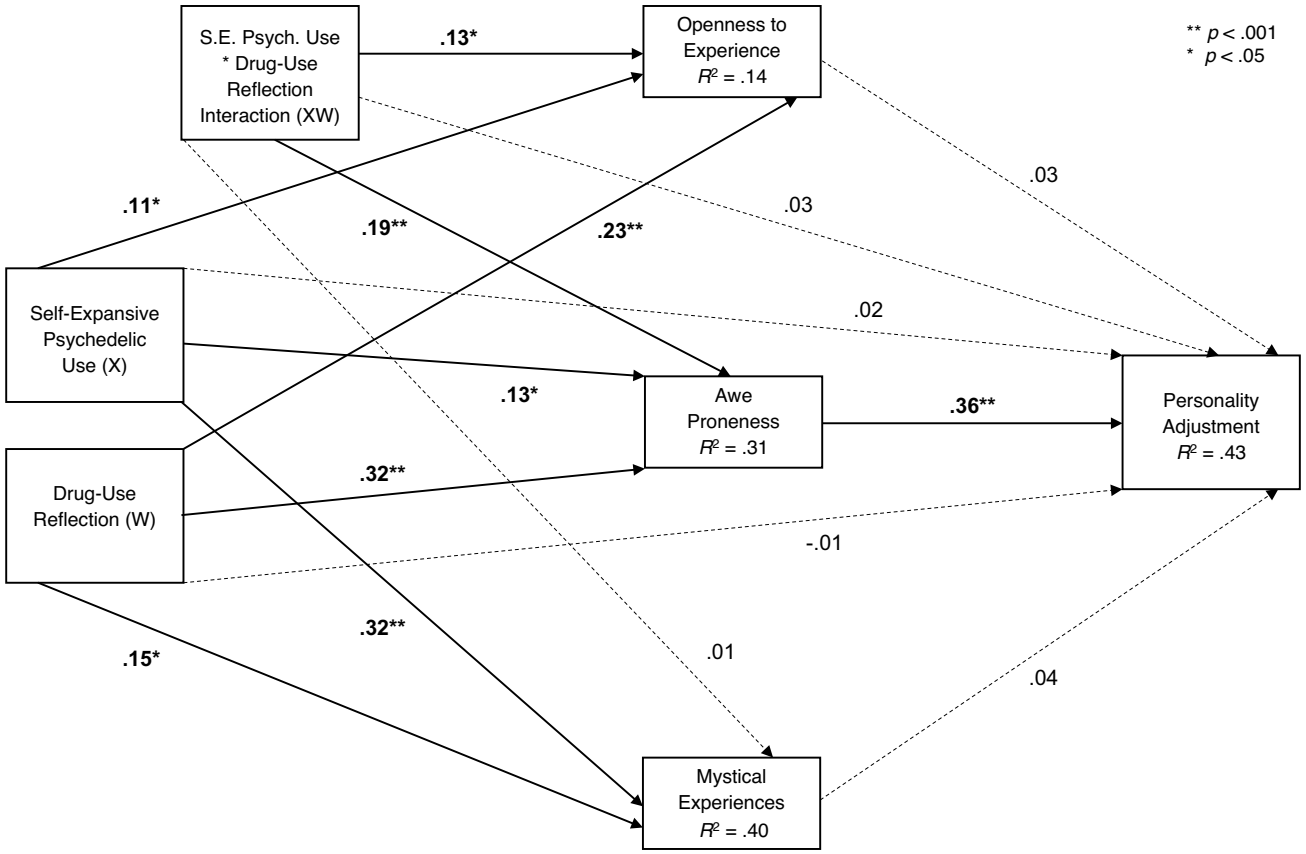
Self-Expansive Psychedelic Use and Personality Adjustment with Mediators

The adjustment model was run again with the mediators and was statistically significant, $F(15, 657) = 32.40$, $p < 0.001$, $R^2 = 0.43$ (Fig. 4[1]; Table 3). Self-expansive use ($\beta = 0.02$, $p = 0.674$), drug-use reflection ($\beta = -0.01$, $p = 0.872$), their interaction ($\beta = 0.03$, $p = 0.452$), openness ($\beta = 0.03$, $p = 0.441$), and mystical experiences ($\beta = 0.04$, $p = 0.374$) did not predict adjustment, but awe-proneness ($\beta = 0.36$, $p < 0.001$) did. The index of moderated-mediation for the indirect relationship between self-expansive use and adjustment mediated by awe-proneness was significant ($\beta = 0.08$, $p < 0.001$). Simple slopes showed the indirect relationship was not statistically significant for those with low drug-use reflection (one standard deviation below the mean; B = -0.01, $p = 0.443$), though it was statistically significant for those with average (at the mean; B = 0.03, $p = 0.02$) and high (one standard deviation above the mean; B = 0.07, $p < 0.001$) levels of drug-use reflection.

Self-Expansive Psychedelic Use and Personality Growth with Mediators

The growth model was run again with the mediators and was statistically significant, $F(15, 657) = 57.86$, $p < 0.001$, $R^2 = 0.57$ (Fig. 5). Self-expansive use ($\beta = 0.03$, $p = 0.418$) and mystical experiences ($\beta = 0.07$, $p = 0.055$) did not predict growth, but drug-use reflection ($\beta = 0.10$, $p = 0.029$), the interaction ($\beta = 0.09$, $p = 0.014$), awe-proneness ($\beta = 0.40$, $p < 0.001$), and openness ($\beta = 0.15$, $p < 0.001$) did. Simple slopes showed the relationship between self-expansive use and growth was not statistically significant for those with

[1] Covariates between the independent variables and between the mediator variables are included in the models but are not shown in Figs. 4 and 5.



Note: Significant coefficients (standardized) are shown in bold/solid. Non-significant coefficients are shown non-bold/dashed.

Fig. 4 Moderated-Mediation of Personality Adjustment Note: Significant coefficients (standardized) are shown in bold/solid. Non-significant coefficients are shown non-bold/dashed

low (one standard deviation below the mean; B = −0.02, $p = 0.319$) and average (at the mean; B = 0.01, $p = 0.412$) drug-use reflection, though it was significant for high drug reflection (one standard deviation above the mean; B = 0.05, $p = 0.026$).

The index of moderated-mediation for the indirect relationship between self-expansive use and growth mediated by openness was statistically significant (β = 0.02, $p = 0.045$). Simple slopes showed the indirect relationship was not statistically significant for those with low drug-use reflection (one standard deviation below the mean; B = −0.001, $p = 0.878$), but was significant for those with average (B = 0.01, $p = 0.045$) and high (one standard deviation above the mean; B = 0.02, $p = 0.014$) drug-use reflection. The index of moderated-mediation for the indirect relationship between self-expansive use and growth mediated by awe-proneness was statistically significant (β = 0.08, $p < 0.001$). Simple slopes showed the indirect relationship was not statistically significant for those with low drug-use reflection (one standard deviation below the mean; B = −0.01, $p = 0.436$), though it was significant for those with average (at the mean; B = 0.02, $p = 0.002$) and high (one standard deviation above the mean; B = 0.05, $p < 0.001$) drug-use reflection.

Discussion

The present study had three goals: (1) to assess the associations between self-expansive psychedelic use, openness, awe-proneness, mystical experiences, and development; (2) to assess whether the relationships between self-expansive psychedelic use and adjustment and growth would be mediated by openness, awe-proneness, and mystical experiences; and (3) to assess whether these relationships would be moderated by drug-use reflection/integration. Correlation analysis fully supported the first hypothesis. Self-expansive psychedelic use correlated with openness, awe-proneness, mystical experiences, adjustment, and growth. Although previous literature supported these connections (Griffiths et al., 2006; Lyvers & Meester, 2012), this is the first study to show that self-expansive psychedelic use is correlated positively with both aspects of adult development—personality adjustment and personality growth.

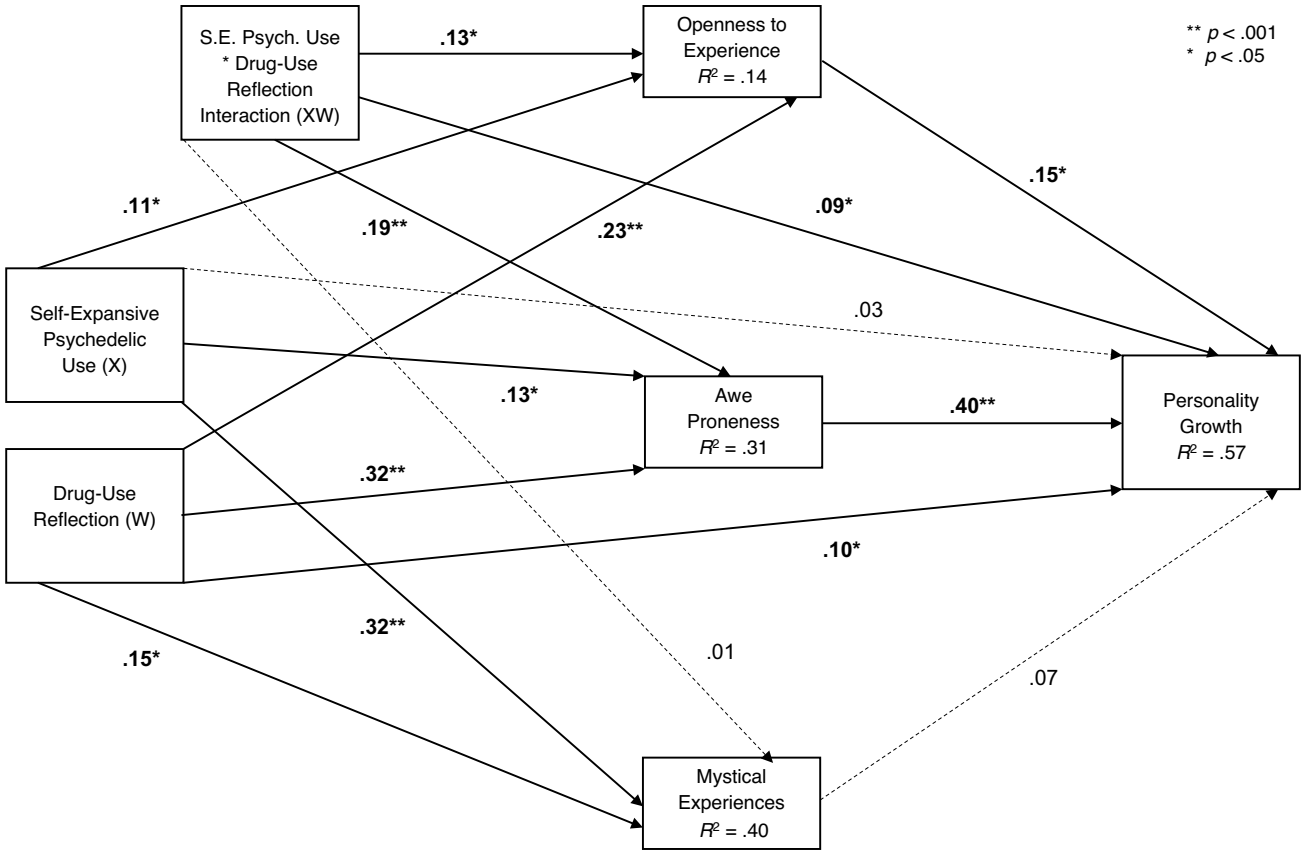


Fig. 5 Moderated-Mediation of Personality Growth. Significant coefficients (standardized) are shown in bold/solid. Non-significant coefficients are shown non-bold/dashed

Moderated-mediation analyses partially supported the second and third hypotheses. Self-expansive psychedelic use predicted all three mediators. Moreover, openness and awe-proneness were also predicted by drug-use reflection *and* the interaction effect. As such, the relationships between self-expansive use and openness and awe-proneness were moderated. With low drug-use reflection, self-expansive use did not predict openness or awe-proneness. However, with average and high levels of drug-use reflection, self-expansive use predicted increasingly higher levels of openness and awe-proneness. Self-expansive use and drug-use reflection predicted mystical experiences, but their interaction did not. Thus, drug-use reflection and self-expansive psychedelic use equally but independently predicted mystical states.

When the mediators were not included, self-expansive use did not predict adjustment, but drug-use reflection *and* the interaction did. Thus, with low and average drug-use reflection, self-expansive use did not predict adjustment, though with high drug-use reflection, self-expansive use predicted adjustment. When the mediators were included, only awe-proneness predicted adjustment. This suggests an indirect relationship between self-expansive use and adjustment mediated by awe-proneness and moderated by drug-use reflection. With low drug-use reflection, self-expansive use did not predict adjustment via awe-proneness. With average and high drug-use reflection, self-expansive use predicted increasingly higher levels of adjustment through awe.

Similarly, when the mediators were not included, self-expansive psychedelic use, drug-use reflection, *and* their interaction effect predicted growth. With low drug-use reflection, self-expansive use did not predict growth, though with average and high drug-use reflection, self-expansive use predicted increasingly higher growth. When the mediators were included, drug-use reflection, the interaction, openness, and awe-proneness predicted growth. The direct relationship between self-expansive use and growth is thus moderated; with low and average drug-use reflection, self-expansive use did not predict growth, though with high drug-use reflection, self-expansive use predicted growth. In addition to the direct effect, these findings suggest indirect relationships between self-expansive use and growth mediated by openness and awe-proneness and moderated by drug-use reflection. With low drug-use reflection, self-expansive use did not predict growth through openness or awe-proneness, but

with average and high drug-use reflection, self-expansive use predicted increasingly higher levels of growth via openness and awe-proneness.

Psychedelic-Assisted Awe and Positive Adult Development

When taken together, this study suggests that using psychedelics with a self-expansive intention and deliberately reflecting upon one's psychedelic experiences may promote adult development. Importantly, at the lowest levels of drug-use reflection, self-expansive psychedelic use did not predict either adjustment or growth, whether directly or indirectly through any of the mediators in any of the models. As such, self-expansive psychedelic use alone is not sufficient for adult development. Rather, actively reflecting upon one's psychedelic experiences appears critical to gain benefit. Furthermore, experiencing awe in daily life stand out as the largest predictor of positive adult development in any of the models tested. This may be due to awe's capacity to challenge preexisting meaning systems, thus leading to accommodative changes in core beliefs, worldviews, and identity (Ihm et al., 2020). That is, awe presents us with the limits of current understanding, which evokes a need for accommodation (Keltner & Haidt, 2003). This state of uncertainty foments a search for meaning, thereby catalyzing growth and self-expansion (cf. Bonner & Friedman, 2011). Indeed, awe appears to update meaning systems while promoting eudaimonic development by moving one closer toward their "true" self (Ihm et al., 2020). In such a way, psychedelics should not be considered shortcuts to wisdom. Instead, they may offer an opportunity to promote an openness to awe that serves to challenge our beliefs, foster self-insight, and decenter our egoic-selves as we mature through adulthood.

Limitations

Given that a random sample was not used, the results of this study cannot be assumed representative of the broader population. Self-report inventories can be biased, particularly in the direction of making oneself appear more favorable. Furthermore, cross-sectional data cannot establish causality. While self-expansive psychedelic drug use may promote development, individuals with high levels of development may use psychedelics with self-expansive intentions. Similarly, openness likely shows a bidirectional relationship with self-expansive psychedelic use and drug-use reflection. Future research should use longitudinal designs to assess developmental changes over time, as well as random samples to better address the question of causality.

Conclusion

Despite these limitations, this study hopes to shed light on the utility of psychedelics as tools for promoting positive development. However, caution is warranted. Bonner and Friedman (2011) have noted that awe can induce a state of incomprehensibility and weakened sense of coherence which may lead to self-transcendent growth *or* traumatic self-annihilation. This bipolar nature of awe may partially explain why psychedelic experiences can be terrifying or enlightening (Grinspoon & Bakalar, 1979). Nelson and Sass (2008) have similarly warned that while psychedelics can precipitate self-transcendence in some individuals, they can elicit a sense of alienation in those prone to psychosis. Thus, although psychedelic awe may hold potential for catalyzing adult development, the pronounced state of awe they can evoke may be hazardous for some individuals. Accordingly, this study hopes to stimulate further research into the potential benefits, and hazards, of psychedelics for the field of positive adult development.

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