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The Associations of Naturalistic Classic Psychedelic Use, Mystical Experience, and Creative Problem Solving

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ABSTRACT

Developing methods for improving creativity is of broad interest. Classic psychedelics may enhance creativity; however, the underlying mechanisms of action are unknown. This study was designed to assess whether a relationship exists between naturalistic classic psychedelic use and heightened creative problem-solving ability and if so, whether this is mediated by lifetime mystical experience. Participants (N = 68) completed a survey battery assessing lifetime mystical experience and circumstances surrounding the most memorable experience. They were then administered a functional fixedness task in which faster completion times indicate greater creative problem-solving ability. Participants reporting classic psychedelic use concurrent with mystical experience (n = 11) exhibited significantly faster times on the functional fixedness task (Cohen's d = –.87; large effect) and significantly greater lifetime mystical experience (Cohen's d = .93; large effect) than participants not reporting classic psychedelic use concurrent with mystical experience. However, lifetime mystical experience was unrelated to completion times on the functional fixedness task (standardized β = –.06), and was therefore not a significant mediator. Classic psychedelic use may increase creativity independent of its effects on mystical experience. Maximizing the likelihood of mystical experience may need not be a goal of psychedelic interventions designed to boost creativity.

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Given the importance of creativity to the range of human pursuits, reliable methods for enhancing creativity have been pursued for some time and include cognitive, behavioral, and pharmacologic approaches (Arnon and Kreitler 1984; Frati et al. 2015; Oppezzo and Schwartz 2014). Stimulants, including caffeine, amphetamines, and methylphenidate, may acutely facilitate creativity by improving attention and working memory, though findings are equivocal (Haskell et al. 2008; Smith and Farah 2011). Furthermore, alcohol use at low to moderate doses may acutely enhance a particular domain of creativity characterized by open-ended and spontaneous cognition known as divergent thinking (Jarosz, Colflesh, and Wiley 2012). Although cannabis use may acutely impair creativity, long-term use may improve creativity in abstinent states (Jones, Blagrove, and Parrott 2009; Kowal et al. 2015), and it may enhance creativity in individuals low in trait creativity via increased verbal fluency (Schafer et al. 2012). Classic psychedelics (e.g., dimethyltryptamine [DMT], lysergic acid diethylamide [LSD], mescaline, and psilocybin) have been studied in this regard as well, and though findings are equivocal, some results have shown promise (Baggott 2015; Sessa 2008). A recent study found that ayahuasca (a DMT-containing concoction used in South America and increasingly worldwide) enhances divergent thinking while decreasing convergent thinking during acute drug effects (Kuypers et al. 2016). While divergent thinking is more typically associated with creativity, convergent thinking is also involved in creative processes, so the relationship between classic psychedelic use and creativity remains unclear.

The effects of classic psychedelics include altered states of self-awareness, pseudo-hallucinations, and mystical-type experiences characterized by feelings of awe, salience, ineffability, timelessness, and oceanic boundlessness/absolute unitary being (Griffiths et al. 2006; Vollenweider and Kometer 2010). From the late 1950s to the early 1970s, a number of investigations sought to determine if classic psychedelics could be useful in augmenting creativity, with results ranging from neutral to positive for the enhancement of this cognitive domain (Sessa 2008). The most notable of these studies found that the classic psychedelics LSD

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and mescaline can aid in creative problem solving when used in carefully controlled settings (Harman et al. 1966). Unfortunately, politically motivated legal proscriptions and lack of funding halted human research with classic psychedelics for decades (Nutt, King, and Nichols 2013), effectively barring the development of classic psychedelic-based interventions for medical indications or any other purpose, including creativity enhancement.

Research with classic psychedelics is currently experiencing a modest renaissance, leaving open the possibility of future investigation designed to boost creativity through controlled classic psychedelic use. Contemporary studies indicate that classic psychedelic-assisted psychotherapy may alleviate end-of-life distress (Gasser et al. 2014; Grob et al. 2011), decrease alcohol misuse (Bogenschutz et al. 2015), promote tobacco smoking cessation (Johnson et al. 2014), relieve treatment-resistant major depression (Carhart-Harris et al. 2016), and trigger durable positive changes to personality and affect among healthy volunteers (Griffiths et al. 2008; MacLean, Johnson, and Griffiths 2011). Moreover, naturalistic classic psychedelic use is associated with reduced recidivism among substance-involved offenders (Hendricks et al. 2014) and decreased psychological distress and suicidality among adults in the U.S. population (Hendricks et al. 2015). Several of these studies indicate that beneficial outcomes are robustly correlated with classic psychedelic-occasioned mystical experience, supporting a long-held putative mechanism of action (Bogenschutz and Johnson 2015; Garcia-Romeu, Griffiths, and Johnson 2015; Griffiths et al. 2008; MacLean, Johnson, and Griffiths 2011). It is for this reason that contemporary studies of classic psychedelic-assisted psychotherapy aim to maximize mystical experience (Johnson, Richards, and Griffiths 2008).

Recent media attention has been paid to the purported link between classic psychedelics and creativity, though in the absence of modern peer-reviewed research (e.g., Fink 2015; Koebler 2015; Leonard 2015; Woods 2016). A substantial portion of this media attention surrounds "microdosing," or the practice of taking sub-perceptual doses of a classic psychedelic with some frequency. James Fadiman, one of the authors of the seminal Harman et al. (1966) study, is a proponent of microdosing and has collected relevant self-report data. However, there is currently no empirical data regarding microdosing. Additionally, Fadiman has described a putative modality for enhancing creative problem solving in *The Psychedelic Explorer's Guide*. In part three (chapters 9–14) of this book, Fadiman and Harman describe the program of Harman et al. (1966) in more detail and report on some additional participants and research. At the time of this writing, however, there have been no further empirical investigations into enhancing creative problem solving via classic psychedelic administration.

Scientists who design classic psychedelic-based creativity interventions would benefit from understanding how or why such interventions work. If, for instance, changes in creativity are mediated by mystical experience, then maximizing mystical experience would represent a priority of such interventions. If classic psychedelic-occasioned mystical experience is unrelated to creativity, then interventions might seek to emphasize non-mystical components of the experience (e.g., altered states of self-awareness, pseudo-hallucinations), or simply administer the substance assuming a purely neurobiological mechanism of action (e.g., changes to the Default Mode Network (DMN), neuroplastic adaptation, or increase in size and number of dendritic spines (Bouso et al. 2015; Carhart-Harris et al. 2014; Vollenweider and Kometer 2010).

In this study, we tested the indirect effects of naturalistic classic psychedelic use on creative problem-solving ability via lifetime mystical experience. Given recent research indicating that mystical experience may mediate the therapeutic effects of psilocybin (Bogenschutz et al. 2015; Garcia-Romeu et al., 2015; Garcia-Romeu et al. 2015 Griffiths et al. 2008; MacLean, Johnson, and Griffiths 2011), we hypothesized that naturalistic classic psychedelic use would be associated with greater mystical experience, which would be, in turn, associated with greater creative problem-solving ability.

Methods

Participants

Participants were recruited from the student body of a regional university in the southeastern U.S. and the local community via flyers and social media. Participation was limited to those aged 18 years and older, with no additional inclusion or exclusion criteria. This study was approved by the Institutional Review Board of the university.

Procedure

Participants were scheduled for individual appointments held in a computer lab on campus. After providing informed consent, participants completed a battery of questionnaires, and then a functional fixedness task (Duncker's Candle Problem, see the following).

Participants were then debriefed and, if enrolled in an eligible psychology class, a participation slip for possible extra credit was given.

Measures

Demographic Questions: age, gender, ethnicity, and educational attainment.

Hood mysticism scale (M Scale)

This 32-item self-report survey is the most frequently used measure of primary mystical experience. It consists of 16 positively expressed and 16 negatively expressed items regarding lifetime mystical experience. We used the original M scale, which is scored on a 5-point scale (−2 = "this description is extremely not true of my own experience or experiences"; 0 = "I cannot decide"; +2 = "this description is extremely true of my own experience or experiences" Hood 1975). The M Scale is both well-studied and highly regarded in the study of psychology of religion (Hood et al. 2001). Intercultural reliability has been established (Hood et al. 2001) and, in the past decade, it has also been used to measure intensity of mystical experiences after administration of classic psychedelics (e.g., Griffiths et al. 2006).

Open-ended response

Immediately following administration of the M Scale, participants were presented with an open-ended response item which asked, "If you have had any of those mystical experiences, please briefly describe the most memorable experience. Please include such details as location and if any religious or spiritual practices (such as fasting, meditation, prayer, worship, yoga, etc.) or other techniques (physical exertion, music, sex, dance, drug or alcohol use, etc.) immediately preceded or coincided with the experience."

Duncker's candle problem

Duncker's Candle Problem, the prototypical measure of functional fixedness, is administered by presenting the participant with a candle, a box of thumb tacks, and a book of matches (Duncker 1945). He or she is then instructed to attach the candle to the wall (in this case, a cork board) in such a way that if the candle were lit, the wax would not drip onto the floor. The solution is to dump the tacks out of the box and place the candle inside it, and then nail the box to the wall with the tacks (Adamson 1952). If the task had not been solved after five minutes, a prompt (hint) was offered. The task was timed in seconds for both selection of the target object (dumping the tacks out of their box) and completion. While we recorded both indices, the two were highly correlated (r = .93) and thus only target selection latency, which is considered a more accurate index of functional fixedness (German and Barrett 2005), was used in the final data analysis.

Data analysis

The independent variable was self-reported classic psychedelic use concurrent with mystical experience as determined by the second open-ended response item (0 = no classic psychedelic use, 1 = classic psychedelic use). Differences in demographic characteristics between those reporting no classic psychedelic use and those reporting classic psychedelic use were examined with analyses of variance and chi-square tests. Consistent with mediation analysis, M Scale total scores and target selection latency were then regressed on self-reported classic psychedelic use, and the indirect effect of classic psychedelic use on target selection latency through M Scale total scores was tested using a bootstrap approach (Preacher and Hayes 2008).

Results

Of the 84 participants, 14 failed to complete the functional fixedness task (failure unrelated to classic psychedelic use, χ^2 = .146, p = .70) and two provided invalid data, yielding a final N of 68. Participants' mean age was 22.55 (SD = 4.13), 44% were men, and 75% were White. Mean educational attainment was 14.11 (SD = 1.68) years of education. Eleven participants reported mystical experiences concurrent with classic psychedelic use, and this was not significantly associated with any demographic data collected.

Participants reporting classic psychedelic use concurrent with mystical experience displayed significantly faster target selection latency (M = 70.75, SD = 67.49) than participants not reporting classic psychedelic use concurrent with mystical experience (n = 57; M = 156.89, SD = 122.91, p = .02, Cohen's d = −.87; large effect). Furthermore, participants reporting classic psychedelic use concurrent with mystical experience noted significantly greater lifetime mystical experience (M = 136.27, SD = 14.18) than those not reporting classic psychedelic use concurrent with mystical experience (M = 118.03, SD = 23.68, p = .01, Cohen's d = .93; large effect). However, lifetime mystical experience was unrelated to reaction times on the functional fixedness task (standardized β = −.06, p = .62), and was therefore not a significant mediator (point estimate = −5.7,

bias corrected 95% CI −32.47, 16.72). Secondary analyses using the Interpretation, Introvertive, and Extrovertive subscales of the M scale yielded similar findings.

Discussion

The objective of the current study was to determine if naturalistic classic psychedelic use is associated with heightened creative problem-solving ability, and if so, whether this effect is mediated by lifetime mystical experience. We found that, although naturalistic classic psychedelic use was robustly associated with greater creative problem-solving ability and self-reported mystical experience, the latter was unrelated to creative problem-solving ability. Thus, contrary to our hypothesis, lifetime mystical experience was not a mediator of the effect of classic psychedelic use on creativity. This suggests that some other mechanism may be responsible for the effects of classic psychedelics on creativity. Non-ordinary states of consciousness are concurrent with some temporary states of increased plasticity and non-standard connectivity (Carhart-Harris et al. 2014). This allowance for communication between parts of the brain that do not normally communicate with one another, and decreases in communication between areas that normally do, may be responsible for the types of perspective shifts and less rigid thinking that facilitate creative problem solving.

While all current pharmacological modalities for enhanced cognition rely on acute drug effects and, in a few cases, steady-state plasma concentrations, classic psychedelics may require neither. Though Harman and colleagues (1966) did have participants work on problems during acute drug effects, they used a substantially lower dose than typically used in psychotherapeutic modalities. As the likelihood of mystical experience appears to be somewhat dose dependent, Harman's (1966) findings would seem to corroborate our results that mysticism is not the chief factor in creative problem-solving enhancement. Thus, it appears putative increases in creative ability post-psychedelic drug use are a discrete phenomenon, unlike standard pharmacological cognitive enhancement or positive therapeutic outcomes from psychedelic-assisted psychotherapy thought to be consequent to mystical experience.

Religious practices known to sometimes induce mystical experiences, albeit less frequently and reliably than classic psychedelics, may also have desirable effects on creative problem-solving ability (Ding et al. 2014; Raingruber and Robinson 2007). There may be some shared mechanisms between classic psychedelics and religious practices not specific to mystical experience that might contribute to creative problem-solving enhancement. Meditation's effects on creativity may be attributable to increased blood flow in the orbitofrontal and prefrontal cortices of the brain combined with decreased blood flow in the superior parietal areas (Newberg et al. 2001). This cerebral blood flow pattern largely mirrors the observed effects of psilocybin on certain neurological networks, namely the DMN and the Task Positive Network (TPN). A hypothesis for some beneficial psychotherapeutic effects of classic psychedelics may reside in their effects on functional connectivity between the DMN and TPN (Bouso et al. 2015; Carhart-Harris et al. 2014). Given the overlapping neurobiology of these practices and classic psychedelic drug administration, it seems that these "sub-mystical" states could be important in producing the observed desirable effects on creative problem solving, or at least provide an indication of the underlying neurological correlates.

The current study did not assess classic psychedelic use patterns. However, extant data suggest that administration is relatively infrequent except in an extreme minority of cases (Hallock et al. 2012; Tyls, Palenicek, and Horacek 2014). Given that changes in personality measures and therapeutic outcomes have proven quite durable, lasting months to years (Bogenschutz and Johnson 2015; Griffiths et al. 2008; Grob et al. 2011), and the results of this study in which no drugs were administered, it would stand to reason that enhancements in creative problem-solving ability would be long-lasting. Indeed, in a 25-year follow-up to Walter Pahnke's Good Friday experiment, in which divinity students were administered psilocybin, scores for personal significance and persisting positive changes in attitude and behavior exhibited only scant change (Doblin 1991). While it was not immediately clear from the original text of Harman et al. (1966) whether the participants reached novel solutions to their chosen problems during or after the acute drug effects, subsequent interviews with the authors indicate that the bulk of the creative work was done after the drug effects had plateaued or begun to wane (Fadiman 2011; Walsh and Grob 2005; Hanna and Manning 2010). A short-term follow-up at two weeks found sustained creative problem-solving enhancement.

The recent study of classic psychedelic-assisted psychotherapy has seen mystical experience as a putative mediating factor (Bogenschutz et al. 2015; Garcia-Romeu et al. 2015; Griffiths et al. 2008; MacLean, Johnson, and Griffiths 2011). However, it seems possible that enhancement of creative problem-solving ability may be a mediating factor as well, particularly in the treatment of end-of-life

anxiety and addiction, as treatment for these conditions may involve learning how to think differently about an otherwise static issue. Indeed, two subtypes of quantum change—sudden, dramatic, and enduring change that classic psychedelic use may occasion—have been proposed: the Mystical type, and the Insightful type, the latter of which lacks the core characteristics of the mystical experience with the exception of sudden realization or knowing (Miller 2004). Furthermore, male alcoholics and their sons have been shown to be less creative than healthy controls, both with and without family histories of alcoholism (Noble, Runco, and Ozkaragoz 1993), suggesting a potential causal role of reduced creativity in addiction. To better understand and thus maximize the efficacy of psychedelic-facilitated treatments, it may prove important to better understand the relative contribution of enhancements in creativity.

There are some notable limitations to this study. First, the correlational nature of the study and the lack of drug administration with randomized controlled trial methodology limit our ability to make causal inferences. Second, no inferences about the durability of the proposed effect can be made. Further naturalistic research in this area would do well to assess recency of use. Third, this study used functional fixedness as a proxy for creativity, so results are limited to this one specific facet of the construct. Fourth, the M Scale assessed lifetime mystical experience as opposed to a single mystical experience elicited by a psychedelic drug. It is possible that greater specificity in the measurement of mystical experience would have yielded different results. Lastly, the generality of the results may be affected by the sample being composed of largely Western university students and the relatively small sample size.

Recommendations for future research include using larger samples, more diverse demographic groups, and randomized clinical trial methodology. Controls for personality factors could elucidate whether enhanced creativity among classic psychedelic users represents an effect of drug administration, or characteristics of those who use classic psychedelics. Follow-ups at various intervals after drug administration to more precisely determine effect durability also would be advisable. Lastly, administering multiple functional fixedness tasks and other measurements of creative problem-solving ability (e.g., Guilford's Alternate Uses, Einstellung situations) would provide a more comprehensive picture of how classic psychedelics might affect the broad concept of creativity, as opposed to solely functional fixedness. Many of these measures could be added to research protocols with minimal burden.

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