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RESEARCH REPORT

Cannabis Use Does Not Increase Actual Creativity but Biases Evaluations of Creativity

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In this research, we examine the effects of cannabis use on creativity and evaluations of creativity. Drawing on both the broaden-and-build theory and the affect-as-information model, we propose that cannabis use would facilitate more creativity as well as more favorable evaluations of creativity via cannabis-induced joviality. We tested this prediction in two experiments, wherein participants were randomly assigned to either a cannabis use or cannabis abstinence condition. We find support for our prediction that cannabis use facilitates joviality, which translates to more favorable evaluations of creativity of one's own ideas and others' ideas. However, our prediction that cannabis use facilitates creativity via joviality was not supported. Our findings suggest that cannabis use may positively bias evaluations of creativity but have no impact on creativity. Implications for theory and practice are discussed.

Keywords: cannabis use, creativity, evaluations of creativity, joviality

In recent years, the United States has legalized cannabis use in several states, with a trend toward legalization in others (National Conference of State Legistlatures, 2020). These changes mirror global trends. An estimated 183 million people use cannabis worldwide (United Nations World Drug Report, 2017), and this is slated to rise. In tandem, a growing percentage of the U.S. workforce is testing positive on workplace cannabis drug tests (Quest Diagnostics, 2019). Such trends spotlight the growing importance of examining the impact of cannabis use on work outcomes.

Research has linked cannabis use to detrimental outcomes (e.g., cognitive–motor impairment; Karila et al., 2014; Volkow et al., 2016). Despite this, employees often still use cannabis for several reasons, such as to reduce work-related stressors (Frone, 2008) or improve concentration (Liebregts et al., 2013). Employees may also use cannabis to facilitate creativity, defined as "the production of useful and novel ideas" (Amabile et al., 1996, p. 1155). Many have the lay belief that using cannabis can increase creativity (Heisler, 2012; LaFrance & Cuttler, 2017), though evidence for this link is mixed (Bourassa & Vaugeois, 2001; Kowal et al., 2015; LaFrance & Cuttler, 2017).

In this research, we test the accuracy of this lay belief by examining the effects of cannabis use on creativity and evaluations of creativity, which are key to the creativity process that determines organizational success (Anderson et al., 2014). As affect plays a crucial role in the creativity process (George, 2007), we adopt an affective approach to understand the relationship between cannabis use and creativity outcomes. Drawing on the broaden-and-build theory (Fredrickson, 1998) and affect-as-information model (Clore et al., 2001), we predict that cannabis use would facilitate joviality, which in turn leads to more creativity and more favorable evaluations of creativity of one's own ideas and others' ideas.

Our research makes several contributions. First, we adopted a rigorous approach (e.g., multiple independent raters, ruling out other mechanisms) to test the lay theory that cannabis use improves creativity. In finding that joviality facilitates the effects of cannabis use on creativity self-evaluations but not creativity, we provide evidence that this lay theory may be inaccurate. Second, in testing whether cannabis-induced joviality influences the evaluation of the creativity of others, we show that the extent of this effect extends beyond the self and can influence one's perception of others' creativity as well. Third, our work informs organizational policies on cannabis use and the debate on cannabis use legalization by advancing knowledge on how cannabis use impacts work, specifically creativity outcomes.

Cannabis Use and Joviality

Many harbor the lay belief that cannabis[1] makes them more creative. More than 70% of cannabis users use cannabis to be more

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[1] Cannabis is extracted from the cannabis plant (*cannabis sativa*), which produces a variety of cannabinoids (Mechoulam, 2005). These cannabinoids largely act as agonists at cannabinoid receptors, which have a wide presence in parts of the brain that influence cognition, memory, and locomotion (Howlett, 1995). The main psychoactive constituent of cannabis is Δ9-tetrahydrocannabinol (THC), although cannabidiol (CBD), cannabinol (CBN), and cannabigerol (CBG) are also key components of the cannabis plant (Martín-Santos et al., 2010; Williamson & Evans, 2000).

creative (Hecimovic et al., 2014), and the majority of cannabis users report being more creative under the influence of cannabis (Green et al., 2003). Prominent creatives have relayed similar beliefs. Lady Gaga shared that cannabis fueled her songwriting (Kaye et al., 2014), and late Apple founder, Steve Jobs, credited cannabis for his creativity at work (Heisler, 2012). Given that people often report that cannabis influences their affective experiences (Green et al., 2003; Osborne & Fogel, 2008) and the copious evidence on the affect–creativity link (Amabile et al., 2005; Davis, 2009), we examine the effects of cannabis use on creativity outcomes via an affective lens.

We propose that the effects of cannabis use on creativity outcomes would be facilitated by positive affect, specifically joviality. Defined as "good-humored cheerfulness and conviviality" (Merriam-Webster, n.d.), joviality is a discrete emotion belonging to the basic emotion prototype of joy (Shaver et al., 1987). Cannabis use has been linked to several positive emotions (Gonzalez, 2007; Green et al., 2003). Positive mood facets, however, have differentiated and at times opposing courses (Baas et al., 2008; Egloff et al., 2003). For instance, joviality is a high-activation and approach-oriented state which urges broader thought repertoires and openness to novel associations, but another positive mood facet, such as relaxation, is a low-activation and avoidance-oriented state which activates narrower thought processes and limits novel associations (Friedman & Förster, 2001; Gasper & Middlewood, 2014; Watson et al., 1999). We thus pinpoint joviality as the facilitator of the effects of cannabis use on creativity outcomes vis-à-vis relaxation or other positive emotions.

> *Hypothesis 1:* Cannabis use has a positive effect on state joviality.

Affective Implications of Cannabis Use on Creativity and Evaluations of Creativity

We test the accuracy of the lay belief that cannabis use improves creativity via an affective lens. Creativity—the generation of novel and useful ideas—and innovation—the successful implementation of creative ideas (Amabile, 1988)—are crucial to the success of organizations (Anderson et al., 2014). Creative ideas fuel successful innovations, but only a few ideas can be invested in due to finite resources, rendering the accurate evaluation and implementation of the best ideas key to successful innovation (Berg, 2016). We thus focus on the affective effects of cannabis use on both creativity and evaluations of creativity.

To explain how cannabis use affects creativity outcomes via increased joviality, we draw on *broaden-and-build theory* and *affect-as-information model*—two affective theories that support our proposed effects. The broaden-and-build theory posits that positive mood facilitates a broadened mindset, such that people are more flexible, integrative, and open to a wider array of options (Fredrickson, 1998; Kahn & Isen, 1993). The affect-as-information model proposes that affective states provide information on people's situations that shape their judgment and behavior (Schwarz & Clore, 1983, 2003). With this overview in mind, we delineate the affective impact of cannabis use on *creativity* and *evaluations of creativity*.

Creativity

We expect that cannabis use would increase creativity via joviality. The broaden-and-build theory suggests that positive moods, such as joviality, broaden people's thought-action repertoires, prompting them to discard usual scripts in pursuit of creative paths of thought and action (Fredrickson, 1998). Similarly, the affect-as-information model suggests that positive feelings like joviality signal that the situation is safe, urging people to take risks and explore new creative associations (Schwarz & Bohner, 1996). Supporting these theories, there is evidence for the positive link between positive mood and creativity (Amabile et al., 2005; Baas et al., 2008). We thus propose that cannabis use elicits state joviality that in turn facilitates creativity.

> *Hypothesis 2:* Cannabis use has an indirect positive effect on creativity via state joviality.

Evaluations of Creativity

Further, we expect that cannabis use would facilitate more favorable evaluations of creativity via joviality. In organizations, idea generators are involved in evaluating the creativity of their own ideas, but those external to the creative process, such as managers, are often also involved in deciding which ideas are worth implementing (Berg, 2016). Understanding the impact of cannabis use on evaluations of creativity is important as such evaluations tend to be subjective, which gives rise to evaluation errors (Licuanan et al., 2007). Such errors harm organizations as they will only be apparent after substantial resources have been invested into implementing the ideas on the market (Fleming, 2001). We thus consider both *creativity self-evaluations* and *evaluations of the creativity of others*.

Drawing again on the broaden-and-build theory, cannabis-induced joviality is likely to facilitate a more expansive array of thought and action repertoires, urging playful engagement with ideas (Fredrickson, 2001; Fredrickson et al., 2000). Thus, it is likely that broadening effects of joviality would facilitate more favorable creativity evaluations of ideas, since seeing the positives of each idea would likely come with greater ease. Similarly, the affect-as-information model suggests that feeling joviality after using cannabis likely signals that the situation is safe, encouraging risk-taking and playful exploration (Schwarz & Bohner, 1996; Schwarz & Clore, 1996). With fewer constraints and more diverse thinking patterns (Schwarz, 1990), those who feel jovial likely spot the positives of ideas more effortlessly, and are thus likely to evaluate them more favorably. As such, we propose that cannabis use elicits state joviality that in turn facilitates more positive evaluations of creativity with respect to the self and others.

> *Hypothesis 3:* Cannabis use has an indirect positive effect on creativity self-evaluations via state joviality.

> *Hypothesis 4:* Cannabis use has an indirect positive effect on the evaluations of the creativity of others via state joviality.

Cognitive Functioning as a Competing Facilitating Mechanism

We adopted an affective lens to examine the cannabis use and creativity outcomes link, given the consensus that the creativity process is highly susceptible to affective influences (Amabile et al., 2005; George, 2007). However, other work indicates that this relationship may concurrently be influenced by cognitive functioning. Crean et al. (2011) review illustrates how cannabis use may impair cognitive functions such as the ability to make decisions, solve problems, and control behavior. As such, it is possible that cannabis use may hinder both creativity outcomes as it impairs cognitive functions crucial to the creativity process (Dietrich, 2004). We thus examine cognitive functioning as an alternative mechanism. This adds rigor as accounting for another known potential mechanism ensures that we do not overstate the faciliatory effects of joviality (de Jong & Elfring, 2010; Lanaj et al., 2019). Exploring its potential countervailing effects with joviality also offers more insight into the cannabis use and creativity outcomes link. Figure 1 presents our proposed model.

Research Overview

We conducted two experiments to offer a rigorous test of the effects of cannabis use on creativity and evaluations of creativity. Participants provided these evaluations of creativity, while trained and crowdsourced raters provided ratings for participants' creativity. Our studies were complementary in nature, seeking to investigate our hypotheses beyond the potentially idiosyncratic context of a single approach. We used different creativity task contexts (general in Study 1 vs. work in Study 2), a variety of raters of participants' creativity (two sets in Study 1 [trained RA raters, crowdsourced raters] vs. four sets in Study 2 [two pairs of trained RA raters, novice and expert crowdsourced raters]), and different versions of joviality (short scale in Study 1 vs. expanded scale in Study 2) and creativity self-evaluation (global scale in Study 1 vs. global- and idea-level scales in Study 2) measures. Study 2 also extended Study 1 by examining the effects of cannabis use on the evaluation of creativity of others' ideas and considering cognitive functioning as an alternative mechanism.

Transparency and Openness

We describe our sampling plan, all data exclusions, all manipulations, and all measures in both Studies 1 and 2, and we adhered to the *Journal of Applied Psychology* methodological checklist. Data were analyzed using SPSS Version 20 and Haye's PROCESS Version 3.5.2. Our measures, data, and analysis code are available at the following link.[2] The study design, hypotheses, and analyses were not preregistered.

Study 1 Method

Participants and Procedure

We recruited participants from a U.S. state that has legalized recreational cannabis. We posted recruitment flyers at several cannabis dispensaries and on Craigslist message boards of cities within the state. Our inclusion criteria adhered closely to the state laws regarding cannabis use.[3] We targeted light users (i.e., those who smoke one joint a few times per week on average) to avoid potential desensitization effects. Due to the sensitive nature of this study and the potential risks to participants, we did not collect demographic information.

A total of 382 individuals signed up to participate in our study (University of Washington institutional review board [UW IRB] STUDY00003440, *Title: Cannabis and Work II*). Participants were mailed cannabis test kits to their residences and emailed study information and the survey link. They were given approximately 1 week to complete the study. A total of 194 participants started the survey. After removing those who exited the survey before the creativity task (1) and before providing creativity self-evaluations (2), the final sample consisted of 191 participants. A post hoc power analysis using G Power (Faul et al., 2007) revealed the sample to be sufficiently powered (power = .93; Cohen, 1992).[4]

Participants were randomly assigned to one of two conditions ($N_{\text{cannabis}} = 107$; $N_{\text{control}} = 84$). We slightly oversampled the cannabis use condition because we expected compliance to be lower in the cannabis condition—which has more constraining test-taking requirements (i.e., within 15 min after using cannabis)—than in the control condition (i.e., any time i.e., 12 hr after cannabis use). We did not provide our participants with the cannabis. Instead, we studied participants in the manner in which they used cannabis in their typical daily lives. As such, the cannabis used likely varied in composition across participants. Importantly, rather than studying a specific cannabis strain that potentially did not match the cannabis that participants typically use, we measured the effects of their typical cannabis use.

In the cannabis use condition, participants were instructed to only begin the study if they have used cannabis in the past 15 min. If they had not done so, they were asked to exit the study and return to it right after they had used cannabis. We chose the 15-min time frame based on research on the amount of time it takes for cannabis to result in effects in people (Fant et al., 1998). Instead of stipulating a specific time to complete the study, participants were asked to begin the study within 15-min of their volitional cannabis use. This addressed the IRB restriction of not instructing cannabis use. In the control condition, participants were instructed to only begin the study if they have not used cannabis in the past 12 hr. If they had used cannabis, they were asked to exit the study and return to it after they had gone at least 12 hr without using cannabis. This 12-hr period was stipulated based on the largest estimated duration of cannabis use effects in prior studies (Grotenhermen, 1999, 2003; Harder & Rietbrock, 1997).

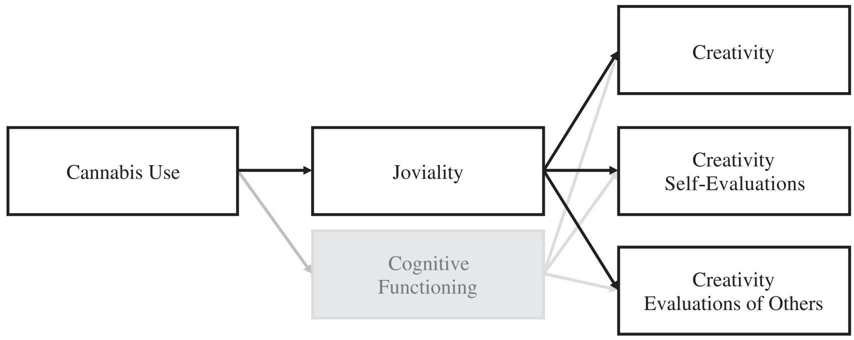
Participants reported their state joviality and completed the alternative uses task (AUT; Guilford, 1967), a well-established creativity task in psychological and organizational research (Lu, Akinola, et al., 2017; Lu, Hafenbrack, et al., 2017). Participants were asked to generate as many creative uses as they could for a brick in 4 min. These ideas should neither be typical nor virtually impossible (Friedman & Förster, 2001). Then, they provided self-ratings of creativity. As an objective manipulation check,

[2] Open Science Framework (OSF) link: https://osf.io/3hbd6/?view_only=19a1106ec9e94000b14f8870c1260b36.

[3] We required all participants to be at least 21 years old and a resident of the state to ensure that they were able to legally purchase, possess, and consume cannabis. Given the potential pregnancy risks associated with cannabis use, we only recruited participants who were not pregnant.

[4] To probe for potential response bias, we compared the median household incomes of respondents and nonrespondents, which were scraped based on postal codes. We found that respondents (M = 43510.32, SD = 16609.13) had a significantly higher median income than nonrespondents (M = 39884.96, SD = 14783.51), $F(1, 376) = 5.02$, $p = .026$.

Figure 1
Proposed Conceptual Model



participants were asked to complete a THC saliva test kit and send us an image of it.[5] As another check, participants also reported their cannabis use in the past 12 hr. Upon study completion, they received a $25 gift card of their choice. We report all measures and tasks in Supplemental A (OSF).

Measures

State Joviality

Participants rated whether they were "happy" and "joyful" at the moment (Scott & Judge, 2006; 1 = *very slightly or not at all*, 5 = *extremely*; $\alpha = .89$).

Creativity Self-Evaluation

Participants rated their own creativity via an adaptation of Shally et al.'s (2009) three-item creativity scale (sample item: "The ideas(s) I came up with for uses for a brick was/were creative"; 1 = *strongly disagree*, 5 = *strongly agree*; $\alpha = .76$).

Creativity

We trained two research assistants (RAs) who were blind to the experimental conditions to rate the 2,141 generated ideas. They were told to subjectively judge the novelty and usefulness of each idea based on their tacit and personal meanings of novelty and usefulness (Amabile, 1982; Silvia et al., 2008). After several practice rounds, the RAs independently rated all ideas. Ideas were rated on a 5-point scale (1 = *least novel/useful*; 5 = *most novel/useful*). There was high agreement across raters ($\alpha_{novelty} = .97$, $\alpha_{usefulness} = .97$).

We also utilized a second coding approach[6] by crowdsourcing raters (Landy et al., 2020; Yam et al., 2019). We recruited 430 raters from prolific. These raters were blind to the experimental conditions and each rated the novelty and usefulness of approximately 50 ideas on a 7-point scale (1 = *least novel/useful*; 7 = *most novel/useful*). On average, each idea was rated by 10.44 unique raters ($\alpha_{novelty} = .60$; $\alpha_{usefulness} = .82$). Whereas the reliability coefficients of the crowdsourced ratings were not high, it was within the acceptable range. Such variability confirms the subjectivity of creativity judgment (Tierney et al., 1999).

We calculated creativity by multiplying novelty and usefulness scores to obtain a single creativity score per idea of each rater (Brown & Baer, 2015; Hoever et al., 2012). Then, we averaged raters' creativity scores to obtain a single mean creativity score per idea. Finally, we aggregated the creativity scores of all ideas of each participant to obtain an overall creativity score per participant. Trained and crowdsourced rater approaches were significantly correlated ($r = .23$, $p < .001$), increasing our confidence in these ratings.

Control Variable

Given that creativity is less about many mediocre ideas and more about a few good ideas, we controlled for *number of ideas generated* in our analyses involving creativity (Baer, 2012; Liu et al., 2020).

Study 1 Results and Discussion

We present descriptive statistics of focal variables in Table 1 and analysis of variance (ANOVA) results of cannabis use on focal variables in Table 2. We first probed the success of our manipulation. Only 117 participants successfully completed the cannabis saliva test. Incomplete tests were due either to a faulty test kit (i.e., no lines displayed) [$n = 22$] or participants failing to submit a test kit image [$n = 52$]. Three independent raters blind to the experimental condition rated each of these test kit images (1 line = positive result, 2 lines = negative result, no lines = faulty test). There was high agreement across raters ($\alpha = .96$). We utilized the rating of the majority when there was a disagreement on a test kit result, which typically arose from blurriness in the test kit image. Participants in the cannabis use condition were more likely to test positive on the cannabis test than those in the control condition, $\chi^2(1, 117) = 15.63$, $p < .001$ (72% in cannabis condition tested positive, 64% in the control condition tested negative). Further, participants in the cannabis use condition were more likely to self-report cannabis

[5] The saliva test kit measures the presence of the Δ9-THC molecule of cannabis in the mouth. The test we utilized had a cutoff of 25 ng/ml of THC. This cutoff is generally sufficient to detect THC in the saliva of an average person who has smoked a single joint just before taking the test (Lee et al., 2012; Maseda et al., 1986), although the amount of cannabis detected by this cutoff likely varies by the strain of cannabis used.

[6] The crowdsourced creativity rating studies (in both Studies 1 and 2) were approved by the UW IRB (STUDY00009539, *Title: Creativity Study*).

Table 1
Means, Standard Deviations, and Correlations of Study 1 Variables

Variable	*M*	*SD*	1	2	3	4	5	6
1. Cannabis use manipulation	0.56	0.50	(—)					
2. State joviality	2.90	1.01	.21**	(.89)				
3. Creativity self-evaluation	3.39	0.84	.17*	.17*	(.76)			
4. Creativity (RA ratings)	8.27	1.42	−.08	−.15*	−.09	(—)		
5. Creativity (crowdsourced ratings)	14.57	2.02	−.01	−.11	−.13	.23**	(—)	
6. Number of ideas	11.21	6.42	.07	−.03	.33**	−.07	−.09	(—)

Note. $N = 191$. Cannabis use manipulation: 1 = cannabis use condition; 0 = control condition; α coefficients are presented on the diagonal. RA = research assistants.
* $p < .05$. ** $p < .01$.

use than those in the control condition, $\chi^2(1, 159) = 128.66$, $p < .001$.[7] The test kit results and cannabis use self-reports were highly convergent: Participants who received a positive test result were more likely to report cannabis use than those who received a negative test result, $\chi^2(1, 117) = 17.21$, $p < .001$. Thus, both checks indicated that participants generally complied with the research protocol, including condition assignment. We took an intent-to-treat instead of as-treated approach,[8] keeping participants in their assigned condition even if the manipulation check indicated that they did not comply. This is considered the more rigorous approach than reassigning participants based on manipulation check outcomes or dropping them from the analysis (Lachin, 2000; Newell, 1992; Ten Have et al., 2008).

Supporting *Hypothesis 1*, participants in the cannabis use condition ($M = 3.08$, $SD = 1.01$) reported significantly higher state joviality than those in the control condition ($M = 2.66$, $SD = 0.96$), $F(1, 189) = 8.45$, $p = .004$, $\eta_p^2 = .043$, 95% CI [13, .70]. We tested the indirect effects in *Hypothesis 2* and *Hypothesis 3* via the PROCESS macro (Hayes, 2013; Model 4). Following Preacher and Hayes (2008), we estimated the indirect effect via a bootstrapping procedure with 5,000 resamples. We did not find a significant indirect effect of cannabis use on creativity via state joviality, RA: *indirect effect* = −.08, *SE* = .05, 95% CI [−.20, .001]; crowdsourced: *indirect effect* = −.10, *SE* = .08, 95% CI [−.28, .02]. Thus, *Hypothesis 2* was not supported. Supporting *Hypothesis 3*, we found a significant indirect effect of cannabis use on creativity self-evaluations via state joviality, *indirect effect* = .06, *SE* = .03, 95% CI [.01, .13]. In sum, we found that cannabis use facilitates higher creativity self-evaluations but not creativity via joviality.

Table 2
Study 1 ANOVA Analyses

Dependent variable	*M*	*SD*	*F*	95% CI
State joviality				
Cannabis use condition	3.08	1.01	8.45**	[.13, .70]
Control condition	2.66	0.96		
Creativity self-evaluation				
Cannabis use condition	3.52	0.84	4.98*	[.03, .48]
Control condition	3.23	0.81		
Creativity (RA ratings)				
Cannabis use condition	8.17	1.51	1.12	[−.63, .19]
Control condition	8.40	1.30		
Creativity (crowdsourced ratings)				
Cannabis use condition	14.55	2.13	0.004	[−.60, .57]
Control condition	14.59	1.90		

Note. $N = 191$. Cannabis use manipulation: 1 = cannabis use condition; 0 = control condition. RA = research assistants; CI = confidence interval; ANOVA = analysis of variance.
* $p < .05$. ** $p < .01$.

Study 2 Method

In Study 2, we constructively replicated Study 1 to address a few limitations. Whereas Study 1 used a general creativity task and sample, in Study 2, we increased the work relevance of our study by sampling full-time employees and using a work-focused creativity task. Also, given the high alignment between test kit results and self-reported cannabis use in Study 1, we did not collect test kit results in Study 2, which allowed us to collect more data (e.g., cannabis strains, demographics) without posing the same level of risk to participants. Finally, we did not test the indirect effect of cannabis use on creativity *other*evaluation in Study 1. Thus, Study 2 tests our full model and also the role of cognitive functioning as an alternative mechanism. We made additional study design changes to further increase rigor. Specifically, we used expanded versions of joviality and global creativity evaluation scales and changed the creativity scale anchors to capture creativity in a more objective (*not at all* to *extremely novel/useful*) instead of relative way (*least* to *most novel/useful*). To urge greater compliance with protocol, we further set up a filter upfront to only allow participants to proceed after indicating compliance with their assigned condition.

Participants and Procedure

We recruited participants from the same U.S. state as in Study 1 by posting recruitment flyers on online Craigslist message boards of cities within the state. The inclusion criteria were the same as in

[7] Only a subset of the full sample self-reported their cannabis use. Some participants had stopped participating in the study before completing the cannabis use self-report measure, which was measured after the battery of tasks.

[8] Nonetheless, we present in Supplemental B's (OSF) secondary analysis that excludes participants who did not adhere to their assigned conditions as it may be informative for future research as well as researchers from other disciplines.

Study 1, with the exception that individuals had to be full-time employees to participate. A total of 370 participants signed up for our cannabis and work study (UW IRB STUDY00010834, *Title: Cannabis Use and Creativity*), and received an email containing study information and the survey link. They had approximately 1 week to complete the study. As in Study 1, there was significant attrition between sign-up and completion. A total of 179 participants started the survey. After removing those who exited the survey before the creativity task (25), finished the survey but not the creativity task (4), provided responses of questionable quality (9), or indicated never having used cannabis (1), left 140 participants (M_{age} = 30.84 years, 35.0% women). Although we targeted light cannabis users in our recruitment, there was substantial variance in general cannabis use frequency within our sample (breakdown: a few times a day [26.4%], daily [23.6%], a few times a week [32.1%], weekly [6.4%], a few times a month [7.1%], monthly [1.4%], a few times a year [2.1%], yearly [0.7%]). An a priori power analysis using G Power (Faul et al., 2007) revealed that our sample was well powered (power > .80). Respondents and nonrespondents were not significantly different in age and gender ($p > .05$), but respondents were more highly educated (67.9% had college or higher education) than nonrespondents (47.4% had college or higher education), $\chi^2(1, 370) = 14.74, p < .001$.

We randomly assigned participants to one of two conditions ($N_{\text{cannabis}} = 62$; $N_{\text{control}} = 78$), and again slightly oversampled the cannabis use condition. Via a filter at the start of the study, participants were only allowed to proceed with the survey if they indicated compliance with their condition (i.e., used cannabis in the past 15 min [cannabis use condition]/not using cannabis in the past 12 hr [control condition]). Those in the cannabis use condition reported the cannabis strain used and amount of cannabidiol/Δ9-tetrahydrocannabinol (CBD/THC) consumed. Again, we did not provide cannabis, studying them in the way that they used cannabis in their daily lives.

All participants reported their state joviality and completed a shortened version of the Sternberg memory scanning task (Rockstroh & Schweizer, 2001, 2004; Sternberg, 1966) as a measure of cognitive functioning. Thereafter, participants completed a work-focused creativity task (Grant & Berry, 2011; Motro et al., 2021). Participants were instructed to imagine that they were working at a consulting firm and had been approached by a local music band, File Drawers, to help them generate ideas for increasing their revenues. They were told that their goal was to generate as many creative ideas as possible in 5 min. Following which, they completed global and idea-level creativity self-ratings.

After the creativity task, participants were instructed to rate the creativity of others. Participants read that others were asked to imagine that they work in product development, and that their goal was to develop ideas for a new piece of fitness equipment that is both novel and useful in 5 min. In a randomized order, we presented six ideas that were generated in response to this creativity task. We drew this creativity task and six ideas from Berg's (2019) Experiment 2. Of these six ideas, two received a creativity score around the mean, two at +1 *SD* above the mean, and two at −1 *SD* below the mean. Finally, participants reported their general cannabis use frequency. Participants who completed the study received a $25 Amazon e-gift card. In Supplemental A (OSF), we report all measures and tasks.

Measures

State Joviality

Participants rated state joviality via the eight-item joviality subscale of the positive and negative affect schedule–expanded form (PANAS-X; Watson & Clark, 1994). A sample item in addition to those from Study 1 is "delighted" (1 = *very slightly or not at all*, 5 = *extremely*; α = .95).

Creativity Self-Evaluation

We measured creativity self-evaluations in two ways. First, we used a global measure via the three-item creativity measure by Shally et al. (2009) from Study 1. As the original measure only captured the novelty component of creativity, we added two items to reflect the usefulness component of creativity. A sample additional item is "The ideas(s) I came up with for this task was/were practical" (1 = *strongly disagree*, 5 = *strongly agree*; α = .85). Second, participants rated the novelty and usefulness of each of the ideas that they generated on a 7-point scale (1 = *not at all novel/useful*; 7 = *extremely novel/useful*). We used the same creativity scoring approach as in Study 1.

Creativity Evaluation of Others

Participants rated the novelty and usefulness of six ideas drawn from responses to a creativity task of an earlier study (Berg, 2019; Experiment 2; 1 = *not at all novel/useful*; 7 = *extremely novel/useful*). Via the same approach as in our scoring of creativity self-evaluations, we obtained an overall score per participant.

Creativity

Two pairs of RAs blind to the experimental conditions rated the novelty and usefulness of the 1,044 ideas on a 7-point scale (1 = *not at all novel/useful*; 7 = *extremely novel/useful*). There was high agreement across both rater pairs (Pair 1: $\alpha_{\text{novelty}} = .77$, $\alpha_{\text{usefulness}} = .75$; Pair 2: $\alpha_{\text{novelty}} = .97$, $\alpha_{\text{usefulness}} = .97$). We also used a crowdsourcing approach as in Study 1, recruiting from prolific a sample of 240 novices and a sample of 240 experts—who currently work in the marketing and sales industry—to obtain two complementary sets of ratings[9] (Berg, 2019). Each rater rated approximately 50 ideas. On average, each idea was rated by 10.09 unique novice raters ($\alpha_{\text{novelty}} = .57$; $\alpha_{\text{usefulness}} = .76$) and 10.14 unique expert raters ($\alpha_{\text{novelty}} = .65$; $\alpha_{\text{usefulness}} = .79$). Again, these reliability coefficients were not high, but were acceptable and similar to Study 1. We used the same approach as in Study 1 to calculate creativity scores. Creativity scores across rater groups were significantly

[9] We utilized both novice and expert raters as past research suggests that experience may be a double-edged sword when it comes to the accuracy of creativity ratings. On the one hand, experts may be more accurate in their creativity judgments as they have mastered the technical skills and knowledge of their domain (Ericsson, 1999). On the other hand, experts may also be too entrenched in their domains, which may result in less accurate creativity judgments (Dane, 2010). Moreover, utilizing three different sources of ratings would increase the robustness of our creativity measure.

Table 3

Means, Standard Deviations, and Correlations of Study 2 Variables

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Cannabis use manipulation	0.44	0.50	(—)												
2. State joviality	2.93	1.11	.20*	(.95)											
3. Creativity self-evaluation (global)	3.78	0.86	−.03	.49**	(.85)										
4. Creativity self-evaluation (idea-level)	26.63	14.52	−.07	.42**	.70**	(—)									
5. Creativity evaluation of others	26.28	12.36	−.01	.39**	.52**	.65**	(—)								
6. Creativity (crowdsourced novice ratings)	16.97	5.09	−.06	−.10	−.09	−.16	−.18*	(—)							
7. Creativity (crowdsourced expert ratings)	16.71	4.63	−.12	−.03	.07	.001	−.07	.23**	(—)						
8. Creativity (RA ratings—Pair 1)	11.43	3.11	.06	.01	.01	−.05	−.25**	.34**	.15	(—)					
9. Creativity (RA ratings—Pair 2)	14.86	5.06	.11	−.05	−.12	−.18*	−.34**	.37**	.23**	.59**	(—)				
10. Number of ideas	7.46	4.72	−.05	−.14	.03	.03	−.11	−.01	−.11	.01	.05	(—)			
11. General cannabis use frequency	2.61	1.47	−.06	−.05	−.15	−.19*	−.27**	.08	−.06	.22*	.12	.06	(—)		
12. State cognitive functioning (speed)	1729.79	1665.86	.07	.06	.01	.08	.06	−.17	.07	−.14	−.12	−.14	−.11	(—)	
13. State cognitive functioning (accuracy)	0.81	0.20	.03	−.07	−.09	−.12	−.19*	.24**	.05	.34**	.32**	.34**	.06	−.31**	(—)

Note. $N = 140$, except for state cognitive functioning due to missing responses on the Sternberg Task ($N = 117$). Cannabis use manipulation: 1 = cannabis use condition; 0 = control condition; state cognitive functioning (speed), measured in milliseconds, and state cognitive functioning (accuracy), wherein correct answers were scored as 1 and incorrect answers were scored as 0, were obtained by averaging across trials. α coefficients are presented on the diagonal.
$^{*}p < .05$. $^{**}p < .01$.

correlated (all $p < .01$) except between RA Pair 1 and experts, which was marginally significant ($p = .072$).

Control Variables

As in Study 1, we controlled for the *number of ideas generated* for all analyses involving creativity. Further, we controlled for *general cannabis use frequency* given the considerable variance in our sample (1 = *A few times a day*; 8 = *yearly*).

Study 2 Results and Discussion

We report descriptive statistics of focal variables in Table 3 and ANOVA results of cannabis use on focal variables in Table 4. Via a filter upfront, we required compliance with study instructions before participants could begin the study. As a supplemental check, we asked those in the cannabis condition to send us an image of their cannabis product or receipt. There was 79.0% compliance, suggesting that participants generally complied with the research protocol. As in Study 1, we took an intent-to-treat instead of as-treated approach.

Supporting *Hypothesis 1*, those in the cannabis use condition ($M = 3.18$, $SD = 1.09$) reported significantly higher state joviality than those in the control condition ($M = 2.74$, $SD = 1.09$), $F(1, 137) = 5.32$, $p = .023$, $\eta_p^2 = .037$, 95% CI [.06, .80]. The indirect effect of cannabis use on creativity was not significant via joviality, novice: *indirect effect* = −.19, *SE* = .18, 95% CI [−.59, .11]; expert: *indirect effect* = −.05, *SE* = .14, 95% CI [−.35, .27]; trained rater Pair 1: *indirect effect* = .004, *SE* = .10, 95% CI [−.20, .22]; trained rater Pair 2: *indirect effect* = −.11, *SE* = .18, 95% CI [−.55, .18]. Thus, *Hypothesis 2* was not supported.[10] Supporting *Hypothesis 3*, we found a significant indirect effect of cannabis use on creativity self-evaluation via state joviality for both global, *indirect effect* = .17, *SE* = .08, 95% CI [.02, .34], and idea-level aggregated creativity ratings, *indirect effect* = 2.46, *SE* = 1.26, 95% CI [.23, 5.21].[11] Supporting *Hypothesis 4*, we found a significant indirect effect of cannabis use on creativity other-evaluations via state joviality, *indirect effect* = 1.78, *SE* = .91, 95% CI [.21, 3.74]. Thus, we found that cannabis use would facilitate creativity self- and other-evaluations but not creativity via joviality.

Finally, we conducted extra analyses on the role of cognitive functioning and cannabis strain (see Supplemental C [OSF]). Of note, we found that cannabis use did not significantly impact cognitive functioning (speed: $p = .584$, accuracy: $p = .681$). Further, results held when we examined cognitive functioning and joviality as simultaneous facilitating mechanisms. The indirect effects of cannabis use on creativity self-evaluations and creativity evaluation of others were significant via joviality but not significant via speed and accuracy. Also, the indirect effects of cannabis use on creativity were not significant for joviality,

[10] As a robustness check, we tested *Hypothesis 2* using the collapsed ratings of novice and experts and found consistent results: *indirect effect* = −.13, *SE* = .13, 95% CI = [−.42, .10].

[11] As a robustness check, we tested *Hypothesis 3* using the joviality and creativity self-evaluation measures from Study 1 and found consistent results: *indirect effect* = .17, *SE* = .08, 95% CI = [.04, .36].

Table 4
Study 2 ANOVA Analyses

Dependent variable	*M*	*SD*	*F*	95% CI
State joviality				
Cannabis use condition	3.18	1.09	5.32*	[.06, .80]
Control condition	2.74	1.09		
Creativity self-evaluation (global)				
Cannabis use condition	3.75	0.84	0.15	[−.35, .23]
Control condition	3.80	0.88		
Creativity self-evaluation (idea-level)				
Cannabis use condition	25.58	14.69	0.77	[−6.99, 2.69]
Control condition	27.47	14.42		
Creativity evaluation of others				
Cannabis use condition	26.18	11.77	0.11	[−4.70, 3.37]
Control condition	26.35	12.88		
Creativity (crowdsourced novice ratings)				
Cannabis use condition	16.66	5.26	0.36	[−2.25, 1.21]
Control condition	17.21	4.98		
Creativity (crowdsourced expert ratings)				
Cannabis use condition	16.08	4.93	2.42	[−2.78, .33]
Control condition	17.21	4.34		
Creativity (RA ratings—Pair 1)				
Cannabis use condition	11.63	2.91	0.73	[−.59, 1.48]
Control condition	11.26	3.27		
Creativity (RA ratings—Pair 2)				
Cannabis use condition	15.47	5.13	1.89	[−.52, 2.88]
Control condition	14.38	4.98		
State cognitive functioning (speed)				
Cannabis use condition	1857.99	2410.10	0.30	[−450.60, 796.75]
Control condition	1630.73	679.32		
State cognitive functioning (accuracy)				
Cannabis use condition	0.82	0.19	0.17	[−.06, .09]
Control condition	0.80	0.20		

Note. $N = 140$, except for state cognitive functioning due to missing responses on the Sternberg Task ($N = 117$). Cannabis use manipulation: 1 = cannabis use condition; 0 = control condition; RA = research assistants; CI = confidence interval; ANOVA = analysis of variance. State scognitive functioning (apeed), measured in milliseconds, and state cognitive functioning (accuracy), wherein correct answers were scored as 1 and incorrect answers were scored as 0, were obtained by averaging across trials.
* $p < .05$.

speed, and accuracy. Our analyses also revealed a potential influence of cannabis strain on creativity self-evaluation.

General Discussion

Across both studies, we consistently found that cannabis use elicits joviality that in turn facilitates more favorable creativity self-evaluations, but had no effect on creativity. These findings were consistent across various creativity tasks, measures, and rater groups.[12] In Study 2, we further found that cannabis use facilitates more favorable evaluations of *others'* creativity via joviality. These findings held even when we accounted for cognitive functioning (speed and accuracy) as a simultaneous facilitating mechanism.

The null effect of cannabis use on creativity via joviality warrants further discussion. Drawing on both affective theories, we had expected that cannabis-induced joviality would facilitate creativity. One explanation for this null effect is that joviality from cannabis use increased one's *ability* to be more creative, but the *motivation* to do so remains context dependent. Feeling joviality signals that it is safe to explore possibilities but can also signal that good progress has been made (George & Zhou, 2002; Martin & Stoner, 1996), reducing motivation to think of more ideas. This explanation does not contradict our findings on creativity evaluations—perhaps cannabis-induced joviality led to more favorable creativity evaluations as people are more likely to spot the positives of each idea (ability) and further do not feel like they have to take an effortful approach since they are already doing a good job (motivation). These insights may help to reconcile prior mixed findings, where studies have found creativity-enhancing (Jones et al., 2009), null (Tinklenberg et al., 1978), or creativity-hindering (Kowal et al., 2015) effects. Taking a context-dependent approach (George & Zhou, 2002), perhaps the way to harness creativity-enhancing effects of cannabis use via joviality would be to ensure that motivation is also high, such as ensuring a match between employees' intrinsic interest and the creativity tasks.

Turning to our supplemental analyses, cannabis use did not worsen creativity via cognitive functioning, which suggests that the null cannabis use and creativity link is unlikely to be due to offsetting effects of cognitive functioning and joviality. Ruling this out strengthens support for our plausible explanation above. Our null cannabis use and cognitive functioning result diverges from past work that mostly found a negative effect. One reason may be that we sampled general, recreational users while past studies used extreme samples, such as those seeking addiction treatment (Solowij et al., 2002) or who have other illnesses (Honarmand et al., 2011). A nuanced approach to examining cognitions could reconcile the mixed findings. We focused on working memory capacity but cannabis use may have varying effects on different cognitive processes (e.g., perspective taking, flow; Miller, 2014).

We make several contributions. Our test of the lay theory that cannabis use has creativity-enhancing effects has notable implications. In showing that cannabis use induces jovial feelings that facilitate more favorable creativity self-evaluations but has no effect on creativity, we provide evidence that challenges this lay theory. Further, in articulating the faciliatory role of joviality, we provide insight into *why* this lay theory is common. We also consider the extent to which this lay theory affects people. In finding that cannabis-induced joviality facilitates more favorable creativity evaluations of others, we suggest that this bias extends beyond the self to affect perceptions of others' creativity. Relatedly, in examining the effects of cannabis use on creativity, our work goes beyond the creativity literature's main focus on individual (e.g., knowledge, thinking styles) and contextual antecedents (e.g., job complexity, leader influence; Anderson et al., 2014) to consider the impact of treatments. Further, management scholars are increasingly recognizing the impact that factors outside of work have on creativity, with a particular focus on social interactions (work–family support at home; Stollberger et al., 2021; home strain; Van Dyne et al., 2002). Our findings on cannabis use and creativity provide an interdisciplinary extension of this work, as we connect pharmacology (commonly consumed substances) and management (creativity) research.

Our work has organizational and societal implications. We contribute to the small organizational evidence based on cannabis

[12] We note that the relationship between cannabis use and creativity self-evaluation, which was not hypothesized, was inconsistent across studies. We thus conducted internal meta-analyses of our direct effects of cannabis use on creativity self-evaluation and creativity to examine the overall effect across studies (see Supplemental D [OSF], for results and discussion).

use by showing that it has little effect on creativity but may positively bias creativity evaluations. These findings highlight how biased creativity evaluations stemming from employee cannabis use may cost organizations valuable resources as they end up wrongly investing in noncreative ideas. Given the negative work outcomes linked to cannabis use (poorer task performance, more deviance; Bernerth & Walker, 2020), leaders may want employees to be sober, especially while evaluating ideas. Our work also factors into the cannabis legalization debate as it adds to the knowledge base that lawmakers draw on. Finally, employees can apply our findings. Cannabis use may be enticing for its joviality effects or the lay belief that it enhances one's creativity, but we urge them to be cognizant that using cannabis may bias their evaluation of ideas. Particularly if their job entails creativity evaluation, it might be best to refrain from cannabis at work.

We encourage future work to address the limitations of our research. First, we did not collect data over time, which meant that we were unable to compare acute versus delayed effects of cannabis use and examine creativity outcomes over time. We encourage an extension of our work via longitudinal studies. Also, we were able to ensure causal inference from our experimental design, but research ethics considerations meant that we were unable to stipulate that participants complete our study during work hours. As cannabis use timing can differentially affect work outcomes (Bernerth & Walker, 2020), we invite future work that considers cannabis use timing, which may enable more precise cannabis use policy decisions.

Second, we targeted light users but ended up with a sample that varied widely in cannabis use frequency. Given potential accumulation effects that may occur in heavy users (Pope & Yurgelun-Todd, 1996), it would be worthwhile to examine the roles of cannabis use frequency and amount. It would also be meaningful to consider how the effects of cannabis use on creativity compare with other forms of substance use (e.g., alcohol; Benedek & Zöhrer, 2020; 3, 4-Methylenedioxymethamphetamine [MDMA]; Jones et al., 2009). Examining the role of cannabis strain could also be valuable (Supplemental C [OSF]). Beyond personal usage factors, we urge more work on contextual factors such as the nature of work (e.g., industry, job characteristics) and implications for creativity-related social interactions (e.g., incorporation of feedback on ideas). Further, beyond focusing on consistency in creativity ratings of ideas, it would be interesting to consider variance in creativity ratings across raters and ideas.

Third, our samples likely skewed toward participants with higher socioeconomic status (SES), as indicated by higher median household incomes and education (Kraus & Keltner, 2013; Piff et al., 2010). We thus invite future work on lower SES cannabis users. Also, we did not achieve perfect random assignment due to the challenges of doing so in the field. Thus, we invite more work using different research designs and methods. For instance, neuroimaging techniques (e.g., electroencephalogram [EEG], functional magnetic resonance imaging [fMRI]) can complement self-reported data and cognitive tasks (Waldman et al., 2017, 2019). Finally, we urge more work on the antecedents and outcomes of cannabis use at work as findings remain limited (some exceptions: Biasutti et al., 2020; Wadsworth et al., 2006; Zhang et al., 2020). As recreational cannabis use becomes legal in more parts of the United States and the world, there is a growing need for research on cannabis use to inform workplace policies. We contribute to this evidence base by adding pertinent knowledge on how cannabis use impacts creativity outcomes.

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