MIND FOUNDATION

Psychedelic-induced creativity: Fact or fiction?

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Psychedelics and creative endeavors appear intimately linked throughout history. Countless musicians and artists have reportedly been inspired by psychedelic experiences. But what does the research say? Do psychedelics actually make people more creative? To find out more, I talked to Natasha Mason about a study she recently published with her colleagues from Maastricht University, where they explored this exact topic: Mason, N.L., Kuypers, K.P.C., Reckweg, J.T. et al. Spontaneous and deliberate creative cognition during and after psilocybin exposure. *Translational Psychiatry 11*, 209 (2021).

Lukas Basedow, M.Sc.: What inspired you to look into the relationship between psychedelics and creativity?

Natasha Mason, PhD: That is a good question, and I think there are many sides to the answer. For one, there is the interesting anecdotal side, consisting of many claims from people that taking psychedelics enhances their creativity. These reports span across many individuals, with scientists, engineers, artists, authors, and famous people having made such remarks. That said, the scientific literature as to whether this is the case or not was very much lacking. There were early historical interests and very interesting studies done, which definitely started the scientific field, but they were lacking in regard to the methodological rigor we would employ today. Some naturalistic work has also been done by our group looking to see whether aspects of creativity were enhanced after participants went to a psychedelic retreat.1 However, these are self-selected samples, and there are methodological issues with that as well, so we just said, okay, we want to do the gold standard experiment: placebo-controlled, double-blind – do psychedelics enhance creativity, both acutely and in the long term, as people claim? So, it was interesting to look at this from the psychedelic research side.

But there's also a therapeutic side to this. Creativity or an ability to think outside the box has been found to be reduced across different psychological disorders like depression and anxiety. Individuals are stuck with their problems and unable to adapt to everyday circumstances. Thus, creativity has also been suggested to play a role in treating psychological disorders. If you can enhance creativity, then perhaps you can enhance coping and induce adaptive interpretations of life challenges. This is interesting to think about in regards to psychedelic drug action because we know these drugs are being investigated for disorders like depression and anxiety, and individuals claim they gain creative insights into their problems. Since these insights might allow for long-term therapeutic change, we thought there were overlapping variables here that also made it extremely therapeutically relevant to investigate psychedelic-induced creativity.

L: How did you investigate whether psychedelics have an effect on creativity?

N: Well, first, I have to explain how we define creativity because you might think of painting, music, or other arts. In the scientific literature, however, creativity is defined as consisting of two constructs. The first is divergent thinking and the second convergent thinking. I usually describe these with an example: If you think of brainstorming, as when you are trying to solve a problem, divergent thinking allows you to come up with as many solutions for that problem as possible, while convergent thinking is how you decide what the best solution is. So, this is a very goal-directed form of creativity, and our tasks assess creativity in this way.

In the study, we used the "alternate uses task," which is the gold standard for assessing divergent thinking. Here we ask people to come up with uses for an everyday object like a brick or a pen, and they have to write down how many different uses they can come up with. We score each response according to fluency, which is how many uses they came up with; and originality, which is how unique they are. To do this, we compare each response to those of all the other participants. For example, if I say that I could smash a window with a brick and other people also say they could smash a window, then that would be a low originality score because it wasn't unique. For our study, we also asked how many uses they came up with that were completely new to them, meaning ways in which they had never seen or envisioned this object used before. This added the dimension of "novelty" to our measures of divergent thinking.

We also used the "picture concept task," which assesses both divergent and convergent thinking. Here we show people three rows of three pictures, and they have to make associations between them. There is always one correct answer, with the number of correctly identified associations across the task serving as a benchmark for more convergent creativity. Then, after finding the correct answer, we ask them to come up with all of the alternative creative answers they can. We count how many answers they have, and they write down why they made that association, which designated objective raters then use to assess originality. Finally, we had a questionnaire asking how creative they felt, not specifically during the tasks but throughout the whole testing day. It consisted of statements like "I had insights into problems," "I had insights into connections that had previously puzzled me," or "I had very original thoughts," which participants rated after the testing day.

L: Could you elaborate on the study design and the substances participants received?

N: This was a between-group study with 60 people, 30 of whom received a moderate dose of psilocybin. I think the average was 15 milligrams or so, maybe a little less. "Moderate" doses are hard to quantify, but these are not ego-dissolution-level doses; people are still able to perform our tasks. The other group received placebo, of course. Comparisons were between-subjects because we were interested in the longer-term effects, which we assessed seven days after their psilocybin dose.

L: What did you discover? Does psilocybin influence creativity?

N: Well, we did not discover what we hypothesized to find! We found that participants performed worse under the influence of psilocybin than under placebo in all aspects of our tasks. Both divergent and convergent creativity were reduced, yet at the same time participants reported feeling more creative. Now again, this feeling of creativity was not assessed specifically with respect to the tasks; rather, participants reported having more insights throughout the testing day.

We also did some brain imaging to look at correlations between changes in the brain and changes behavior-wise. For this, we looked at two brain networks: The *default mode network* (DMN), which is involved in idea generation with regards to divergent creativity, and the *task-positive network*, which is more involved in idea evaluation, so this is convergent thinking.

We found that psilocybin induced changes in the activity within these networks that correlated with our divergent and convergent thinking measures in the way we expected. More specifically, acutely reduced functional connectivity within the DMN was related to impaired divergent thinking, while acutely reduced functional connectivity between the DMN and the positive task network was related to impaired convergent thinking.

Then, seven days later, participants returned to the lab. We mostly found no changes between the groups, but there was a significant increase in the number of new ideas people came up with on the alternate uses task for the psilocybin group. Interestingly, we also found that the more subjective creativity they reported on the acute testing day, the more new ideas they had on the seventh day.

As for what may be going on in the brain that sustains this persisting increase in new ideas, we found correlations between acutely decreased functional connectivity in the DMN and improved performance in divergent thinking-related cognition seven days after. So, in sum, decreased within-network functional connectivity of the DMN correlated with both an acute reduction in divergent thinking and a sub-acute increase in divergent thinking – this seems counterintuitive but may be in line with previous work.

Specifically, it is suggested that the DMN underlies the idea-generation process of divergent thinking. So, an acute reduction in DMN functional connectivity would be expected to result in acutely poorer divergent thinking performance on a creativity task. That said, previous work has found that while psychedelics decrease within-network DMN functional connectivity acutely, they increase DMN integrity sub-acutely, potentially via a neuroplastic effect on brain network function. Thus, it could be that the sub-acute psilocybin-induced increase in DMN functional connectivity facilitates the increased generation of novel ideas.

L: It's interesting that participants performed worse in all creativity tasks under the influence of psilocybin butr eported feeling more creative. Could you explain what is going on here?

N: We proposed two kinds of explanations for these contradictory findings. First, it could be that people think they are more creative when they are under the influence of a psychedelic, while they actually are not. A well-known effect of psychedelics is that they increase feelings of insight, profoundness, and attribution of meaning to previously neutral stimuli. Maybe you think of breaking a window with a brick, and because of this increased feeling of profoundness you believe this to be a very original thought when that is not actually the case. So, that would be one explanation.

Another explanation, which we favored, is that there are different ways of looking at creativity. There is one type of creativity, termed deliberate creativity, which is characterized by being more attention-demanding and goal-directed. This is the type we measured in our study with these tasks. Deliberate creativity can be contrasted with spontaneous creativity — a mental state more characterized by unrestrained, bizarre, random, and unfiltered thoughts. This is less like asking people to be creative and more like people letting

their thoughts flow to creative spheres. This is what is captured with our questionnaire. This distinction could mean that our results show a decrease in this deliberate, goal-directed creativity, but that spontaneous insight, this letting-your-mind-go kind of creativity, might be increased. Then, when the drug has worn off, maybe this more deliberate creativity is increased, as we have seen in our study.

Actually, after we published the paper, there was a remark by somebody online summarizing this quite well: "You can experience some of the coolest, most interesting lines of thinking [under the influence of a psychedelic] but at the same time turning on the TV can seem like a nearly impossible obstacle." So, participants might have had all these cool thoughts but couldn't really do anything with them, which is very interesting with regards to how to think about the assessment of creativity and what tasks we are using to assess it.

We are asking participants to write their answers down, and the tasks are timed and very attention-demanding. We know psychedelics decrease your attention span, motor coordination, and language production,2–4 so all of this may be influencing why we found these acute reductions in our tasks. It could be a reduction of deliberate creativity, but maybe it is also a reflection of a decreased ability to properly do these tasks, which might reduce our ability to really investigate the effect of these drugs on creativity.

L: I noticed that all of your tasks are related to language production and wondered if that might explain the results in some way. As your tasks are really dependent on the language modality, do you think focusing on creativity in another modality might lead to different results?

N: Yes, exactly. I think of this study as the first of many more to come. We assessed whether this substance (psilocybin) has an effect using these standardized measures of creativity. These are tasks people have been applying across the field, and I think this study needed to happen because now we can look at adaptations in methodology. We did it the gold standard way, but these tasks were validated in groups that have all their faculties, who can write and are not impaired in faculties like language production. We now definitely need to adapt this research design to people who are intoxicated, for example, by taking away the time pressure or having people talk instead of writing, or, as you said, by investigating other modalities like painting. I will say that we actually considered this, but it gets really difficult because how do you assess whether a painting is more creative or not? Do you look at the amount of color? The abstractness? Since this is not my field, I will never be able to run a study like that, but it gets harder the more subjective the judgment becomes. What is also nice about the picture concept task we used is that we could have multiple people rating the originality responses. So, multiple people went through the answers and said how original they thought the answers were and then we could compare the ratings of different raters. In the end, these tasks are already hard enough to score. I think a painting task would be even more difficult, but it could overcome some hurdles like language production.

L: You mentioned that your findings could be explained by the difference between deliberate and spontaneous creativity. In line with what we have been discussing: Are there any standardized ways, or can you think of proper ways to measure spontaneous creativity?

N: Sure. The literature on spontaneous creativity consists mainly of questionnaires, like the mind-wandering questionnaire, that ask participants questions like "where did your mind go" and "did you consider it creative or novel." Regarding actual tasks, one that we used in another study with ayahuasca is a "chain free association task" [results not yet published]. This tries to capture your train of thought. For example, you say a word like "snow," and then you ask participants to come up with a word that is related to this, like "ball." Then you ask what comes to their mind when they hear "ball" and so forth. You then measure the semantic distance between the words, and a larger distance is considered more creative. If I said "snow" and you said "phone,"

for example, that would be considered more creative because there is a greater semantic distance to the first word. This task we tried, based on previous literature, is the only one that actually comes to mind. I am sure though that there are more out there that I am not aware of.

L: Spontaneous creativity does sound difficult to assess in a laboratory.

N: Exactly. Another aspect of the creativity tasks that I think will be more interesting to pathological populations is making it more personalized. Nobody cares what you do with a brick, but focusing more on a personal problem participants want to solve and seeing if they can come up with more ideas could be more relevant. That might also reduce this attentional impairment I mentioned because participants will be more motivated to actually engage with this task because they can gain something out of it.

L: As a last question, many people reading this blog might aspire to become psychedelic researchers like yourself, so could you share some fun, exciting, interesting, or frustrating aspects of your work?

N: First, I will say that the whole thing is fun! The whole study was fun to do, but one of the greatest aspects is the participants, who are always very motivated. Since the effects of these substances last for a long time, you get to spend a lot of time with these individuals, and they are in a vulnerable state, which often means getting to know people very well during that time.

Two participants especially came to mind when you asked this question. One was a PhD student who was using the study to gain insight into their own work and started giving me a lecture on this very complex fundamental neuroscience topic while they were clearly high on psilocybin. They definitely tried their best and were super stoked talking about this, which was a lot of fun – even though I did not understand everything they were saying. They told me afterwards that they actually realized something about their own research during the experience and was extremely thankful that they could take part in this study. Another memorable participant experience relates to the brain imaging aspect. During part of our experiment, participants are lying in an fMRI scanner, which is always nerve-racking for me because you never know how they are going to react to lying inside this massive machine while under the influence. When you get into an fMRI scanner, you actually pass through a very strong magnetic field that can make you feel somewhat dizzy and induce a feeling of turning around a corner even though you are going straight.

This one participant entered the scanner and was really confused and kind of shocked because they clearly experienced going around a corner and asked me why they were turning around. When I told them they were actually going straight in, they did not believe me, and I let them get out to show them that they really were going straight. Interestingly, sometimes getting participants out of the scanner was actually the hardest part, because once you are in there, it can be quite cozy with a nice blanket and actually feel a bit womb-like. Some participants were actually asking me to stay in a bit longer.

Regarding unpleasant aspects, one of the most frustrating ones is the stigma that is still attached to this kind of research. When we post these studies online looking for participants, we get a lot of people who actually have no idea about what you are doing, saying things like, “You are a horrible person for giving drugs to people.” On the other hand, there are also participants who just think, “Taking drugs and getting paid sounds super fun” but do not take it seriously at all. So, working through this stigma and finding out if people are actually serious about participation can be a bit frustrating.

L: Thank you, Natasha, for this interview, and let us hope that stigma will be less of a problem for the next generation of researchers!

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