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A qualitative analysis of the psychedelic mushroom come-up and come-down



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Psychedelic therapy has the potential to become a revolutionary and transdiagnostic mental health treatment, yielding enduring benefits that are often attributed to the experiences that coincide with peak psychedelic effects. However, there may be an underrecognized temporal structure to this process that helps explain why psychedelic and related altered states of consciousness can have an initially distressing but ultimately distress-resolving effect. Here we present a qualitative analysis of the self-reported ‘come-up’ or onset phase, and ‘come-down’ or falling phase, of the psychedelic experience. Focusing on psilocybin or psilocybin-containing mushroom experience reports submitted to Erowid.org, we use phenomenological, thematic content and word frequency analysis to show that the come-up is more often characterized by negatively valenced feeling states that resemble an acute stress reaction, while the come-down phase is more often characterized by positively valenced feeling states of the sort often observed following recovery from illness or resolution of stress. The therapeutic and theoretical relevance of these findings are discussed.

Studies have shown that classic serotonin 2A receptor agonist psychedelics are promising treatments for anxiety and depressive disorders, obsessive-compulsive disorder and substance use disorders¹, but the mechanism of action (MoA) mediating the transdiagnostic therapeutic effects of these agents is not yet agreed on. Evidence is strong that the acute subjective effects of psychedelics play a role in moderating outcomes^{1–3}, while others argue, mostly based on rodent research, that conscious experience may be secondary or peripheral to the therapeutic effects of these agents⁴.

Here we ask whether there is something particular about the phenomenological trajectory of the psychedelic experience that helps explain why users often report a sense of relief after a single dose of these agents. While a great deal of attention has been paid to the mystical^{5–7}, insightful⁸ or emotional breakthrough⁹ experiences that occur during peak psychedelic experiences, comparatively little attention has been directed towards the states that precede or follow these peak experiences.

In accordance with recent theoretical proposals that psychedelic-like altered states of consciousness reflect compensations against various stressors^{10–13}, we anticipate that the psychedelic come-up or onset phase can resemble illness-like discomfort or stress that often characterize psychological crisis states – such as can occur in incipient psychotic or trauma

disorders^{14–16} or trigger spiritual experiences^{17,18} – and that the psychedelic come-down phase is akin to a state of relief.

That is, we hypothesize that the trajectory of psychedelic mushroom experiences might recapitulate, in a time-limited manner, the trajectory of naturally occurring visionary or hallucinatory experiences that are often preceded by aversive feelings of illness, anxiety, panic, lethargy, despair and so forth. A transition from aversive come-up to relieving come-down is not only a testable prediction derived from recent theories^{10,11}, but may also help explain why individuals often report emotional breakthroughs or therapeutically relevant insights during or after psychedelic experiences^{8,9,19}. For example, the typical trajectory of the psychedelic mushroom experience might foster a progressive visionary transformation and positive reappraisal of thought content initially or typically associated with aversive states, such as often occurring during the come-up. The theoretical and therapeutic implications of the current study are elaborated further in the discussion.

Methods

This study uses phenomenological, thematic content and word frequency analysis to examine the psychedelic mushroom come-up and come-down. The phenomenological analysis allows for a careful examination of subjective experience²⁰, and here provides a rich source of first-person quotes to

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convey a gestalt or holistic sense of how individuals experience and describe the psilocybin mushroom come-up and come-down. Thematic content analysis²¹ allows us to code descriptions of the come-up and come-down and determine the relative frequency of themes emerging from our initial phenomenological analysis and subsequent word frequency analysis. Word frequency analysis allows us to test whether words associated with various themes are used with different frequencies when describing different phases of the psychedelic experience. We use word frequency analysis primarily to check whether themes emerging from our phenomenological and thematic content analysis of the come-up ($N = 47$) and come-down ($N = 83$) map onto a larger set of timestamped reports ($N = 279$, see below) which generally do not include explicit reference to the come-up or come-down. While less informative, word frequency analysis helps protect against possible interpretative biases.

Phenomenological Analysis

A phenomenological analysis of experience reports from Erowid Experience Vaults (<https://erowid.org/experiences/>) was conducted to identify common experiential themes of the (psilocybin) mushroom come-up and come-down. All Experience Reports were selected for publication, reviewed, categorized and lightly edited for readability by the Erowid crew. Note that nearly half of the reports submitted to Erowid are not published due to indecipherability, irrelevant content or failure to describe the effects of a substance (see also https://www.erowid.org/experiences/exp_info1.shtml). We chose to focus exclusively on psilocybin mushroom experiences due to the large number of available reports ($N = 2343$), familiarity with the time-course of the psilocybin experience and relevance to clinical trials. Advanced Search of Erowid Experience Vaults (<https://erowid.org/experiences/search>) for published self-reported ‘mushroom’ experiences, filtered to exclude concurrent use of other substances, yielded $N = 53$ reports that contained the search terms ‘come-up’ or ‘come-up’ and $N = 90$ reports that contained the search term ‘come-down’ or ‘come-down’. Despite filtering out concurrent use of other substances with Erowid’s advanced search function, some reports still included reference to the use of cannabis, alcohol and tobacco/nicotine, and we chose to include these accounts in our analysis, as it would be difficult to systematically remove these reports, and concurrent use of these substances appeared common and vaguely reported (see discussion). A secondary search within the text body of each relevant mushroom experience report yielded smaller text fragments that described the come-up or come-down. Reports that did not describe the come-up or come-down were removed leaving $N = 47$ and $N = 83$ text fragments for analysis, respectively. Each textual account of the mushroom come-up and come-down was read through once to identify common themes. A second read through was done to extract quotes relating to themes previously identified. Excerpts from these reports are presented at length below (see results section: phenomenology) and in Supplementary Note 1 and 2. In

general, we erred towards including longer quotes in order to convey a gestalt (holistic) sense of interrelated experiential themes, rather than dissecting each text fragment.

Thematic content analysis

Thematic content analysis of textual descriptions of the come-up ($N = 47$) and come-down ($N = 83$) was conducted. Codes were derived from themes found via phenomenological analysis as well as novel themes suggested by word frequency analysis (see below). Author AB hand-coded all passages referring to explicitly the come-up ($N = 47$) and come-down ($N = 83$). A second independent coder (JB) coded a subset of text fragments for the come-up ($N = 22$) and come-down ($N = 25$) to test for intercoder reliability. Codes with $\geq 75\%$ percentage intercoder agreement and Cohen’s Kappa (K) ≥ 0.15 on the first coding attempt were included in the analysis. Percentage of text fragments describing the come-up and come-down expressing relevant themes are presented below in the results section.

Word frequency analysis of timestamped Mushroom reports

To check the results of our phenomenological analysis against a larger sample of reports, a word frequency analysis was conducted on mushroom reports from Erowid.org that were timestamped by reporters. Timestamps (eg ‘T + 0.00’, ‘0:30 min’, ‘t + 1 hour’ ‘at 15:20’) are used by reporters to detail the progression of their experiences. Excluded from our analysis were reports with less than two timestamps, reports including the use of other substances (except for cannabis, alcohol, and tobacco/nicotine) and reports of multiple doses of mushrooms taken more than an hour apart. Doses below 0.5 g dried mushrooms were also excluded from the analysis (see discussion). All doses of fresh mushrooms were included. Out of a total of 2343 reports, $N = 279$ were extracted for analysis.

All timestamped reports were then separated into 30-min time-segments in an excel spreadsheet (rows = individual reports, columns = time-segments). All text following a timestamp was included in the relevant time-segment only if the next timestamp was an hour or less later. Otherwise, only the paragraph immediately following the timestamp was included. There was a significant attrition of reporting for later time-segments, so all results of word frequency analysis are presented as percentages of reports per time-segment that contain relevant terms. The number of reports that contained timestamps per time-segment are as follows: 0+ min ($N = 258$), 30+ min ($N = 235$), 60+ min ($N = 222$), 90+ min ($N = 165$), 120+ min ($N = 167$), 150+ min ($N = 98$), 180+ min ($N = 112$); 210+ min ($N = 73$), 240+ min ($N = 87$), 270+ min ($N = 51$), 300+ min ($N = 52$), 330+ min ($N = 31$), 360+ min ($N = 60$). See Fig. 1 directly below for an example of a segmented timestamped report.

Note that each time-segment captures experiences within the next 30 min (e.g. 0+min refers to experiences that occur between 0 and

Example of segmented timestamped report					
0+min (0-0.5h)	30+min (0.5-1h)	60+min (1-1.5h)	90+min (1.5-2h)	120+min (2-2.5h)	150+min (2.5-3h)
T: = 00 Three of my housemates and I ate 3.5 grams of dried mushrooms each and washed them down with cheese-itz and orange juice. No sitter was present.	T: =40 Effects were felt. I felt a nervous, flighty “pink” energy in my arms and legs, and felt like stretching. When I looked at my hands they appeared sparkly and a long distance from my face. The lights and the computer screen dispensed lights and moods.	T = 1:20 My roommates came outside and, again, I was disappointed in their banter. I talked to them for a short time then went upstairs into my room and turned on some favorite music.	T = 1:30 I felt the emotions of the music strongly and sat down with my back against my dresser and cried. My roommates, A and T, eventually came and found me again, and this time I wasn’t annoyed. They took on the mood of the room, but without crying themselves.	T = 2:00 A left and T stayed. I started dancing in the middle of the room, while he sat against a wall and watched. Dancing like this has been a lifelong hobby and it didn’t feel at all out of the ordinary. A very happy song came on and I danced like a fool. I reached out and touched T’s finger with my finger, and it felt like a jolt of light. It was the most sublimely happy I’ve ever been.	T = 2:30 We walked around incoherently in the upstairs, and we were generally more afraid. A started talking about the sky and looked at me frightened saying, “this is not what is supposed to happen!?”
T = :15 We smoked a couple bowls together and listened to music	T = :50 I grew tired of the conversation of my roommates, it seemed as if they were repeatedly being amazed, which seemed worthless to me. I left them and went outside on the patio. It was night out, and a little cold, but I couldn’t resist the urge to take off my shoes and socks and pants and shirt. I touched my toes and saw faint ribbons of rainbow colors traveling up my calves.				

Fig. 1 | Example of a timestamped mushroom experience report organized into 30-min time-segments in an Excel spreadsheet.

30 min). The only exception is 360+ min which contains all further descriptions of the experience. Searching within each time-segment (each column of our Excel spreadsheet) for terms referring to the come-up ('come-up', 'come-up', 'coming-up') and the come-down ('come-down', 'come-down', 'coming down') verified that reference to these terms matches onto the temporal progression of the mushroom experience. See Fig. 2 directly below.

Each time-segment was subsequently searched for word stems that reflect the emotional (eg anxiety; search stem 'anxi'), cognitive (eg confusion; search stem 'confus') and physical (eg nausea; search stem 'naus') themes revealed by phenomenological analysis. Graphs of terms by time-segment, depicted as percentage of reports containing relevant word stems by time-segment, are presented below in the results section.

Results

Thematic content analysis of descriptions of the come-up and come-down revealed that individuals are more likely to experience aversive feelings in the come-up such as nausea (34%), anxiety (28%), restlessness (21%), confusion (17%), detachment (11%) as well as other physical sensations such as energy rushes (19%), tingling (15%), feeling cold (9%), heavy (9%) or uncoordinated (9%). Alternatively, the come-down is more likely to be described as a pleasant (34%), peaceful (22%), reflective (17%), insightful (17%) and socially enjoyable experience (16%). See Fig. 3 directly below.

Word frequency analysis confirmed that words referring to anxiety and nervousness were used more often to describe the first 60 min of the mushroom experience, while words referring to positive emotional states were used more often to describe the latter phases of the mushroom experience. Increased reference to nausea, confusion, laughter, breathing

Fig. 2 | Percentage of timestamped reports that reference the come-up ('come-up', 'come-up', 'coming up') and come-down ('come-down', 'come-down', 'coming down') at given timepoints. Despite low percentages of timestamped reports that explicitly reference the come-up and come-down, the graph maps well onto first-person accounts, as well as the temporal relationships between plasma psilocin levels, 5-HT2AR occupancies, and subjective intensity ratings after psilocybin ingestion^{45,46}.

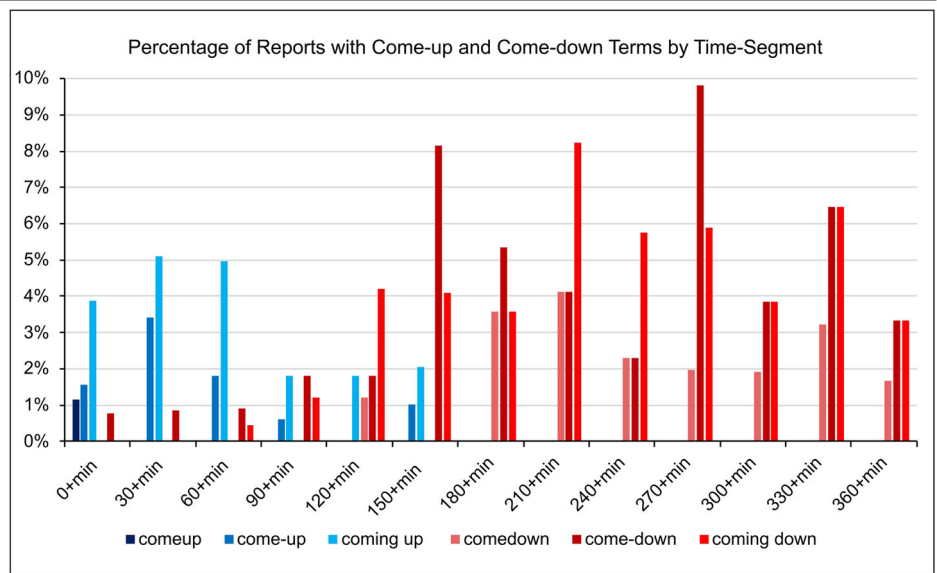
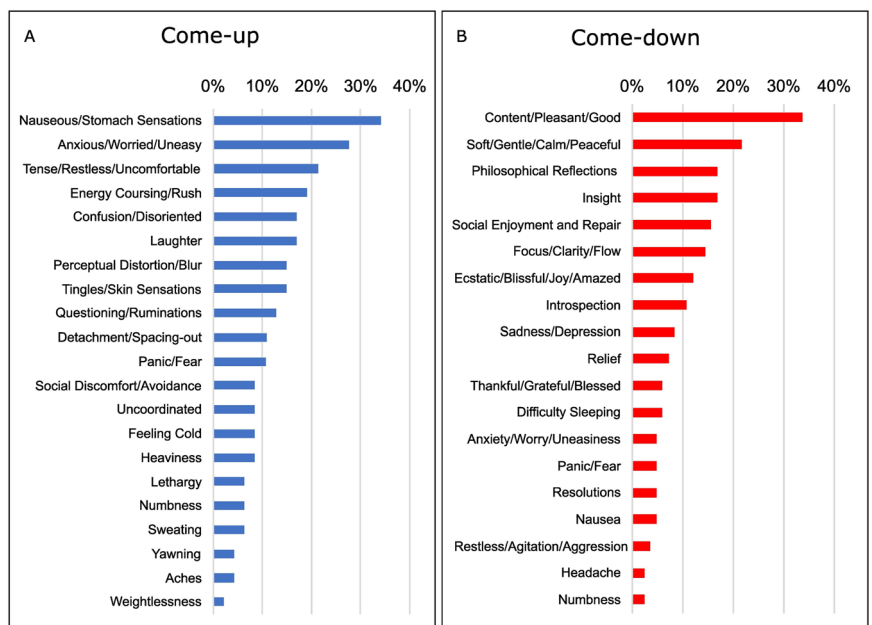


Fig. 3 | Percentage of text fragments expressing common themes of the come-up (3A) and come-down (3B).



and distortion also characterizes descriptions of earlier phases of the mushroom experience. See Figs. 4 and 5 directly below.

Phenomenology of the Come-up

A description of the mushroom come-up is presented below. See Supplementary Note 1 for quotes referencing the following themes: struggling through (ignoring, avoiding, waiting out or dealing with) an unpleasant mushroom come-up (Supplementary Note 1; 1B); emotions of anxiety, nervousness and excitement (Supplementary Note 1; 1C); physical sensations of nausea, tension, skin tingling, rushing energy, shaking, cold, numbness, heaviness and lethargy (Supplementary Note 1; 1D); behavioral immobility and isolation (Suppl; 1E); and cognitive-perceptual distortion, disorientation, detachment, confusion (Supplementary Note 1; 1F) and rumination (Suppl; 1G).

First, consider two typical reports:

“I felt the familiar come-up of mushrooms, a slight queasiness in my tummy and waves of electric energy tingling through my body. Soon we

all felt the need to lie down, and be close to the earth.... During the come up period I was quite restless and felt a level of anxiety in my body. I shifted and moved, but just couldn’t seem to get comfortable... At some point in time I felt the need to void my bowels. There was a rumbling, grumbling going on inside my intestines...” (Hypersphere, 2011).

“About 10-15 min after eating them we started feeling the effects. Lightheadedness, spacing out, anxiety, numbness, confusion” (Hannibal, 2013).

The unpleasantness of the mushroom come-up surprises a number of report authors, and author comparison between mushroom and other drug experiences reveals a particular discomfort with the mushroom come-up (Supplementary Note 1; 1A).

References to waiting for or through the come-up are common. While some individuals are surprised by an unpleasant come-up, others expect it, and share strategies for avoiding a harsh come-up (Supplementary Note 1;

Fig. 4 | Percentage of timestamped reports containing stems for common emotion words by time-segment.

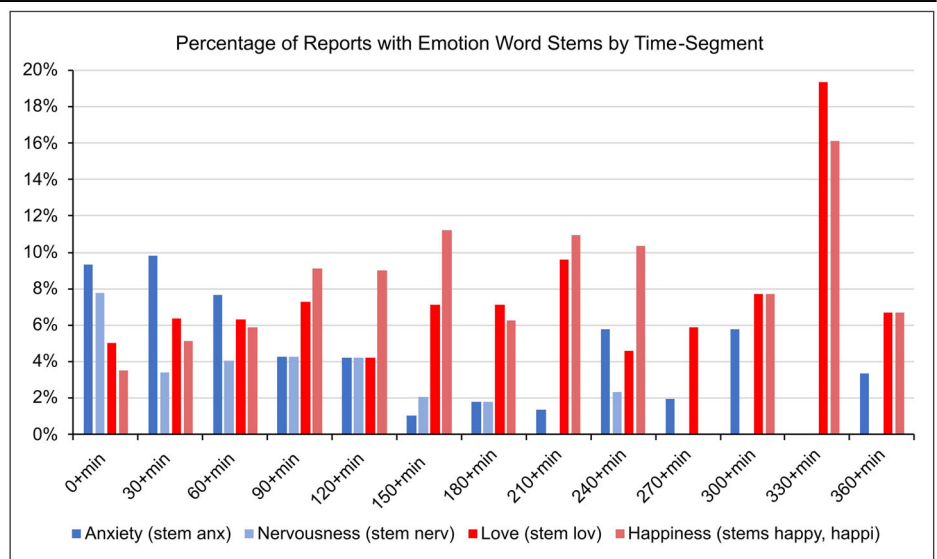
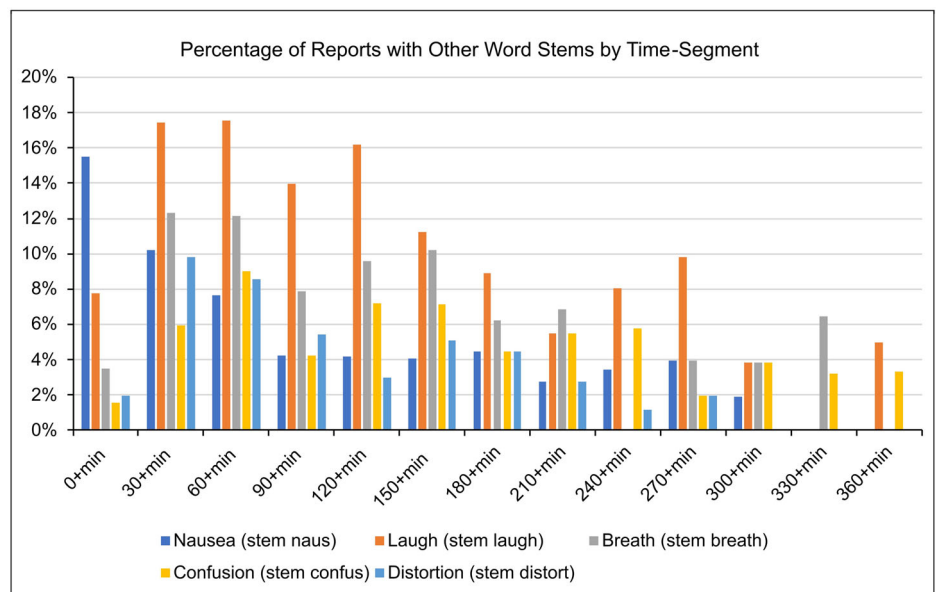


Fig. 5 | Percentage of timestamped reports containing stems for common physical and cognitive words by time-segment.



1B). Although peak drug effects often start to emerge within an hour after ingestion, this can vary (see Fig. 2). Dosage, dose form, administration method and stomach contents can lead to variable onset latencies, and some individuals are taken aback by an unexpectedly slow or rapid onset.

Emotional changes during the come-up might best be described as anticipatory, with feelings of both anxiety/nervousness and excitement being common (Supplementary Note 1; 1C). Sometimes anxiety and excitement are felt simultaneously or in cycles. Anxiety and excitement during the come-up appear to precede self-reflective and therapeutic experiences on psychedelics (Supplementary Note 1; 1C).

Nausea is very common during the mushroom come-up (see Figs. 2 and 5; Supplementary Note 1D), as well as after oral ingestion of other classic psychedelic 5-HT_{2A}R agonists (Breeksema et al., 2022). Individuals also report other bodily sensations including changes in perceived weight, tingles, energy and feeling uncoordinated (Supplementary Note 1; 1D). Feeling cold, sweating and yawning are also mentioned (Supplementary Note 1; 1D).

Oftentimes these bodily sensations are accompanied by a desire for stillness. The desire for stillness during the come-up is accompanied by distortions in perception, as well as confusion and social discomfort, and individuals often become immobile. Solitude and stillness in turn bring feelings of relief (Supplementary Note 1; 1E).

Cognitive-perceptual distortions, disorientation, detachment and confusion are common during the mushroom come-up, as are experiences of altered cognition and mental fragmentation (Supplementary Note 1; 1F). Anxious ruminations in the come-up often coincide with ensuing peak experiences in which problems begin to resolve. In one case, for example, a string of worries or anxieties precedes a sense of ‘otherness’ and then a realization that leads to a peak experience (Supplementary Note 1; 1G).

Phenomenology of the Come-down

The duration of the mushroom come-down is longer than the come-up, but harder to define, as the effects and after-effects of psilocybin mushrooms taper off gradually. A description of the mushroom come-down is presented below, but refer to Supplementary Note 2 for extensive quotes from first-person reports. However, the following description by bongd81²² offers a good general description of the psilocybin mushroom come-down, conveying the sense of calm, beauty, clarity and gratitude that we have identified as typifying a come-down.

“after a felt eternity (literally), this [peak] state somehow shook lose [sic] and my mental faculties gradually came back online again, which then lead [sic] to the last part of the trip, the come-down. T + 5:30, I was anew sitting on the steps located at the entrance to the garden with a view of the lawn and a wide variety of flowers framing it. It was past 4:00 p.m. (I had plugged my earbuds back in and was carried by calm music) and the sunrays were flooding in more shallow and bathed everything in a golden friendly light... “It felt absolutely real.” My mind was still blown by amazement by how all this is even possible, despite the fact that it was actually happening to me right in that particular moment. It was miraculous, but I also got quite emotional. I was filled with a strong sense of gratitude, that both my feet were on the ground again (figuratively speaking) and no apparent harm had occurred and even that there IS such a place ‘to come back to’, a somewhat stable looking baseline reality that we humans inhabit and share.”

Calm, positive emotions predominate in the come-down. In contrast to the anxiety and excitement of the disorienting come-up, or the awe-inspiring peaks of the psychedelic experience, the denouement of the psilocybin mushroom experience is often characterized by a sense of peace, cathartic release, contentment and relaxation. Words such as ‘smooth’, ‘soft’, ‘mellow’, ‘comfortable’, ‘relaxed’, ‘nice’, ‘satisfied’, ‘joy’, ‘bliss’, ‘peace’, ‘pleasant’ and ‘playful’ can be found in case reports.

Several individuals refer to the pleasant calming of an excited mind, and a sense of gratitude (implicit or explicit) is conveyed in a number of reports (Supplementary Note 2; 2A).

In keeping with our overarching theme; the temporal trajectory of the psychedelic experience, it is noteworthy how a number of individuals describe the come-down as a return from a challenging journey. A sense of victory and relief may be associated with this return to baseline, although the period of time that it takes to fully return and grow from a trip may far outlast the acute subjective effects of the mushroom experience. Several individuals acknowledge challenges but nevertheless desire further trips in the future (Supplementary Note 2; 2B).

The confusion that characterizes the mushroom come-up subsides in the come-down, yielding to a compensatory (or comparative) perceptual acuity and mental clarity. In some cases, a flow-state is described in conjunction with synchronous movement. Descriptions of highly enjoyable and beautiful perceptions abound, and individuals convey an appreciation of sensory details in their environment. Mundane habits and experiences are appreciated with a new sense of value and can seem more pleasurable than usual (Supplementary Note 2; 2C).

A feeling of enhanced social connectedness and a desire to engage in social repair is common in descriptions of the come-down (Supplementary Note 2; 2D). Individuals also report being unbothered by what would normally be aversive experiences (Supplementary Note 2; 2E). Several individuals report an inspiration, insight or realization, or make resolutions for living better or how to approach psychedelic experiences in the future (Supplementary Note 2; 2F). Philosophical musings and talkativeness are also common during come-down and often accompanied by elevated mood.

Other writings reveal fast-paced thought accompanied by an elevated spiritual mood. In some reports, attention becomes focused on ideas of dubious value, and lingering excitability and irritability can in some cases lead to difficult come-downs. Two individuals also report an absence of positive emotions following elevated states (Supplementary Note 2; 2G). These reports do reveal some variability between mellow/calm come-downs and excited come-downs, and whether positive emotions (contentment and happiness) persist or are absent following peak experiences.

Discussion

Our results support the hypothesis that the come-up phase of a psilocybin mushroom experience (and likely other classic psychedelic experiences) can resemble an aversive illness-like state and that the come-down can resemble a state of relief. See Fig. 6 below for a visual summary of our results.

We will now discuss how our results may be relevant to the therapeutic mechanism of action (MoA) of psychedelics, as well as the idea that naturally occurring psychedelic-like experiences, such as hallucinations and spiritual experiences, are elicited by stress¹⁰⁻¹³.

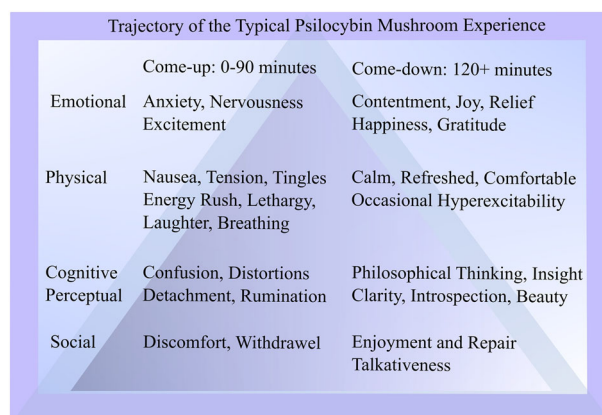


Fig. 6 | Summary of the trajectory of a typical psilocybin mushroom experienced based on the current analysis.

First let us address therapeutic considerations. The psychedelic mushroom come-up described above specifically resembles an acute stress reaction – which is relevant to but not isolated to illness-like states and symptoms. Feelings of anxiety, irritability and excitement, energy coursing through the body, attention to heartbeat and breathing, numbness, nausea and detachment are common symptoms of a stress reaction or disorder and are associated with the release of stress hormones and adrenaline^{23–26}. Psychedelics have been shown to elicit release of stress hormones and acutely increase anxiety-like behaviors in rodents, a process which is positively associated with post-acute anxiolytic effects²⁷. Some scholars also suggest that an acute stress response may contribute to the therapeutic effects of psychedelic agents^{28,29}. De Wit and colleagues²⁹, for example, ask whether the acute stress response elicited by psychedelics is a result of the powerful subjective psychedelic experience and/or shapes the emotional intensity and memorability of the psychedelic experience. Our qualitative analysis suggests that the acute stress response elicited by psychedelics begins prior to peak psychedelic subjective effects but does appear to shape the emotional content and insights that occur during the peak and come-down of the psychedelic experience.

For example, the unique subjective experience of emotional breakthrough⁹ or psychological rebirth following an acute period of challenge or distress might exert therapeutic influences on individuals' views towards illness and healing. In some reports, we noticed that fears, as objects of attention, were first elicited by aversive emotional states, but then drastically reinterpreted as negative emotions gave way to positive emotions. Consider the following passage.

“That fear, it turned out, was a fear of fanatical Islam. I realize I had been harboring a deep fear of radical Islam for some time, to the point of bordering on feelings of hatred. I had been rationalizing it and quietly suppressing it and not dealing with it. In that state, the shock of finding that fear was very intense and sad, and it appeared within my subconscious as a tangled messy ball of black yarn-like strings, all bound up and tense and chaotic. I had to let it go, I had to surrender to love. I decided in that moment the only way forward was to love Islam and all Muslims as well, and forget fears of the future, and not to generalize.”³⁰

Above we glimpse a psychotherapeutic process uniquely relevant to the temporal trajectory of the psychedelic experience (and related spiritual experiences). First, one may experience anxiety or fear, followed by visualizations or symbolic representations of fears. Subsequently, feelings of fear subside, leaving one to reinterpret objects of fear from an unusually non-reactive, accepting and even loving perspective.

Certainly, this process can occur outside contexts of psychedelic use. However, the fact that psychedelics can elicit this trajectory in an amplified, short-duration and controlled manner is of immense therapeutic import. Note here that there is a tradition of psychoanalytic therapy conducted with low doses of psychedelics – referred to as psycholytic therapy³¹ – that actively encourages patients to engage with symbolic representations of ‘subconscious’ conflicts or fears.

The current findings may also provide additional insights into the antidepressant mechanism of action (MoA) of psychedelics, and perhaps how this MoA relates to other antidepressant treatments. For example, aversive feelings in the come-up overlap to some extent with the adverse side effects of serotonin selective reuptake inhibitor (SSRI) antidepressants^{32,33}; side effects that may occur before therapeutic effects are noticed. Initial activation of 5-HT_{2A}Rs may therefore be anxiogenic in both cases, while rapid or chronic downregulation of 5-HT_{2A}R signaling, respectively, might contribute to the antidepressant effects of both types of serotonergic antidepressant^{34–36}.

In addition to being therapeutically relevant, our findings also support the idea that naturally occurring psychedelic-like experiences, such as hallucinations and spiritual experiences, may be elicited by stress-induced activation of 5-HT_{2A}Rs^{10–13}. Indeed, the impetus for this study comes from

recent theoretical attempts to reconcile psychedelics, as therapeutic agents, with a broader psychotomimetic perspective¹. Brouwer and colleagues¹¹ propose that transient endogenous psychotomimetic compensation elicited by illness, injury, social threat or loss, depression, anxiety or panic is often neuroprotective and energizing, and promotes learning and behavioral reengagement, while psychotomimetic sensitization over time in response to recurrent intense stress or repeated drug use can sensitize an individual to psychotic disorder.

According to this theory, the phenomenological trajectory of a psychedelic experience might mimic the trajectory of naturally occurring psychedelic-like (eg spiritual, psychotic, and near-death) experiences facilitated by stress, in which feelings of lethargy, anxiety, detachment, confusion, pain and panic precede visionary/hallucinatory phenomena and increased mental energy. We note above that a minority of come-downs are characterized by racing thoughts, extra excitability or irritability, and ideas of dubious value (see also Supplementary Note 2; 2G), which may reflect a particular sensitivity to the energizing effects of psychedelics and possibly a predisposition to mania or psychosis. We refer the reader to Brouwer et al.^{10,11} for further explanations and implications of the model.

There are, of course, other potential implications of our findings, and ties to prior research and other theoretical frameworks, that we cannot adequately elaborate on here. Therefore, in addition to suggesting specific directions for future research based on the limitations of the current study (see below), we also encourage theoretical efforts to synthesize the findings and frameworks mentioned here with other perspectives on psychedelics.

Now turning to some limitations of our study. The choice to focus exclusively on psilocybin mushroom experiences limits our ability to extrapolate to other classic psychedelics; however, it was motivated by clinical interest in psilocybin, and a desire to privilege rich descriptions over a broader scope. Focusing specifically on textual descriptions of the mushroom come-up and come-down likewise provided us with an easily manageable number of reports, allowing us to carefully read and extract quotes from the text at our discretion, without fear of misrepresenting our sample.

The large number of mushroom reports available at Erowid.org also provided an adequate sample size of timestamped reports ($N = 279$) for conducting a meaningful word frequency analysis. Word frequency analysis and visualization (Figs. 4 and 5) increased our confidence in the generalizability of our qualitative analysis.

One possible limitation of the current study, and indeed a critique that is often levied against qualitative analyses, is that a priori assumptions lead to biases in interpreting data. We acknowledge this limitation and encourage interested readers to explore the primary source material at Erowid's Experience Vaults (<https://erowid.org/experiences/search>), as well as to reflect upon their own experiences and ask whether they resonate with our interpretations. Good phenomenological research is characterized verisimilitude – the appearance of being true or real – and the value of the current analysis will age accordingly.

An a priori focus on illness and relief-related themes is, in our view, more of a strength than a limitation, as post hoc identification of meaningful themes presents an opportunity for bias and error inherent in the search for explanations. Moreover, formulating clear hypotheses allowed us to question whether emergent themes fit with our preconceived notions. One finding that challenged us in this regard; laughter was more commonly referenced in descriptions of the come-up than in descriptions of the come-down. A quick review of background literature, however, helped make sense of this association.

While laughter may indicate a positive emotional state, it is also associated with anxiety and uncertainty^{37,38}, and a signaling of ‘playfulness’ or ‘non-threat’ to others during arousing or potentially uncomfortable, uncertain or threatening scenarios³⁹. Uncertainty is an expected feature of the onset of psychedelic experiences and fits with theoretical propositions that psychedelics increase brain entropy^{40,41} and lead to a temporary relaxation of priors⁴².

Future research is still needed to ascertain whether the trajectory of the mushroom experience reported here is generalizable to psychedelic experiences that occur in clinical contexts, that are elicited by different routes of administration (smoked, insufflated, intravenous), or are elicited by psychedelics other than mushrooms and/or psilocybin. While we expect some variability regarding these factors, note a similar trajectory in the first LSD experience ever recorded. Albert Hofmann writes...

[Come-up] “4/19/43 16:20: 0.5 cc of 1/2 promil aqueous solution of diethylamide tartrate orally = 0.25 mg tartrate. Taken diluted with about 10 cc water. Tasteless. 17:00: Beginning dizziness, feeling of anxiety, visual distortions, symptoms of ataxia, desire to laugh.” (p. 19)⁴³.

[Peak] [Experience with demon] (p. 20)⁴³.

[Come-down] “Slowly I returned from a weird, unfamiliar world to my reassuring everyday reality. The horror softened and gave way to a feeling of great fortune and immense gratitude; more normal perceptions and thoughts returned, and I became more confident that the danger of insanity was decidedly past. Now, little by little, I could begin to enjoy the unprecedented colors and plays of shapes that persisted behind my closed eyes” (p. 21)⁴³.

Questions regarding the context-dependency of psychedelic experiences are another key matter for future research. The reports analyzed here were written by people using psilocybin mushrooms outside of controlled settings – and some of our findings may not translate to clinical or experimental contexts.

For example, individuals might be less likely to mention paralysis or immobility during the come-up or express “socially inappropriate” reactions like uncontrolled laughter, when lying on a couch in a clinical trial or in a therapist’s office. Likewise, concentration difficulties, perceptual distortions and social discomfort may be more noticeable in contexts that require concentration, perceptual acuity and social interaction.

Our findings may also not be generalizable to all psychedelic users. Individuals motivated to submit their mushroom experience reports to Erowid.org may differ in some general ways from other populations of users (eg in level of education), just as the demographic and psychological characteristics of individuals in clinical trials may differ from the average psychedelic user. Note also that roughly half of all experience reports submitted to Erowid are not published (see methods). This could affect the generalizability of our findings as well.

Relating to variables unique to our sample, the use of cannabis appeared very common in conjunction with the use of psychedelics. Additionally, our search criteria did not filter out some reports in which cannabis was, or was likely to have been, used. Cannabis has been shown to potentiate the psychedelic experience, albeit in a non-linear dose-dependent way⁴⁴ and so might also influence descriptions of the mushroom come-up and come-down as described here. The choice to exclude low-dose experience reports (less than 0.5 grams of dried mushrooms) is another potential limitation/oversight of the current study.

Another set of limitations applies to the analysis of unstructured experience reports. Our analysis does not capture what percentage of individuals experienced nausea or anxiety during the come-up, or what percentage of individuals felt content during the come-down. We were only able to capture the relative prevalence of themes that individuals chose to write about.

The advantage of this method, of course, is that researchers do not impose expectations on individuals reporting their experiences. Nevertheless, the development of questionnaires and observational methods for assessing the frequency of these themes in experimental trials is a promising area for future research.

Another potential area of concern is non-random attrition of reporting as the experience progressed, particularly in our sample of timestamped

reports. It is possible, for example, that positively valenced come-downs, as captured by word frequency analysis, better represent the experiences of individuals who continued to keep track of time. In turn, perhaps these individuals had more pleasant trips in general, including during the come-up. However, a preliminary review of the come-ups experienced by these authors did not bear out this concern. Moreover, word frequency analysis and derivative visuals (Figs. 4 and 5) are, in our opinion, of secondary importance, and merely supportive of our primary phenomenological and thematic content analyses.

A qualitative analysis of the psilocybin mushroom come-up and come-down is an important first step in describing the temporal trajectory of the mushroom experience. To our knowledge, little research has parsed the psychedelic come-up or come-down and likened it to an aversive/challenging state and recovery from it. Our approach could therefore inspire future work on this theme, including more formal hypothesis testing.

Data availability

All data is publicly available at <https://erowid.org/experiences/>

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Author contributions

Authors (A.B., J.K.B., C.L.R, R.L.C-H) were involved in developing the conceptual framework for the article and in writing and editing the manuscript. Authors (E.E, F.E, S.T) were involved in more than 20 years of collecting, editing, and publishing experience reports, and in the editing of the manuscript.

Competing interests

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Additional information

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