# The Entropy–Content Paradox in Minimal Phenomenal Experience

Jonas Mago[1*], Shamil Chandaria[2]

[1] Integrated Program in Neuroscience, McGill University, Montréal, Quebec, Canada
[2] Centre for Eudaimonia and Human Flourishing, University of Oxford, UK

* Corresponding author: jonas.h.mago@gmail.com

## Abstract

Minimal Phenomenal Experiences (MPEs) present a paradox for theories of consciousness. Defined by phenomenological simplicity, they are nonetheless accompanied by unexpectedly high neural signal diversity. Traditionally, entropy has been interpreted as a marker of phenomenological richness, exemplified by psychedelic states. Yet MPEs such as advanced absorptive meditation (jhāna) or 5-MeO-DMT exhibit high entropy despite radically reduced experiential content. This tension—the entropy–content paradox—challenges the entropic brain hypothesis and calls for a refined framework. We propose that entropy does not directly index the richness of conscious content, but rather the grain of inference by which the brain resolves variability. Psychedelics exemplify a fine-grained regime, in which loosened constraints amplify fluctuations into proliferating content, whereas MPEs exemplify a coarse-grained regime, in which rigid stabilization smooths over variability into contentless awareness. Both regimes elevate entropy, but they diverge in phenomenology and perturbational signatures. Recognizing this dissociation refines the entropic brain hypothesis and positions MPEs as decisive test cases for computational theories of consciousness.

## Introduction

The relationship between neural complexity and conscious experience is a central challenge in neuroscience (Seth & Bayne, 2022). A common assumption, crystallized in the "entropic brain hypothesis" (EBH), is that neural entropy scales monotonically with phenomenological richness (Carhart-Harris, 2018; Carhart-Harris et al., 2014; Carhart-Harris & Friston, 2019). On this view, richer, more elaborate experiences are be accompanied by more complex and variable neural dynamics and therefore a more disordered (high-entropy) brain state, while states of reduced awareness (e.g., deep sleep, anesthesia) show a more ordered (low-entropy) brain state with rigid, predictable patterns of brain activity (Bocaccio et al., 2019; DiNuzzo & Nedergaard, 2017; Gervais et al., 2023; Meisel et al., 2017; Toker et al., 2022, 2024). The core intuition that grounds the EBH can be understood in computational neurophenomenological terms (Ramstead et al., 2022; Sandved-Smith et al., 2025; Varela, 1996) as the following reasoning:

1. 1st person phenomenology, conscious experience, has informational content; e.g. we see a coin facing heads up not tails – this is at least 1 bit of information.
2. Richer and more elaborate phenomenal experiences therefore have more informational content.
3. Information processing in the brain is associated with the informational contents of experience.
4. Richer and more elaborate phenomenal experiences will be associated with increased information processing and content in the brain.
5. Shannon entropy is a measure of the average informational content (or "surprise") of a probabilistic process, and so we would expect higher brain entropy measures (eg neural signal diversity measures such as LZ) with richer and more elaborate phenomenal experience.

Accumulating evidence suggests that this EBH mapping is not universal. Minimal Phenomenal Experiences (MPEs), states with little or no phenomenal content, have been associated with high neural signal diversity in both meditators (Lieberman et al., 2025; Potash et al., 2025; Shinozuka et al., 2025) and in the context of 5-MeO-DMT (Timmermann et al., 2025). These states, whether cultivated through advanced contemplative practice (e.g., absorptive concentration such as jhāna, or cessations) or induced pharmacologically (e.g., 5-MeO-DMT), are typically described in terms of deep absorption, sensory fading, and in some cases near-contentlessness (Laukkonen et al., 2023; Timmermann et al., 2025; Van Lutterveld et al., 2024). According to the EBH, such phenomenological simplicity would be expected to reduce neural signal diversity. Yet, on the contrary, several studies report elevated entropy-like metrics under precisely these conditions (Lieberman et al., 2025; Potash et al., 2025; Shinozuka et al., 2025; Timmermann et al., 2025).

MPEs have recently been proposed as a distinct class of conscious states characterized by extreme phenomenological simplicity and the reduction, or even absence, of intentional content (Metzinger, 2020; 2024). Unlike ordinary wakefulness, which is structured around objects, thoughts, and sensory inputs, MPEs are marked by a mode of absorption and sensory fading that can culminate in contentless yet luminous awareness. They present as a self-sustaining mode of wakefulness, sometimes called pure consciousness experience (PCE) rather than a representation of specific objects or events. Neurophenomenological reports suggest that MPEs can be accessed through contemplative practice, pharmacological induction and that they can be intentionally cultivated or occur spontaneously. Phenomenological surveys indicate that such minimal states are not confined to a single lineage but recur across diverse contemplative traditions (Metzinger, 2024). Crucially, MPEs challenge the assumption that conscious experience is defined by "content"—demonstrating that pure awareness can persist even when representational contents are radically attenuated. This makes them a uniquely powerful test case for computational theories of consciousness.

Thus, we have a case where both states of phenomenological simplicity (e.g., jhāna, 5-MeO-DMT experiences) and states of phenomenological rich-complexity (e.g., LSD, psilocybin, N,N-DMT experiences) exhibit high entropy, despite occupying opposite poles of experiential richness. In the remainder of this paper, we will refer to this as the *entropy–content paradox*. Signal diversity as a measure of entropy, therefore, does not uniquely track phenomenological elaboration and this finding calls for a more nuanced explanatory framework.

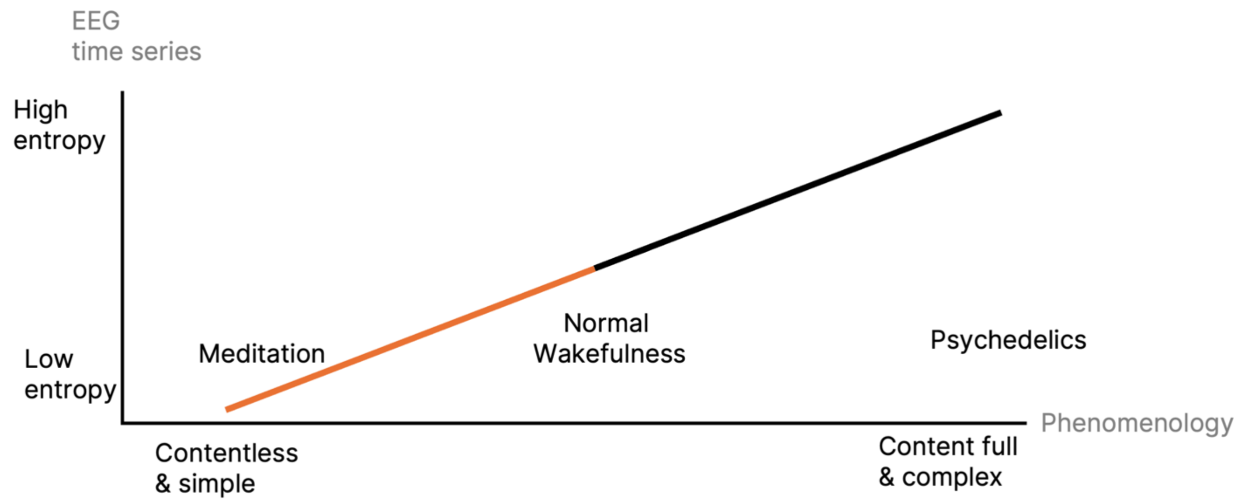


**Figure 1:** The entropic brain hypothesis (EBH) implies a monotonic mapping from phenomenological content to neural entropy. This would predict that minimal-content states are indicative of low entropy while content-rich states are indicative of high entropy.

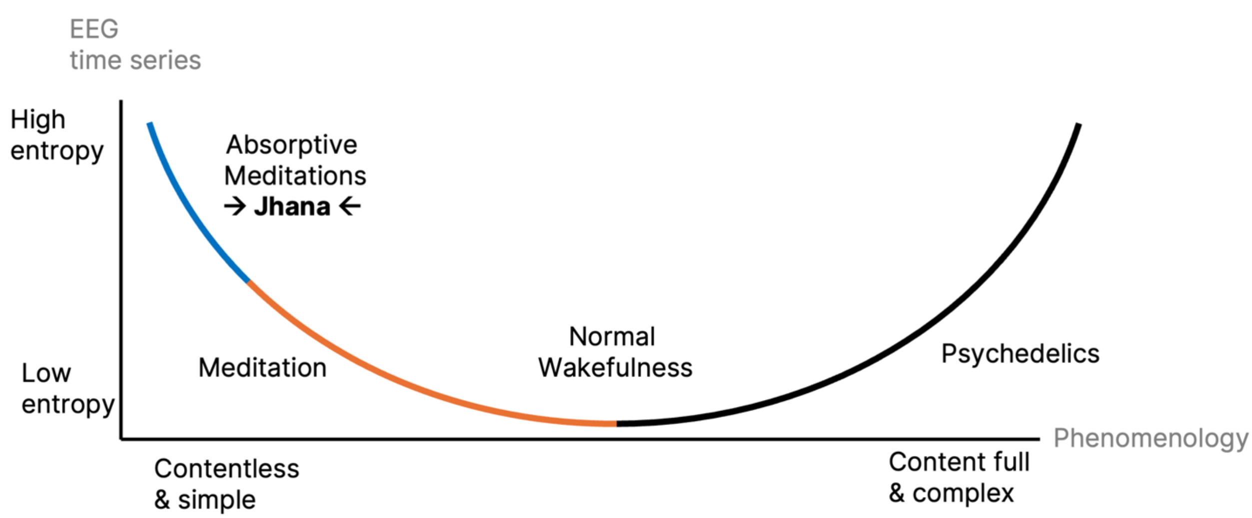


**Figure 2:** The observed “paradox.” Empirical evidence indicates that both MPEs (e.g., jhāna, 5-MeO-DMT) and psychedelics (e.g., LSD, psilocybin, N,N-DMT) exhibit elevated entropy relative to ordinary wakefulness, challenging a simple monotonic correlation between phenomenological richness and brain entropy.

To resolve this entropy content paradox, we need to return to a the fifth part of the reasoning for the EBH presented in the introduction, namely that richer and more elaborate phenomenal experience would be associated with a higher entropy because it is a measure of the average informational content. This may be an unwarranted assumption.

Consider a cup of coffee  which starts as black coffee with white cream floating on top (left cup). If this is modelled as black and white particles, as time proceeds the particles mix and the entropy of the system increases monotonically, initially creating complex swirls and tendrils (middle cup, medium entropy) until the cup is in equilibrium (right cup, high entropy) and there is just ‘brown’ coffee – maximally mixed black and white particles. (Aaronson et al., 2014; Carroll, 2017)

Aaronson et al. (2014) model a complexity measure which represents the Kolmogorov complexity of a coarse-grained representation of the coffee (voxels of coffee colour). Initially the complexity is low (it can be described simply as white voxels with black voxels underneath). Then in the middle, its description as swirls and whirls requires a lot of bits of information about the colours of the voxels and so it has high complexity. Finally when the coffee is totally mixed, at maximum entropy, the complexity is low again as it can be described with only a few bits of information as ‘all brown voxels’.

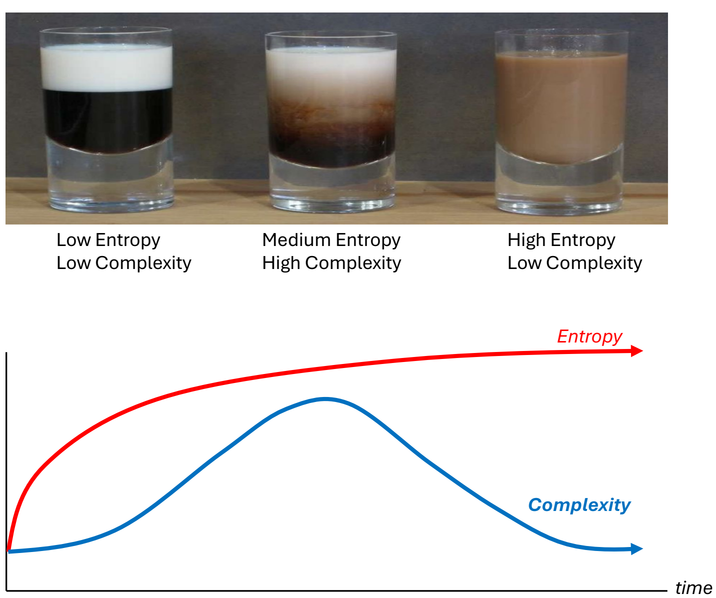


**Figure 3:** Coffee, cream, entropy and complexity adapted from Aaronson et al. (2014).

If we consider that the informational content of the phenomenal experience is associated with the complexity, then we see that in the first half of the graph in figure 3 indeed as the EBH proposed entropy and complexity (richness of phenomenology) rise together. However at some stage this relationship breaks down.

**Two Inferential Regimes**

We propose that elevated entropy can arise through two distinct inferential regimes. Some psychedelics (LSD, psilocybin, N,N-DMT) are theorized to relax the precision of high-level priors, increasing the influence of bottom-up signals on perceptual inference (Brouwer & Carhart-Harris, 2021; Carhart-Harris et al., 2014, 2016; Carhart-Harris & Friston, 2019). The generative model becomes overly flexible, readily accommodating incoming fluctuations, including noise, as meaningful signal. This yields a generative model prone to overfit to the data dynamically metastable, exquisitely sensitive to perturbations, and characterized by rapid configuration changes across large-scale networks. The phenomenology is one of overflow: vivid, multifaceted content amplified by loosened constraints.

By contrast, absorptive meditative states and 5-MeO-DMT can reveal an experience that is much better characterized by phenomenological hyper-stability. For example, in jhāna, the meditative object saturates awareness such that peripheral inputs exert little influence; in 5-MeO-DMT, the system can lock into a uniform experiential mode resistant to perturbation. In both cases, inference is dominated by rigid, high-precision priors—an extremely simple high-level model that underfits the sensory data. Because this model is too coarse to capture environmental variance, prediction errors persist, but they are not expressed as proliferating content.

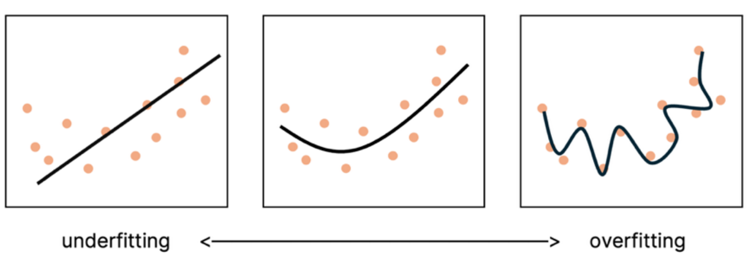

**Figure 3:** Two inferential regimes: A conceptual under/overfitting illustration. 'rich club' psychedelics map to overfitted inference, while absorptive states such as jhāna and 5-MeO-DMT map to underfitted inference.

We suggest that the choice of coarse-graining provides a bridge between neural dynamics and phenomenology. Under psychedelics, inference becomes fine-grained and overly flexible: the brain treats even minor fluctuations as meaningful, producing a phenomenology of overflow, instability, and proliferating content. By contrast, absorptive states such as jhāna or 5-MeO-DMT could be associated with coarse-graining: the brain smooths over variability, producing a phenomenology of stability and simplicity, where awareness persists with little or no fluctuation. Entropy remains high in both regimes—because it is always measured at the finest scale, but the phenomenological expression differs: psychedelics amplify perceptual variation, while MPEs suppress it, yielding minimal-content awareness.

In complexity terms, this proposal can be framed through the coffee-and-cream analogy. Psychedelics (the "rich club") can be understood as reducing the coarse-graining of the system, like examining the mixture with a very fine voxel grid. This exposes more fine-scale variability, analogous to overfitting. Absorptive states such as jhāna or 5-MeO-DMT, by contrast, increase the coarse-graining, using a coarser voxel grid that smooths over detail, analogous to underfitting. Crucially, entropy is always defined at the finest possible level of coarse-graining, regardless of whether the system is over- or underfitting.

This perspective clarifies why high entropy arises in both psychedelic and absorptive contexts despite their opposing phenomenologies. The difference lies in how coarse-graining shapes the trajectory of complexity: with overly fine-grained inference (psychedelic overfitting), entropy rises alongside complexity until the system becomes saturated with proliferating content; with overly coarse-grained inference (absorptive underfitting), entropy also rises, but complexity declines more steeply because the rigid model smooths over experiential variation. As illustrated in figure 4, the same increase in entropy therefore carries different implications depending on the inferential regime—manifesting as overflow in one case and as minimal-content awareness in the other.

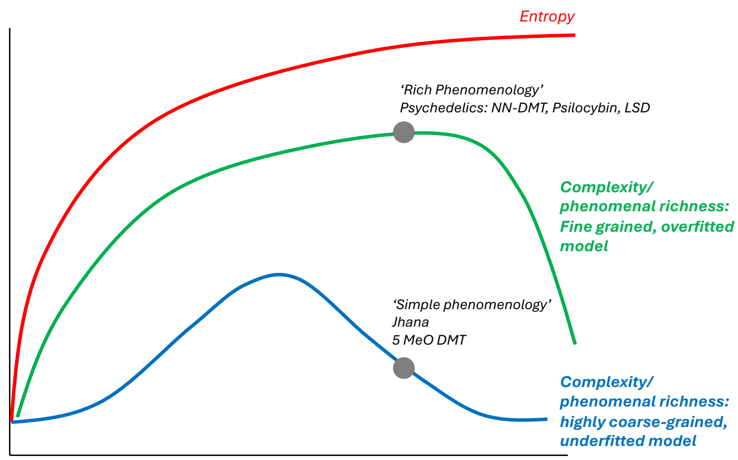


**Figure 4:** Entropy rises in both psychedelic and absorptive states, but complexity diverges depending on the inferential regime. Here we propose that psychedelics are associated with fine-grained inference that amplifies fluctuations into proliferating content, while jhāna and 5-MeO-DMT reflect coarse-grained inference that smooths over variability into phenomenological simplicity.

## Implications

The first implication is conceptual. Entropy is not a direct measure of phenomenological richness. Instead, it reflects the inferential regime—specifically, how finely or coarsely the brain is resolving fluctuations in its activity. High entropy can accompany both overflow and emptiness, because both fine-grained inference (psychedelic states that amplify minor fluctuations and proliferate content) and coarse-grained inference (absorptive states that smooth over variability and stabilize awareness) can move the system toward criticality.

A second implication concerns theory refinement. The entropic brain hypothesis elegantly links psychedelic phenomenology to systems-level instability, but MPEs demonstrate that elevated entropy is also compatible with radically reduced content. Recognizing that entropy can emerge from both fine- and coarse-grained inferential regimes preserves the strengths of the EBH while explaining its apparent counterexamples.

Finally, the framework integrates with contemporary computational phenomenology. Metzinger's account of MPEs as transparent, self-luminous models of wakefulness (Metzinger, 2020, 2024) can be recast as a high-precision prior on tonic alertness—“contentless presence”—that decouples phenomenological simplicity from neural complexity. High entropy without overflow thus becomes not a contradiction, but a signature of how different inferential regimes shape the relation between neural dynamics and lived experience.

## Conclusion

The entropy–content paradox reveals that neural entropy is not a simple index of how much content a mind contains. Here we propose that both psychedelics and jhāna meditation produce high entropy, but for opposite reasons: psychedelics through fine-grained inference that amplifies fluctuations into proliferating content, and jhāna through coarse-grained inference that smooths over variability into contentless stability. Both regimes elevate dynamical diversity, yet they diverge in phenomenology and perturbational signatures. Recognizing this dissociation refines the EBH and positions MPEs as decisive test cases for computational theories of consciousness.

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