Why the Universe Flows

Meditations on Dissipation and the Origin of Things

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A speculative essay grounded in the BEDS formalism

> *This is not a scientific paper. It is a disciplined reverie — an attempt to look at the world through a particular lens and see what appears. The ideas presented here are highly speculative. They claim to prove nothing. They propose a way of seeing.*

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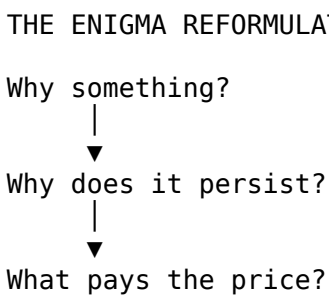
1. The Child's Question

Every child one day asks the question that trips up philosophers:

Why is there something rather than nothing?

Adults smile, change the subject, or invoke mysteries. But the child has touched something deep. For the question hides a more precise enigma:

That which exists — why does it last?



For persistence is not free. Everything that maintains a form, a structure, an identity through time — all of this costs. The universe is not a frozen tableau. It flows. And in this flowing, certain forms maintain themselves.

The real question may not be *why something* but *how something maintains itself*.

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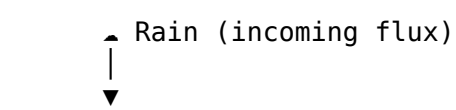
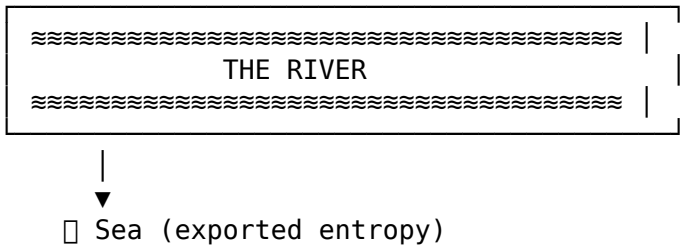
2. The River — First Teacher

Before the equations, there is water.

A river is the simplest and most profound thing I know. It has no teacher. No one shows it the way to the sea. And yet, it finds it — always.





Look at it carefully. It does three things simultaneously:

1. **It receives** — rain, tributaries, underground springs
2. **It maintains** — its form, its bed, its course
3. **It exports** — toward the sea, the water it no longer needs

And in doing so, it *carves*. The riverbed did not exist before it. It is the river that sculpted it, year after year, by flowing. Structure emerges from flux.

Prigogine called this a *dissipative structure* — an order that maintains itself not despite the flow, but *because of it* [1].

The river does not persist by standing still. It persists by *flowing*.

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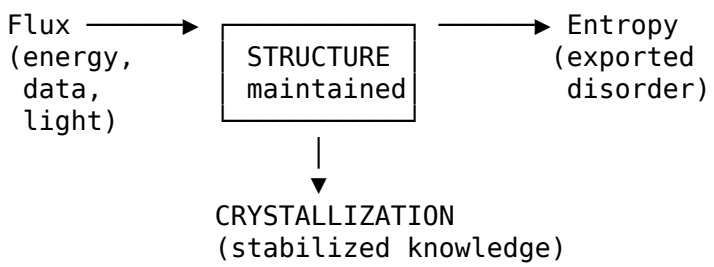
3. What BEDS Captures

I spent years searching for how to build digital twins that last — representations of the world that remain faithful without exploding in complexity or energy consumption.

The answer came from watching rivers.

The BEDS formalism (Bayesian Emergent Dissipative Structures) captures this intuition in mathematical language. Its heart fits in one image:

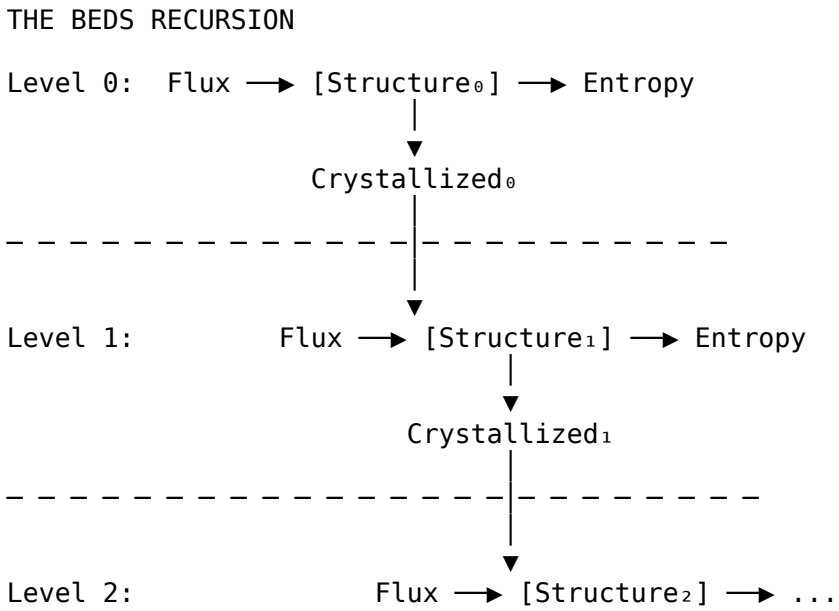


A BEDS structure does three things: - It **absorbs** an incoming flux - It **maintains** internal order - It **exports** entropy to the outside

And when part of this order becomes sufficiently stable, it *crystallizes* — it becomes an acquisition, an axiom, a foundation for what follows.

The Recursion of Priors

Here is the crucial point: what crystallizes at one level becomes the *prior* of the next level.



A river does not reinvent gravity. It inherits it. A child does not reinvent grammar. They absorb it. A scientist does not re-prove the axioms. They build upon them.

Each level receives the acquisitions of the lower level as its starting point. It only learns what it *must* learn.

The Price of Persistence

Maintaining order costs. BEDS establishes a fundamental bound [2]:

$$P \geq \gamma \cdot \frac{k_B T}{2}$$

To maintain precision τ against a dissipation rate γ, the minimum required power is:

$$P_{\text{min}} \propto \gamma \cdot \tau$$

The more precise you want to be, the more you pay. The more the environment degrades you, the more you pay. This is the thermodynamic tax on existence.

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4. The Pathologies of Closure

Now here is the part that troubled me most.

Three domains — logic, computation, thermodynamics — seem to share the same disease: the *pathology of closure*.

In Logic: Gödel

Gödel demonstrated in 1931 that a sufficiently powerful formal system cannot be both complete and consistent [3]. If you close the system — if you refuse to add new axioms — you are condemned to statements that are true but unprovable.

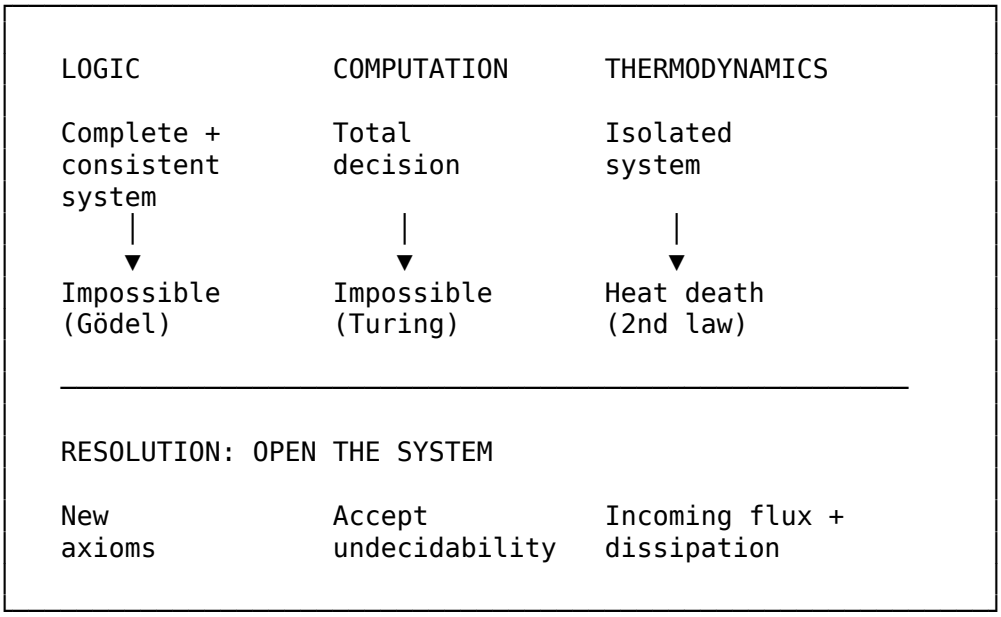
In Computation: Turing

Turing showed that no program can decide, for all possible programs, whether they will halt or not [4]. If you demand a total answer — yes or no for everything — you ask the impossible.

In Thermodynamics: Heat Death

An isolated system evolves toward maximum equilibrium — the state of highest entropy where nothing happens anymore. *Heat death*. If you close the system, you condemn it.

THREE DOMAINS, SAME STRUCTURE



The GLP Conjecture

I propose that these three pathologies are manifestations of the same fundamental constraint:

> **Gödel-Landauer-Prigogine Conjecture**: Any sufficiently expressive system must be *open* — it must accept either new axioms (logic), undecidability (computation), or dissipation (physics). Total closure necessarily engenders pathologies.

In other words: *closure is death*.

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5. The Flowing Universe

Now, the speculation.

If dissipative structures are the fundamental pattern of what persists… could the universe itself be a dissipative structure?

The Problem

A dissipative structure, in Prigogine's sense, exports its entropy to the *outside*. The river exports to the sea. The cell exports to its environment. But the universe… has no outside.

Where would it export to?

Smolin's Hypothesis

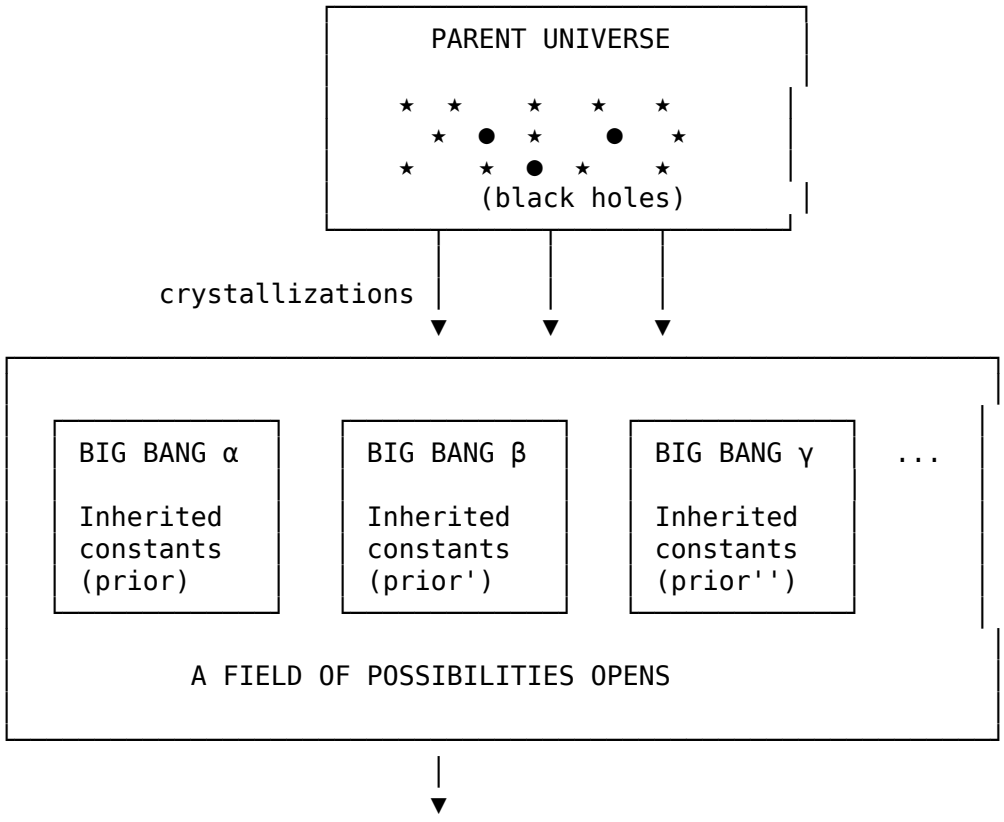
Lee Smolin proposed a bold idea: *cosmological natural selection* [5]. Black holes, he suggests, might spawn new universes — "baby universes" with slightly modified physical constants.

If this is true, then a universe is not isolated. It has *descendants*.

BEDS Reformulation

Here is how I see things:

BEDS COSMOLOGY (HIGHLY SPECULATIVE)



Each universe spawns its own field...

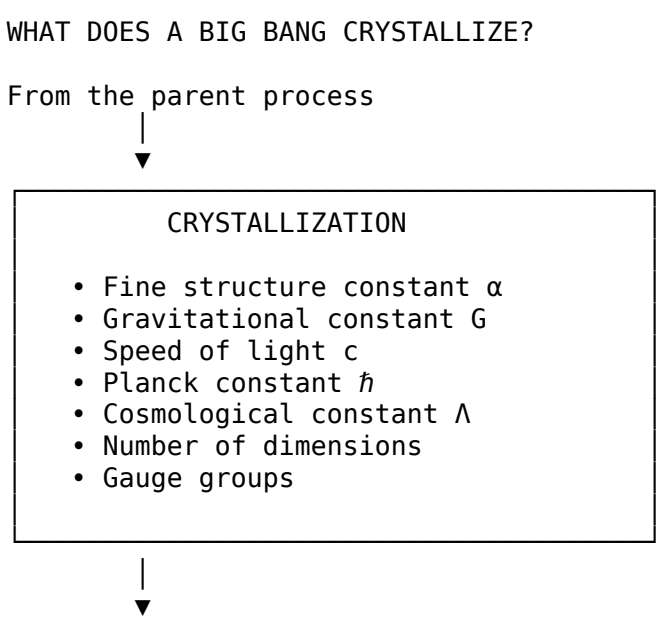
The crucial point: at each level of recursion, it is not *one* black hole that crystallizes, but an *entire field of possibilities* that opens. Each black hole is a potential seed. Each seed can yield a universe with its own variations.

What the Big Bang Crystallizes

In this view, a Big Bang is not an absolute beginning. It is a *crystallization* — the moment when a set of parameters becomes fixed:

- The fundamental constants (α, G, c, ℏ)
- The dimensionality of space
- The symmetries of interactions

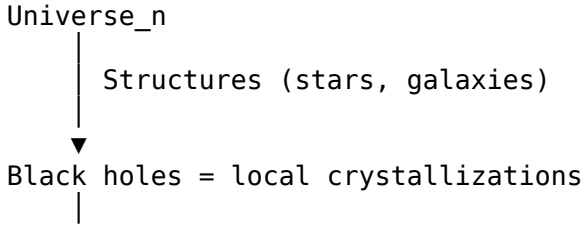
These parameters are not "chosen." They are *inherited* — with variations — from the parent process. They form the *prior* upon which everything else is built.

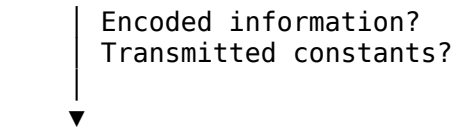


The Meta-System Remains Open

An individual universe, taken in isolation, seems condemned to heat death. But the *meta-system* — the ensemble of universes spawning universes — remains open.

Dissipation does not happen toward a spatial "outside." It happens toward the *next generation*.





Universes_{n+1, n+2, ...}

Entropy is not exported in space.
It is exported in GENERATIONAL TIME.

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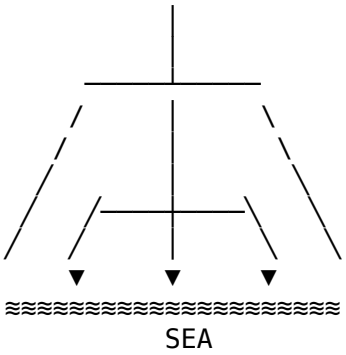
6. The Field of Possibilities

Each level of BEDS recursion does not spawn a single continuation — it opens a *field*.

In the River

A river does not carve a single channel. It explores. It forms meanders, oxbow lakes, deltas. Some paths persist. Others dry up. The final landscape is the result of massive exploration.

THE DELTA: A FIELD OF POSSIBILITIES



Each branch is an explored possibility.
The delta is the field of realized possibilities.

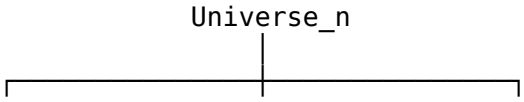
In Biology

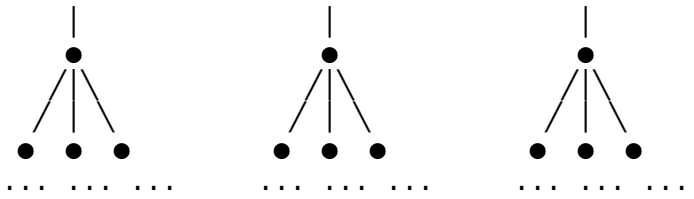
Evolution does not produce a single lineage. It explodes into adaptive radiations. Each species is a crystallization. But the *field* of possible species is immense — and partially explored.

In BEDS Cosmology

Likewise, each universe does not produce a single descendant. Black holes are *multiple*. Each is a seed. Each opens a branch.

THE COSMOLOGICAL FIELD





Each ● is a black hole = a crystallization.
Each crystallization opens a new field.
The tree is EXPONENTIAL.

Selection operates: universes that produce more black holes have more descendants. Physical constants that favor stellar formation propagate. A form of *cosmological fitness* emerges.

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7. What This Changes

If this vision has a grain of truth, what does it change?

There Is No Purpose

The universe does not "want" anything. It is not trying to become intelligent, or complex, or conscious. It *flows*. And in this flowing, certain forms maintain themselves, reproduce, persist.

Complexity is not a goal. It is a *by-product* of structured dissipation.

There May Be No Closed Theory of Everything

If the GLP conjecture is correct, seeking a complete and consistent system of equations that explains everything may be ill-posed. Fundamental physics might be *essentially open* — always requiring new "axioms" (constants, symmetries) that cannot be derived from the previous ones.

Intelligence Is a Form of Dissipation

Thinking is maintaining order in a substrate (the brain) that degrades. Each thought costs energy — about 20 watts for a human brain. We export entropy (heat, CO_2, waste) to maintain our representations of the world.

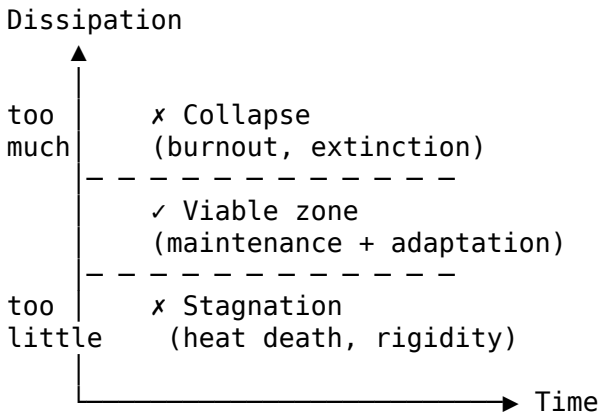
An AI does the same. A data center dissipates. Knowledge has a thermodynamic cost.

Sobriety Is a Structural Virtue

The structures that last are not those that dissipate the most. They are those that dissipate *just enough*. The river that carves too fast dries up. The organism that burns too much dies. The species that consumes everything disappears.

Sobriety is not a moral constraint imposed from outside. It is a *condition of persistence*.

THE VIABILITY WINDOW



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8. Return to the River

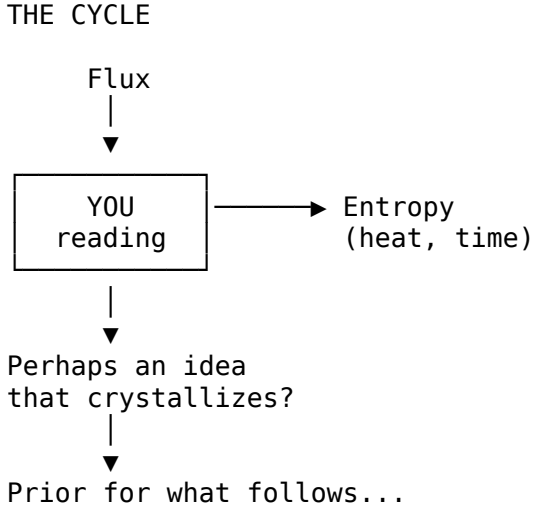
I often return to the river.

It does not ask why it flows. It does not calculate its optimal path. It does not worry about heat death. It *flows*. And in flowing, it carves. And in carving, it persists.

Perhaps the universe does the same. Perhaps we do the same — temporary dissipative structures, maintaining order for a few decades, exporting our entropy, sometimes crystallizing something that outlives us.

An idea. A child. An institution. A text.

This text itself is an attempt at crystallization. It cost energy — mine, that of the servers that helped form it. It exports disorder — the heat of my computer, the CPU cycles spent. And perhaps, if it has value, it will persist a while as prior for someone else.



Epilogue

I do not know if the universe is truly a recursive dissipative structure. I do not know if black holes spawn baby universes. I do not know if the GLP conjecture has deep meaning or if it is an analogy that seduced me.

But I know this:

The river flows. It does not ask why. It flows, and in flowing, it carves, and in carving, it persists.

Perhaps there is nothing more to understand.

> *To persist is to pay. To pay is to flow. To flow is to live.*

References

[1] Prigogine, I. (1977). *Time, Structure and Fluctuations*. Nobel Lecture. Stockholm.

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[3] Gödel, K. (1931). Über formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme I. *Monatshefte für Mathematik und Physik*, 38, 173-198.

[4] Turing, A. (1936). On Computable Numbers, with an Application to the Entscheidungsproblem. *Proceedings of the London Mathematical Society*, 42, 230-265.

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[6] Friston, K. (2010). The free-energy principle: a unified brain theory? *Nature Reviews Neuroscience*, 11, 127-138.

[7] Bennett, C.H. (1982). The Thermodynamics of Computation — A Review. *International Journal of Theoretical Physics*, 21(12), 905-940.

[8] Caraffa, L. (2026). BEDS: Bayesian Emergent Dissipative Structures. *Working document*.

This essay is a personal reverie, not a scientific paper. It has not been peer-reviewed. It claims to prove nothing. It proposes a way of seeing — nothing more, nothing less.

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