Time Did Not Begin

On Change, Irreversibility, and Why Eternal Time Explains Nothing

We often hear it said that time began with the Big Bang. The phrase sounds precise, scientific, even final. Yet when examined carefully, it conceals a quiet confusion. Time is not a thing that can begin. It is not a substance, a field, or a container. Time is a measure—a way of ordering change. To speak of time beginning already assumes the presence of change against which such a beginning could be marked.

If nothing changes, there is no time to begin.

So what, then, could it mean to say that time began?

To understand what time means, ask when it ceases to have meaning. The answer: when there is no before and no after. And there is no before and after without facts—without states that cannot be undone. Time is not what makes facts possible. Facts are what make time possible.

The Core Claim

Facts are more basic than time in any framework where time is said to "flow."

Time does not produce facts. Facts produce time.

In physics, flowing time is never fundamental. What is fundamental are transitions that leave permanent marks—commitments that cannot be undone. These commitments define what is true. Only once something has become true does a before–after ordering exist.

Time is the bookkeeping imposed by facts.

The dependency chain runs in one direction:

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Irreversibility → Facts → History → Time
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Not:

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Time → Change → Facts
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Any theory that places time first quietly assumes facts in order to make time meaningful—which is circular.

Why this is not controversial

Every place physics talks about "time flowing," it is already assuming facts:

- **Thermodynamics:** entropy increase presupposes records that cannot be erased
- **Measurement theory:** outcomes presuppose facts being established
- **Causality:** causes precede effects only once effects are facts
- **Memory:** remembering presupposes facts stored irreversibly

Without facts, there is no distinction between past and future—only reversible evolution.

Time cannot be more fundamental than facts, because time ordering requires something to order.

What this claim does not deny

This argument does not deny Schrödinger evolution, relativistic time coordinates, or spacetime structure.

It says only this: those structures describe how states evolve, not when facts come into existence. Time coordinates describe relations between events once events are facts. They do not generate facthood themselves.

The block universe of relativity already demotes temporal flow from fundamental status—Minkowski showed us that much a century ago. But even block-universe formulations still require an account of *why* the block has an arrow, why one direction is distinguished from the other. That question brings us back to irreversibility and facts.

The claim in one sentence

Time is not the arena in which facts appear; it is the order imposed once facts cannot be undone.

Change Is Not Enough

We instinctively treat all change as equivalent, but this is a mistake. Some changes leave permanent marks; others leave none at all.

A shattered glass does not reassemble itself. A cooled system does not spontaneously reheat. Heat flows from hot to cold and never returns. These are changes that accumulate. They leave traces. They create history.

But other changes are different. A perfectly elastic collision can, in principle, be reversed. A pendulum swinging without friction does not age. An isolated quantum system evolving under

the Schrödinger equation can always, in principle, return to its initial state. These changes occur, but nothing becomes permanently true because of them.

The distinction between reversible and irreversible change is well known in physics, but its philosophical consequences are rarely taken seriously. Only irreversible change produces an arrow. Only irreversible change creates a before and an after that cannot be undone.

Time does not arise from motion. It arises from commitment.

Facts and Irreversibility

In ordinary language, a fact is simply something true. But there is a deeper sense in which facts must be *established*—made true in a way that cannot be reversed without cost.

A fact, in this stronger sense, is a state that cannot be undone without exceeding the resources of the system. Facts require loss: loss of information, loss of symmetry, loss of reversibility. This is not a metaphor. When a measurement is made, when heat dissipates, when a record is inscribed, something is given up that cannot be recovered. The universe has committed.

Irreversible change increases entropy. It destroys accessible information. It leaves records. It enables memory and causality.

Without irreversibility, nothing truly happens. States may evolve, but no history accumulates. There is no past to remember and no future to anticipate. The equations run forward and backward with equal validity, and no moment is distinguished from any other.

Time, in this sense, is not the backdrop against which events unfold. It is the bookkeeping system that emerges because events cannot be erased.

Superposition: Change Without Time

Quantum mechanics provides a rare glimpse of reversible change in nature.

In quantum superposition, systems evolve. Amplitudes interfere. Phases rotate. The mathematics proceeds with perfect determinism—the Schrödinger equation preserves information absolutely. And yet no outcome is selected. No classical fact is established.

Superposition is not many realities stacked together. It is not uncertainty about which outcome has occurred. It is a state in which no outcome *has* occurred—evolution without commitment. The system changes, but nothing becomes irrevocably true.

Until a system becomes irreversibly entangled with its environment—until correlations spread beyond recovery and a record is formed—nothing has happened in the historical sense. The quantum state evolves, but it does not age.

This is change without time. Time appears only when reversibility ends.

Decoherence, measurement, thermalization—these are not additions to physics. They are the moments when physics produces facts. Before them, there is dynamics. After them, there is history.

The Big Bang Reconsidered

Seen from this perspective, the Big Bang need not represent the beginning of existence. It marks something more specific and far more interesting: the onset of irreversible change.

To say there was no time before the Big Bang is not to say there was nothing. It is to say that nothing had yet become irrevocable. No records. No memory. No arrow.

Whatever existed before—if "before" even applies—may have been dynamic, structured, and law-governed. But without irreversibility, it could not produce facts. And without facts, there is no history to order, no sequence to measure, no time to speak of.

This framing does not answer every question. It does not specify what mechanism enabled irreversibility to emerge, or what conditions permitted the transition from reversible dynamics to committed outcomes. These are questions for physics—and for frameworks that take entropy and information seriously as foundational. But the framing does clarify what kind of question we are asking. We are not asking when existence appeared. We are asking when existence began to leave marks.

The universe did not begin by appearing. It began by committing.

The Problem with Eternal Time

Some respond by suggesting that time never began—that it was always here. At first glance this seems to avoid the problem. But it quietly introduces a deeper one.

If time has always existed, then irreversible facts have always been possible. Records, commitments, and loss would have no origin. History would stretch back endlessly, with no first asymmetry and no first scar.

This produces an infinite regress: every fact resting on a prior fact, every commitment justified only by an earlier commitment, every record explained only by an older record. The chain has no anchor. Change becomes infinite but ungrounded.

An eternal-time universe is not a solution. It is an evasion. It inherits the arrow of time without explaining it. It assumes irreversibility as a brute fact rather than accounting for its emergence.

Change without a ground zero is not meaningful change. It is motion without distinction, difference without origin, history without a first chapter.

Why Change Needs a Ground Zero

For change to mean anything at all, something must differ from what came before. But "before" only has meaning if there was once a state with no commitment—and then a state with commitment.

Without this contrast, difference dissolves. If facts have always existed, then the existence of facts explains nothing. If records stretch back forever, then the capacity to make records is not a feature of our universe but a metaphysical necessity—assumed rather than derived.

This is the explanatory failure of eternal time. It does not illuminate why our universe has an arrow. It simply asserts that it always did.

Facts cannot be eternal without becoming meaningless. If nothing ever truly begins, nothing ever truly becomes the case.

What Time Really Measures

Time is often imagined as a flowing river or an invisible dimension—a container within which events occur. A simpler and more honest view is this:

Time measures what cannot be undone.

It is not motion that creates time, but loss. Not change, but commitment. Not evolution, but the closure of alternatives. When the universe can no longer return to what it was, time appears—not as a stage, but as a consequence.

When people say "time flows," they are describing the accumulation of facts. What feels like flow is the steady increase of committed outcomes, the closure of alternatives, the growth of records. No facts means no accumulation means no flow. Flow is not primitive; commitment is.

This is why questions like "what happened before time?" feel paradoxical. They treat time as a container rather than an outcome. Once that assumption is released, the paradox dissolves.

There may have been change before time. There may have been structure before history. There may have been dynamics before facts.

What there was not, was irreversibility.

Conclusion

Time did not begin with the Big Bang because time is not something that can begin.

What began was irreversible change.

The Big Bang marks the transition from reversible possibility to committed reality—from a universe that could still take everything back to one that cannot. Before that transition, there may have been existence. There may have been law. There may have been change. But there was no accumulation, no record, no arrow.

Time is not the stage on which the universe appears. Time is what emerges when the universe can no longer undo itself.

Further Reading

The ideas in this essay connect to long-standing debates in physics and philosophy of time. Readers interested in the technical background may find the following useful:

On the arrow of time and entropy:

- Eddington, A. S. *The Nature of the Physical World* (1928) — introduces the phrase "arrow of time" and its connection to entropy.
- Boltzmann, L. *Lectures on Gas Theory* (1896–1898) — foundational work on statistical mechanics and the probabilistic basis of irreversibility.
- Carroll, S. *From Eternity to Here: The Quest for the Ultimate Theory of Time* (2010) — accessible treatment of entropy, cosmology, and the arrow of time.

On irreversibility and decoherence:

- Zeh, H. D. *The Physical Basis of the Direction of Time* (5th ed., 2007) — comprehensive treatment of decoherence, quantum measurement, and temporal asymmetry.

- Landauer, R. "Irreversibility and Heat Generation in the Computing Process," *IBM Journal of Research and Development* (1961) — establishes the thermodynamic cost of information erasure.

On the philosophy of time:

- Price, H. *Time's Arrow and Archimedes' Point: New Directions for the Physics of Time* (1996) — critical examination of temporal asymmetry and its physical basis.
- Albert, D. Z. *Time and Chance* (2000) — rigorous analysis of statistical mechanics, probability, and the direction of time.

On relational and emergent approaches to time:

- Rovelli, C. *The Order of Time* (2018) — argues that time emerges from thermodynamic and relational structures rather than being fundamental.