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Mukundan's Entropic Destiny: A Thought Experiment for Philosophical Inquiry into Temporal Directionality and Cosmic Final States

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Abstract

This paper examines a thought experiment, **Mukundan's Entropic Destiny**, which contrasts the thermodynamic arrow of time in our universe (Ou) with hypothetical universes featuring reversed or non-monotonic entropy trajectories. We formally define universe $\breve{M}_{\beta 1}$, where entropy decreases toward a state of minimum entropy (a "heat crystal"), and universe $\breve{M}_{\beta 2}$, where entropy first increases then decreases. By analyzing the philosophical implications of these scenarios—particularly concerning destiny, teleology, and the perception of temporal flow—we argue that the forward arrow of time may be an emergent illusion arising from a fundamental sequential progression of states toward an entropic destiny set by a universe's physical laws. The analysis suggests that concepts of purpose, agency, and temporal experience are contingent upon the direction of the thermodynamic gradient, rather than reflecting an intrinsic directionality of time itself.

Keywords: entropy; arrow of time; sequential flow; thermodynamics; time directionality; destiny; teleology philosophical cosmology; $\breve{M}_{\beta 1}$ universe; $\breve{M}_{\beta 2}$ universe; entropic destiny; heat crystal; thought experiment

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1. Introduction

The second law of thermodynamics, which states that the total entropy of an isolated system tends to increase, defines a thermodynamic arrow of time and underpins our experience of temporal direction. This paper examines a thought experiment, *Mukundan's Entropic Destiny*, which explores the consequences of altering this fundamental principle. We compare our universe (denoted **Ou**), in which entropy increases, with two hypothetical universes from a broader multiverse: $\breve{M}_{\beta 1}$, in which entropy decreases over time, and $\breve{M}_{\beta 2}$, in which entropy first increases and then decreases over its cosmic evolution. By formally analyzing these contrasting scenarios, we investigate the philosophical implications for concepts such as destiny, teleology, agency, and the nature of temporal experience. The analysis suggests that the perceived forward flow of time may not be a fundamental feature of reality, but rather an emergent illusion arising from a sequential progression of states toward an entropic destiny set by each universe's physical laws.

2. The Arrow of Time and Entropy in the Universe Ou

"Ou" : Our Observable Universe

In the Universe Ou, entropy S tends to increase:

$$\Delta S_{\mathrm{U}} \geq 0.$$

This increase is statistical: macroscopic states evolve toward those with higher multiplicity. The *past hypothesis*—that the early universe was in a state of extremely low entropy—provides a boundary condition that explains why we observe entropy increasing in the direction we call the future [1]. This

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asymmetry underpins our experiences of causality, memory, and agency. Processes are irreversible; a sambar mixed with idli creates a hybrid dish**(sambar idli)** that cannot be separated back into its original components. Destiny, in this framework, is often seen as a movement toward equilibrium—a **"heat death"** where no further work can be extracted, and all gradients disappear. The forward direction could be an illusion created by the sequential progression toward higher entropy, and any notion of cosmic purpose or destiny must be reconciled with this entropic slide into disorder.

3. The Arrow of Time and Entropy in the Universe $\breve{M}_{\beta 1}$

Universe $\breve{M}_{\beta 1}$ is defined by a fundamental physical law where entropy decreases over time:

$$\Delta S_{\breve{M}_{\beta 1}} \leq 0.$$

This universe is a hypothetical construct from the ($\breve{M}$)multiverse [5] of possibilities, where different fundamental laws may govern thermodynamic behavior. In $\breve{M}_{\beta 1}$, the forward temporal direction (as defined by inhabitants of $\breve{M}_{\beta 1}$ relative to their conscious experience) proceeds from high to low entropy. To an external observer, $\breve{M}_{\beta 1}$ would appear to run "backwards" relative to Ou, but to its inhabitants, it would seem perfectly normal. Their psychological arrow of time, aligned with their thermodynamic arrow, would entail remembering the future and anticipating the past [2]. Crucially, the $\breve{M}_{\beta 1}$ universe moves toward *disequilibrium*—order emerges spontaneously from chaos. Structures form, temperatures differentiate, and complexity increases without external intervention. The forward arrow in $\breve{M}_{\beta 1}$ is similarly an illusion of sequential flow toward its entropic destiny of perfect order.

3.1. Implications for Physical Laws

Familiar laws in Ou (like the diffusion of heat) would be inverted in $\breve{M}_{\beta 1}$. Thermodynamic processes would proceed in directions opposite to those familiar to us. Such behavior requires a fundamental rewriting of microscopic dynamics or special boundary conditions (a final state of minimum entropy). For the thought experiment, we assume $\breve{M}_{\beta 1}$'s fundamental physical laws are indifferent to temporal direction, merely describing a sequential flow of states. The observed thermodynamic arrow—whether perceived as forward or backward—emerges from the boundary condition at the *future* end: a **"culmination hypothesis"**(speculative) of low entropy, meaning the $\breve{M}_{\beta 1}$ universe goes toward a **heat crystal**—a state of minimum entropy. The distinction between forward and backward is an illusion of perspective, not an intrinsic property of the laws themselves.

4. The Arrow of Time and Entropy in the Universe $\breve{M}_{\beta 2}$

Universe $\breve{M}_{\beta 2}$ is defined by a physical law where entropy follows a non-monotonic trajectory over the cosmic sequence:

$$\Delta S_{\breve{M}_{\beta 2}} \geq 0 \quad \text{(first half)}, \quad \Delta S_{\breve{M}_{\beta 2}} \leq 0 \quad \text{(second half)}.$$

This universe is another hypothetical construct from the ($\breve{M}$)multiverse [5] of possibilities. In the first half of its cosmic evolution, entropy increases, driving the universe toward a state of maximum entropy—a **heat death**. In the second half, entropy decreases, driving the universe toward a state of minimum entropy—a **heat crystal**. To an external observer, the universe would appear to first run "forward" (like Ou) and then "backward" (like $\breve{M}_{\beta 1}$), but to inhabitants in either epoch, their local experience would seem normal. Their psychological arrow of time would align with their local thermodynamic gradient: inhabitants of the first half would remember order and anticipate disorder, while inhabitants of the second half would remember disorder and anticipate order.

Crucially, the transition from increasing to decreasing entropy does not constitute a reversal of time. Instead, the universe's evolution is a single, predetermined sequence of states: $S_{fi} \to \cdots \to S_{\mathrm{fn}/2} \to \cdots \to S_{fn}$. The perceived "forward" arrow in each epoch is an illusion created by consciousness traversing this sequence. The universe $\breve{M}_{\beta 2}$ thus demonstrates that multiple, opposing

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thermodynamic arrows can exist within a single cosmic timeline, unified by an underlying sequential flow.

4.1. Implications for Physical Laws

In the first half of the Universe $\breve{M}_{\beta 2}$, familiar thermodynamic laws akin to those in Ou would hold: heat flows from hot to cold, gases expand, and systems evolve toward equilibrium. In the second half, the laws would invert, resembling those in $\breve{M}_{\beta 1}$: heat flows from cold to hot, gases spontaneously compress, and order emerges from chaos. Such a universe requires either a fundamental law that changes at the entropy maximum or a special boundary condition that dictates both an initial low-entropy state and a final low-entropy state. For this thought experiment, we assume the underlying physical laws are indifferent to temporal direction, merely describing a sequential flow of states. The observed thermodynamic arrows—both the increasing and decreasing phases—emerge from the boundary conditions at the *initial* and *final* ends: a combined "past hypothesis" and "culmination hypothesis." The distinction between forward and backward is, once again, an illusion of perspective within the sequential progression.

5. Philosophical Implications: Destiny and the Flow of Time

5.1. The Sequential Flow

The fundamental description of those universes may be expressed as a sequence of states: $S_{f1}, S_{f2}, S_{f3}, \ldots, S_{fn}$. This sequence represents the progression of the universe from its initial condition to its final destiny, irrespective of the direction of the thermodynamic arrow. In this view, the apparent flow of time emerges from the transition between these states. An analogy can be drawn with a pendulum undergoing harmonic motion: the back-and-forth oscillation is a sequential flow of changes in position and momentum. Similarly, the universe's evolution is a sequential flow of configurations. Whether entropy increases or decreases is a feature of the sequence, but the sequence itself is directionless. The perception of moving to **'the next step'**—the feeling of forward time—is an illusion created by consciousness traversing this sequence in one direction.

5.2. Teleology and Purpose

In Ou, the increase of entropy is often viewed as antithetical to teleology—the universe has no goal but equilibrium. Purpose must be locally constructed by agents fighting entropy's pull. In $\breve{M}_{\beta 1}$, the universe inherently moves toward order. Does this provide a natural teleology? If the cosmos inherently trends toward structure, does that confer a "destiny" of ordered complexity? One might argue that $\breve{M}_{\beta 1}$ exhibits a cosmic teleology absent in Ou. Universe $\breve{M}_{\beta 2}$, with its two-phase evolution, presents a teleology that shifts from a trend toward disorder to a trend toward order. In all cases, the forward arrow of time emerges as an illusion from the sequential unfolding toward these final states.

5.3. Agency and Free Will

In Ou, agents act to create local order at the expense of greater global disorder. In $\breve{M}_{\beta 1}$, an agent's actions would align with the universal trend toward order. But what does "action" mean if the future is more ordered than the past? If the future is fixed in a low-entropy state, does that constrain agency? Alternatively, perhaps agents in $\breve{M}_{\beta 1}$ would perceive their will as driving the universe toward order, just as we perceive ours as creating pockets of order. In Universe $\breve{M}_{\beta 2}$, agents living in the first half would experience agency similar to Ou, while those in the second half would experience agency similar to $\breve{M}_{\beta 1}$. In all universes, the experience of agency unfolds within the illusion of forward temporal flow toward destiny [4].

5.4. The Nature of Time and Experience

Our psychological experience of time—the feeling of flowing from past to future—is often linked to entropic gradients [3]. In $\breve{M}_{\beta 1}$, a hypothetical construct from the multiverse[5] of possibilities where different fundamental laws may govern thermodynamic behavior, conscious beings would likely

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experience a similar flow aligned with their decreasing entropy. They would remember a disordered "past" and anticipate an ordered "future." In the Universe $\breve{M}_{\beta 2}$, the experience of time would undergo a profound shift at the entropy maximum: beings in the first half would remember order and anticipate disorder, while beings in the second half would remember disorder and anticipate order. This raises the question: is the content of experience (memory, anticipation) determined by the entropic gradient, or could conscious experience be decoupled from thermodynamics? The forward arrow of time in all universes appears as an emergent property of consciousness processing the sequential flow of states toward their respective entropic destinies. All universes demonstrate that what feels like temporal progression may simply be consciousness tracking the journey from initial to final conditions. The underlying mechanism in any universe of the multiverse might be a sequential flow toward a destiny set by that universe's physical laws. The illusions created by that sequential flow—the conscious experience of time—could vary and be unimaginable across different universes, yet the underlying mechanic might remain a sequential progression toward something according to each universe's physical law, suggesting that the forward flow of time could be an illusion of perspective.

5.5. Destiny as Directionality

The three universes (Ou, $\breve{M}_{\beta 1}$, and $\breve{M}_{\beta 2}$) each have a *destiny* in the sense of an inevitable end state: equilibrium for Ou, disequilibrium for $\breve{M}_{\beta 1}$, and a dual destiny of heat death followed by heat crystal for $\breve{M}_{\beta 2}$. But destiny also implies a *path*. In Ou, the path is one of degradation; in $\breve{M}_{\beta 1}$, of improvement; and in $\breve{M}_{\beta 2}$, a path that first degrades and then improves. If destiny is the final state toward which things tend, then $\breve{M}_{\beta 1}$'s destiny is one of perfect order—a **"heat crystal"**. This inversion challenges our intuitive association of destiny with either progress or decay. The forward arrow of time in all cases is an illusion emerging from the sequential progression along these paths toward their respective destinies.

6. Conclusion

The **Mukundan's Entropic Destiny** thought experiment reveals that our intuitions about time, purpose, and destiny are intimately connected to the thermodynamic arrow of our universe. By imagining universes with opposite or bidirectional arrows, we are forced to disentangle these concepts from their physical underpinnings. Whether destiny is seen as entropic equilibrium or evolving order depends on the directionality of time itself. The experiment suggests that the forward arrow of time may be an illusion created by sequential flow toward entropic destiny, rather than a fundamental feature of reality. Destiny is not an absolute metaphysical category but a narrative constructed upon physical processes, with temporal flow as its emergent illusion. Further research could examine the metaphysical implications of reversed, bidirectional, or cyclic entropy arrows for our understanding of temporal asymmetry and the foundations of causality.

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Conflicts of Interest: None declared.

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