# Time as Change: A Philosophical and Informational Framework for Understanding Temporal Emergence

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**Abstract**

This paper reconsiders the nature of time through the lens of information and change. Rather than treating time as a pre-existing dimension, we argue that time is an emergent property of systems undergoing transformation. The proposal defines time as a measure of *event density*—the informational frequency of distinguishable changes occurring within a system. This view integrates classical philosophical notions of temporality with contemporary information theory, suggesting that what we perceive as the flow of time is in fact the continuous reconfiguration of informational states. By relating temporal experience to entropy, computation, and relational change, the framework bridges the metaphysical and empirical accounts of time, offering a unified philosophy of information and temporality.

**Keywords:** philosophy of time; information theory; event density; change; entropy; emergence; phenomenology of time

## 1. Introduction: The Problem of Time

Philosophers and scientists alike have long wrestled with the nature of time. Is time a fundamental structure of reality, or merely an emergent description of change? Classical physics treated time as a uniform background; relativity made it relational. Yet neither perspective fully explains the feeling and directionality of time—why it "flows," and why that flow is experienced differently across systems.

In information-rich environments—cognitive systems, computational processes, ecosystems—time seems inseparable from change. When nothing changes, time "stops" in every meaningful sense. This intuition is more than metaphorical: it reflects a deep informational truth.

This paper argues that **time is not something in which events occur; it is that which emerges because events occur.** Temporal progression is the index of change, not its container.

## 2. Historical Context: From Aristotle to Information Theory

### 2.1 Aristotle's Measure of Change

Aristotle described time as "the number of motion in respect of before and after." In other words, time is the measure of change, not an independent entity. This early insight laid the foundation for all relational theories of time.

### 2.2 Bergson and Duration

Henri Bergson emphasized the experiential quality of time—*durée*—as the continuous flow of becoming. He distinguished between measured time (quantitative) and lived time (qualitative), arguing that temporal experience cannot be reduced to clock readings.

### 2.3 Information and Temporal Order

With the rise of information theory, thinkers such as Claude Shannon and Norbert Wiener reframed physical processes in terms of information flow and entropy. Information change became a quantifiable measure of system evolution—and thus a potential measure of temporal unfolding.

From this lineage arises the central question of this paper:

> What if time itself is an informational construct, emerging from the frequency and structure of changes within a system?

## 3. Defining Time as Change

Let us define a system $S$ composed of informational states $\{s_1, s_2, \ldots, s_n\}$. An *event* is a transition between states—a change in the informational configuration of $S$.

The temporal measure $T$ can then be expressed as a function of event density $E$:

$$T = kE$$

where $k$ represents the scaling factor between subjective perception and objective event frequency.

If no events occur, $E = 0$ and thus $T = 0$: the system experiences no time. Time, in this view, is the measure of ongoing differentiation within information.

## 4. Information and the Arrow of Time

Entropy provides the bridge between information and temporality. Each event contributes to the reorganization of information, altering the entropy $H$ of the system. The increase in entropy corresponds to what we call the *arrow of time*—the one-way direction of change.

When informational entropy stabilizes (maximum order or randomness), evolution halts. Time, too, ceases to have meaning for that system. This interpretation renders time as a property of transformation, not an external flow.

## 5. Perception and the Experience of Temporal Flow

Human experience supports this model. We perceive time as faster during periods of rich change and slower during stasis. This is because the mind measures temporal passage by counting informational updates—sensory, cognitive, or emotional.

In this sense, subjective time is directly proportional to perceived change, mirroring the proposed model of event-based time. Temporal consciousness thus becomes a cognitive correlate of informational flux.

## 6. Philosophical Implications

### 6.1 Ontological Implications

If time emerges from informational change, it is not a substance but a relation. Time does not exist "in itself," but only through patterns of difference and transformation. This view aligns with relational ontologies and process philosophy.

### 6.2 Epistemological Implications

Knowledge and observation themselves are temporal acts—each new piece of information marks a shift in epistemic state. Thus, epistemic progress can also be seen as a temporal unfolding of understanding.

### 6.3 Ethical and Existential Implications

If time is change, then to live is to transform information—to enact difference in the world. Stasis equates to the absence of life, while evolution is the production of time itself. This interpretation provides a unifying metaphor linking consciousness, creativity, and temporality.

## 7. Comparison with Other Views of Time

| **Framework** | **Nature of Time** | **Source of Flow** | **Relation to T** |
|---|---|---|---|
| Newtonian | Absolute, linear | Independent of events | Rejected |
| Einsteinian | Relative, geometric | Gravity and motion | Compatible bu |
| Quantum (Rovelli, Barbour) | Relational | Configuration of systems | Directly aligne |
| Information-based (this work) | Emergent, informational | Change and entropy | Synthesis |

The event-based model unifies these by grounding relativity and emergence in informational dynamics.

## 8. Conclusion: Time as an Informational Emergence

Time, when stripped of metaphysical assumptions, reveals itself as a measure of informational change. Where there is transformation, there is time; where there is none, there is none. This principle applies to physics, computation, cognition, and lived experience alike.

In the philosophy of information, this view resolves an old duality: time is neither subjective illusion nor objective entity, but an emergent descriptor of informational transformation. Understanding time as change reframes temporality as the ongoing computation of reality itself.

## References


1. Aristotle. *Physics*, Book IV.
2. Bergson, H. (1911). *Creative Evolution.* Macmillan.
3. Shannon, C. E. (1948). *A Mathematical Theory of Communication.* Bell System Technical Journal, 27(3), 379–423.
4. Wiener, N. (1948). *Cybernetics: Or Control and Communication in the Animal and the Machine.* MIT Press.
5. Prigogine, I. (1980). *From Being to Becoming: Time and Complexity in the Physical Sciences.* W. H. Freeman.
6. Rovelli, C. (1996). *Relational Quantum Mechanics.* International Journal of Theoretical Physics, 35(8), 1637–1678.
7. Barbour, J. (1999). *The End of Time.* Oxford University Press.
8. Floridi, L. (2011). *The Philosophy of Information.* Oxford University Press.
9. Smolin, L. (2013). *Time Reborn.* Houghton Mifflin Harcourt.
10. Lloyd, S. (2000). *Ultimate Physical Limits to Computation.* Nature, 406, 1047–1054.