Roads Not Taken: Encoding Ratchets in Cinema, Computation, and Cosmology

Flyxion

August 2025

Abstract

Histories of cinema, computation, and cosmology are frequently portrayed as linear advancements, yet their developments are profoundly influenced by encoding ratchetsrepresentational decisions that, upon standardization, facilitate efficient scaling while marginalizing potential alternatives. This essay investigates how the 2D frame in cinema, ASCII and von Neumann architecture in computation, and the ΛCDM model in cosmology achieved dominance through scalability rather than inherent superiority. Informed by recent effective-fluid models in cosmology [**?**] and the Relativistic Scalar Vector Plenum (RSVP) framework [**?**], it posits that scaling perpetuates initial encodings, potentially eclipsing more comprehensive alternatives. The discussion is grounded in philosophical concepts of emergence, downward causation, and orders of nature, drawing from local metaphysics to illustrate how representational choices constrain scientific and technological trajectories. An expanded appendix delves into mappings between effective-fluid cosmology and RSVP, alongside historical vignettes of alternative computational architectures.

1 Introduction

The narratives surrounding the evolution of media technologies, computational systems, and cosmological theories often convey a sense of inevitability, suggesting a straightforward progression from rudimentary forms to sophisticated paradigms. For instance, cinema is depicted as advancing from mechanical reels to digital projections, computation from mechanical teletypes to advanced neural networks, and cosmology from Einstein's general relativity to the contemporary ΛCDM model. However, these trajectories are not predetermined outcomes of natural progression but are shaped by encoding ratchetsarbitrary yet pivotal representational choices that, once entrenched through standardization, enable efficient scaling and systematically foreclose alternative pathways.

To understand encoding ratchets, it is essential to consider the prerequisites of path dependence in technological and scientific development. Path dependence refers to the phenomenon where early decisions constrain future options, often due to increasing returns and lock-in effects [**?**]. In this context, scaling the amplification of capabilities through increased resourcesplays a critical role, as highlighted by Richard Sutton's Bitter Lesson [**?**], which asserts that general methods combined with extensive scaling outperform specialized designs. Yet, scaling does not inherently select the optimal encoding; instead, it magnifies whichever representation was adopted early, regardless of its alignment with underlying realities.

This essay explores encoding ratchets across three domains: cinema, computation, and cosmology. By examining suppressed alternatives in each, it argues that scaling can obscure richer representational frameworks. Recent advancements, such as the effective-fluid approach to cosmological non-linearities by **?**], demonstrate how mainstream paradigms are converging toward entropic and structural insights that were anticipated by alternative models like the Relativistic Scalar Vector Plenum (RSVP) [**?**]. To provide a robust foundation, the discussion incorporates philosophical prerequisites from emergence theory and local metaphysics, ensuring a comprehensive analysis of how encodings shape our understanding of complex systems.

2 Emergence, Downward Causation, and Local Metaphysics

Before delving into specific domains, it is imperative to establish the philosophical and conceptual prerequisites that underpin the notion of encoding ratchets. This section introduces emergence, downward causation, and local metaphysics, drawing from the works of philosophers and scientists who emphasize the pluralistic and fallibilist nature of knowledge.

2.1 Prerequisites: Understanding Complexity and Hierarchies

Complex systems exhibit properties that cannot be fully predicted from their constituent parts alone. A prerequisite for grasping emergence is familiarity with hierarchical organization, where systems are structured across multiple levels, each with its own dynamics [**?**]. For example, in physical systems, atomic interactions give rise to molecular behaviors, which in turn form macroscopic phenomena. This hierarchy implies that explanations at one level may not suffice for another, necessitating a multi-level approach.

2.2 Emergence and Non-Aggregative Properties

Emergence refers to the appearance of novel properties or behaviors in a system that arise from the interactions of its components but are not reducible to them. Following **?**], emergent properties can be classified as aggregativethose that are simple sums of lower-level attributesor non-aggregative, which require higher-level explanations due to organizational constraints. For instance, the liquidity of water emerges from molecular interactions but cannot be deduced solely from individual hydrogen and oxygen atoms.

In the context of encoding ratchets, emergence highlights how representational choices at one level can constrain possibilities at higher levels. Once a particular encoding is selected, it shapes the emergent properties that are deemed "natural," marginalizing alternatives that might reveal different emergent phenomena.

2.3 Downward Causation as Constraint

Downward causation describes how higher-level structures influence lower-level components, often through constraints rather than direct forces. This concept, elaborated by **?**], posits that emergent organizations prune the possible trajectories of subordinate dynamics. A illustrative example is the difference between a bucket of chemicals reacting randomly and the same chemicals organized within a living organism "walking to the store"the higher-level biological structure constrains chemical reactions to serve functional purposes.

> **Footnote on Downward Causation Analogy:** Consider a pot of soup: uniform heating assumes homogeneity, but clumps and bubbles (higher-level structures) constrain heat distribution, altering global behavior. This mirrors how encodings impose constraints in scientific models.

Downward causation is crucial for understanding ratchets, as standardized encodings act as constraints that limit exploratory paths in technology and science.

2.4 Local Metaphysics and Ontological Parity

Local metaphysics, as articulated by **?**], advocates for partial, fallibilist accounts that relate specific domains without aspiring to a comprehensive "theory of everything." It embraces pluralism, recognizing that different levels of reality require distinct explanatory frameworks. Drawing from **?**], ontological parity asserts that components, structures, and processes are equally real, without privileging one over others.

This framework justifies treating alternative encodings, such as RSVP's scalar-vector-entropy fields, on equal footing with mainstream models. In encoding ratchets, local metaphysics reveals how early choices lock in particular ontologies, making alternatives appear less viable despite their potential richness.

?] further elucidates these ideas, emphasizing that local metaphysics allows for robust naturalism without reductionism, where emergent levels maintain autonomy.

3 Cinemas Encoding Ratchet

Cinema's development provides a paradigmatic example of how encoding choices shape an entire medium. To appreciate this, one must understand the historical prerequisites: the invention of photography in the 19th century and the need for standardized reproduction in the early 20th century.

3.1 The Frame Standard: Historical Development and Standardization

Cinema standardized on two-dimensional frames captured on physical reels, a choice driven by the practicality of duplication and mechanical projection. This encoding facilitated the global dissemination of identical content, creating a monoculture where a single film, with fixed actors and scenes, could be experienced uniformly worldwide [**? ?**]. The frame became the fundamental unit, enabling editing techniques like montage and narrative continuity.

3.2 Detailed Explanations of Suppressed Alternatives

Alternative encodings were explored but ultimately suppressed. Volumetric cinema, inspired by stereoscopic systems dating back to the 1830s, envisioned films as three-dimensional scenes that could be re-projected with viewer-specific perspectives, enhancing immersion [?]. Similarly, in the 1930s, parallel-language versions of films were produced by re-shooting scenes with local casts, suggesting a model akin to distributed theater where global narratives adapted to cultural contexts [?].

These alternatives failed to scale due to technological and economic constraints, such as the complexity of stereoscopic projection and the costs of localized production.

3.3 Downward Constraints in Cinema

The frame encoding imposed downward constraints on subsequent practices: editing software, distribution networks, and performance styles evolved to optimize for frames, reshaping the medium. Had volumetric or localized encodings prevailed, cinema might emphasize interactive or culturally adaptive narratives, illustrating how ratchets constrain emergent cultural forms.

4 Computations Encoding Ratchet

Computation's trajectory similarly reflects encoding ratchets, requiring an understanding of prerequisites like Boolean logic and early electronic engineering.

4.1 ASCII and the Keyboard: Origins and Lock-In

Computing standardized on ASCII character sets and keyboard inputs, initially for compatibility with military and telecommunication systems. This encoded computers as processors of linear text streams, a paradigm perpetuated in modern tokenized AI models [?].

4.2 Suppressed Alternatives: Detailed Historical Context

Alternatives included cursive input systems, such as IBM's 1950s handwriting recognizers and Apple's Newton in the 1990s, which could have oriented computing toward fluid, pen-based interactions. Additionally, Vannevar Bush's Memex and B.F. Skinner's teaching machines proposed modular, card-based storage, envisioning computation as augmented memory rather than stream manipulation [?].

These were marginalized as ASCII's simplicity allowed rapid scaling with early hardware.

4.3 Architectural Ratchets and Downward Constraints

The von Neumann architecture further entrenched sequential processing, creating bottlenecks that favored linear encodings [?]. Downward constraints manifested as programming languages and hardware co-evolved around token streams, making alternatives like dataflow seem unnatural [?].

5 Orders of Nature and Joint-Points

Building on emergence, this section explores orders of nature as empirical joint-points where new constraints emerge, providing a framework for analyzing ratchets across domains.

5.1 Prerequisites: Teleonomy and Hierarchical Systems

A prerequisite is distinguishing teleonomypurpose-like behavior without intention, such as biological adaptationsfrom teleology [? ?]. Hierarchical systems, as per ?], involve nested levels with increasing complexity.

5.2 The Five Orders of Nature

?] delineates five orders: physical (fundamental particles and forces), material (chemical and geological processes), biological (living organisms), mental (consciousness and cognition), and cultural (social and symbolic systems). Each order introduces novel constraints, such as thermodynamic laws in physics or evolutionary selection in biology.

5.3 Characteristic Timescales and Causal Emergence

Timescales serve as indicators of joint-points: chemical reactions occur in nanoseconds to microseconds, neuronal firings in milliseconds, consciousness in 100-250 milliseconds, and behaviors in seconds [?]. Causal emergence, per ?], shows that macroscales can possess greater causal information than microscales, justifying higher-level encodings.

5.4 Joint-Points in Scientific Encoding

If orders represent real discontinuities, encoding ratchets in science often align with one order, suppressing cross-order insights. This bridges to cosmology, where non-linear structures may represent joint-points overlooked by standard models.

6 Cosmologys Encoding Ratchet

Cosmology's encoding choices require prerequisites in general relativity and observational astronomy.

6.1 The ΛCDM Paradigm: Foundations and Assumptions

The ΛCDM model assumes a homogeneous background with perturbations, treating non-linear structures as negligible [?]. This facilitates computational scaling but assumes backreaction vanishes.

> **Sidebar 1 (Backreaction in Plain Terms):** Imagine stirring thick soup: clumps and bubbles affect overall circulation. Backreaction acknowledges that cosmic structures influence global expansion.

6.2 Suppressed Alternatives: Backreaction and Effective Fluids

Backreaction models, like Buchert averaging, suggest structures impact expansion [?]. The effective-fluid model by ?] treats collapsing regions (θ_c) and voids (θ_v) as interacting fluids, easing Hubble and σ_8 tensions using DESI data [? ? ?].

This approach models minimum sizes R_c and R_v, revealing large voids as key to anomalies, resolving discrepancies without new physics.

6.3 RSVP Cosmology: Microphysical Foundations

RSVP derives these phenomenologically as scalar-vector-entropy dynamics: compressive modes (θ_c), expansive modes (θ_v), and lamphron-lamphrodyne couplings [?].

6.4 A Convergence of Intuitions and Resolutions

Effective fluids reinterpret dark energy weakening as entropic structure effects, aligning with RSVP predictions. The Hubble tension, a mismatch between early and late universe measurements, diminishes when structures are active components.

> **Note 1 (Dark Energy Weakening):** ΛCDM assumes constant dark energy; structures mimic variability. RSVP posits acceleration as entropic redistribution.
>
> **Note 2 (Hubble Tension in Plain Terms):** Discrepant rulers adjust when accounting for cosmic "dents."

7 Scaling and the Bitter Lesson

Sutton's Bitter Lesson underscores scaling's power but overlooks how it amplifies contingent encodings [?]. Prerequisites include understanding increasing returns [?].

Detailed examples: ASCII scaled over cursive; frames over volumetric; ΛCDM over backreaction.

8 RSVP as a Counter-Ratchet

RSVP counters ratchets by supporting multiple encodings: field flows in cognition, entropic dynamics in cosmology [?]. It emphasizes representational choice over scaling inevitability.

9 Conclusion

The domains illustrate that scaled encodings reflect historical compatibility, not truth. Effective fluids and RSVP reopen paths, highlighting the need for pluralistic encodings.

A Alternative Encodings in Cosmology and Computation

A.1 Effective Fluids and RSVP Field Dynamics

The model encodes θ_c and θ_v as fluids:

$$w_{\text{tot}} = \frac{\rho_c w_c + \rho_v w_v}{\rho_{\text{tot}}}.$$

RSVP derives these from field divergences and couplings [? ?].

A.2 Ratchets in Computational Architecture

Von Neumann scaled but suppressed alternatives [?].

A.2.1 Suppressed Alternatives with Vignettes

- **Dataflow**: MIT (1970s) promised parallelism but hardware complexity hindered scaling [?]. - **Neuromorphic**: Mead's 1980s chips mimicked neurons, efficient but digital prevailed [?]. - **Associative Memory**: 1960s pattern-based retrieval suited AI, niche due to costs [?]. - **Stack Machines**: Burroughs B5000 (1961) supported high-level languages, overtaken by IBM [?].

A.3 RSVP and Architectural Counterfactuals

Von Neumann $\leftrightarrow$ ΛCDM; dataflow $\leftrightarrow$ backreaction.

A.4 Polycomputational Futures

RSVP enables co-scaling multiple encodings.