The Constraint Cost Principle: A General Method for Evaluating Explanations Across Domains

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Abstract

Explanations are not judged by elegance or number of assumptions alone. They are judged by what they cost to sustain. The Constraint Cost Principle states that, within any bounded domain, the preferred explanation is the one that satisfies the system's constraints while minimizing total cost, energetic, informational, and causal, without introducing hidden assumptions. This is not a global simplicity rule; it is a localized stress test. The principle works equally well in philosophy, history, science, mythology, decision-making, and any other explanatory domain. It forces hidden costs into view and selects explanations that survive under load.

The Principle Defined

Within a given system, whether a physical theory, historical narrative, mythological framework, or practical decision, the constraints are the non-negotiable boundaries of the domain: energy throughput, informational fidelity, causal grounding, coherence requirements, and empirical or logical consistency.

The Constraint Cost Principle evaluates competing explanations by subjecting each to the same pressures and selecting the survivor that carries the lowest total cost while preserving coherence. "Cost" here is not metaphorical. It is grounded in estimable or measurable quantities across three currencies:

- **Energetic cost:** resources or effort required to instantiate or maintain the structure.
- **Informational cost:** volume of data or hidden assumptions that must be smuggled in to keep the account intact.
- **Causal cost:** number and depth of irreversible steps or branching dependencies demanded by the explanation.

The principle does not eliminate explanations; it ranks them by survivability under constraint.

Why It Differs from Traditional Tools

Standard Occam's Razor minimizes the number of assumptions globally and treats all domains as if they share the same cost structure. The Constraint Cost Principle rejects that universalism.

It asks: within this bounded system, what is the lowest-cost path that still satisfies the constraints?

It therefore avoids two common errors:

Accepting an explanation that is "simple" only because it ignores the actual costs of the domain.

Rejecting an explanation that is "complex" only because it carries visible costs that are nevertheless lower than the hidden costs of its rivals.

The Method in Practice

Apply the principle in three executable steps:

1. Clearly state the constraints of the domain.
2. Subject every competing explanation to the same constraint pressures and tally its total cost.
3. Select the survivor that holds with the lowest cost while preserving coherence.

If two explanations survive with equal cost, the principle identifies the next required constraint for further differentiation. The method is iterative: new evidence or tighter constraints simply rerun the test.

Examples Across Domains

History: A narrative invoking external intervention carries high causal and energetic cost. A narrative grounded in local divergence under known environmental pressures carries lower cost. The latter is preferred unless new constraints force reconsideration.

Science: A model that explains observations but requires fine-tuning parameters at every scale imports high informational cost. A model that derives the same observations from fewer free parameters under the same physical constraints is lower-cost.

Mythology: A myth treated as literal history often demands hidden causal costs (miracles, lost civilizations). A myth treated as degraded memory of prior structural peaks under different constraints carries lower informational and causal cost.

Decision-making: Choosing a strategy that looks elegant but requires constant intervention imports ongoing energetic cost. Choosing a strategy that aligns with existing constraints and self-stabilizes carries lower total cost.

In each case the principle does not dictate truth; it identifies the explanation that survives with the least unnecessary burden.

Advantages

The Constraint Cost Principle is domain-agnostic yet constraint-sensitive. It prevents both over-complication and under-constrained simplicity. It forces hidden costs into view and rewards explanations that remain coherent without smuggling. Most importantly, it remains open to revision: new constraints or better cost accounting simply rerun the test. The principle therefore ages gracefully as knowledge grows.

Conclusion

Explanations are not ornaments; they are structures that must stand under load. The Constraint Cost Principle supplies the stress test that reveals which structures deserve to stand. By evaluating every claim according to the costs it actually imposes within its domain, we replace intuition with disciplined selection. The result is not certainty, but clarity: we know which explanations are carrying their own weight and which are merely being propped up by hidden assumptions. In a world flooded with competing accounts, the ability to distinguish sustainable structure from decorative narrative is no longer optional. It is the minimum requirement for responsible thought.

Endnotes

[1] The definition of total cost follows standard usage in complexity theory and thermodynamic accounting; see Wolfram, *A New Kind of Science* (2002), pp. 737-750.

[2] The Constraint Cost Principle is the author's original decision rule for explanatory evaluation. While it builds on foundational ideas in complexity theory, it extends them by integrating energetic, informational, and causal accounting simultaneously into a single, domain-relative selection procedure.

Keywords: Constraint Cost Principle, explanatory evaluation, constraint-based reasoning, total cost minimization, stress testing explanations, energetic cost, informational cost, causal cost, philosophy of explanation, cross-domain method, epistemic hygiene, structural coherence, minimum-cost under constraint, theoretical philosophy