The Predictive Mind and Its Myths: Metaphor, Narrative, and Ritual as Structural Necessities of Scientific Cognition

A Predictive Processing Framework for Understanding the Mythopoetic Dimensions of Science

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Abstract

This article argues that three features commonly regarded as extraneous to scientific rationality—conceptual metaphor, mythological narrative, and institutional ritual—are functionally indispensable components of scientific cognition and practice, not cultural contaminations of an ideally pure rationality. Drawing on the predictive processing (PP) framework—specifically hierarchical generative modeling, precision-weighting, and temporally deep prediction—we propose that these three elements correspond to distinct strategies for managing prediction error at the cognitive, narrative, and institutional levels. We deploy PP not as a universal metaphysical principle but as a heuristic framework whose specific, empirically constrained commitments (hierarchical cortical prediction, precision-weighted inference, social generative modeling) generate testable claims about which metaphors prove scientifically productive, why scientific narratives acquire specifically mythological structure (defined here by four necessary features: cosmogonic framing, agentive causation, eschatological orientation, and identity-constitutive function), and how institutional rituals relate to precision-weighting in social inference. We distinguish between minimal PP (a modeling toolkit with cortical implementation claims) and maximal PP (a grand unifying picture of mind), and anchor our argument in the former. Two extended case studies—Big Bang cosmology and gene-centered evolutionary biology—demonstrate the co-presence and functional interdependence of all three levels. The article engages critically with scientific realism, structural realism,

Paul Feyerabend's epistemological anarchism, and the post-2020 critical literature on the free energy principle. We argue that these mythopoetic dimensions exist on a continuum from weakly present to strongly structuring, and that acknowledging them does not license relativism but enables a more epistemically humble and self-correcting scientific practice.

Keywords: predictive processing, free energy principle, scientific metaphor, myth and science, ritual in science, epistemology, philosophy of science, Feyerabend, Kuhn, cognitive science, precision weighting, structure-mapping, gene-centered view, Big Bang cosmology

1. Introduction

Science presents itself as the paradigmatic rational enterprise—a method for discovering truths about the natural world through observation, experimentation, and logical inference. On this self-understanding, metaphor is ornamental, narrative is pedagogical, and ritual is sociological: none belongs to the epistemic core. The present article challenges this self-image. We argue that metaphor, mythological narrative, and institutional ritual are not peripheral to scientific cognition but functionally indispensable to it, and that the predictive processing (PP) framework in cognitive science provides an explanatory account—not merely a compatible vocabulary—of why this is so.

The argument proceeds through three central theses. First, that science is *pervasively and functionally dependent on metaphor* at the level of concept formation, and that PP's hierarchical structure generates specific predictions about which metaphorical transfers will prove scientifically productive. Second, that scientific explanation acquires *specifically mythological* structure—defined precisely by four necessary features (Section 3)—when it addresses questions of origin, agency, and completion, and that this follows from how temporally deep generative models handle uncertainty at their boundaries. Third, that science *depends on institutional ritual* for its social reproduction, and that PP's precision-weighting mechanisms in social inference provide a specific, non-trivial account of how these rituals function.

Crucially, we do not argue that science is *reducible* to myth or that scientific and mythological claims are epistemically equivalent. Science possesses mechanisms of self-correction—systematic falsification, quantitative prediction, technological application—that mythological systems lack. Our argument is that these self-corrective mechanisms operate *within* and *upon* a substrate that is itself metaphorical, narrative, and ritualistic, and that this substrate matters practically: unexamined metaphors constrain research programs, unrecognized mythological structures distort resource allocation, and unreflective ritual practices can suppress productive inquiry.

We emphasize throughout that these mythopoetic features are best understood as existing on a *continuum* from weakly present (a routine laboratory report has minimal mythological structure) to strongly structuring (a paradigmatic cosmological narrative like the Big Bang displays all four mythological features at full intensity). Our claim is not that every scientific act is mythological but that the cognitive architecture described by PP ensures these features will emerge with increasing strength as scientific discourse addresses questions of greater temporal depth, social scope, and paradigmatic significance.

1.1 Roadmap and Targets

A note on scope. We distinguish between what might be called *minimal PP*—a set of computational modeling tools (hierarchical Bayesian inference, predictive coding algorithms) with specific claims about cortical implementation—and *maximal PP*—the broader claim that PP provides a grand unifying picture of mind, agency, and culture. Our argument is anchored in minimal PP: we rely on hierarchical generative modeling, precision-weighted inference, and social generative modeling, all of which have substantial empirical support independent of the more ambitious claims of the free energy principle (FEP). Where we invoke the FEP, we do so as a *heuristic organizing principle* rather than as a foundational axiom from which our conclusions are deduced. This distinction matters because several of the strongest criticisms of PP/FEP (Section 2.2) target the maximal version, and our argument is designed to survive them.

The article is structured as follows. Section 2 reviews PP, introduces the formal resources we deploy, and engages critically with both classic and recent criticisms of the FEP. Section 3 provides precise definitions of mythological structure and ritual function. Section 4 examines metaphor. Section 5 analyzes mythological narrative. Section 6 addresses institutional ritual. Section 7 presents two case studies: Big Bang cosmology and gene-centered evolutionary biology. Section 8 engages with counterarguments. Section 9 situates the argument relative to Feyerabend. Section 10 develops implications, including proposals for empirical testing. Section 11 concludes.

2. The Predictive Processing Framework

2.1 Core Commitments of Minimal PP

The predictive processing paradigm reconceptualizes brain function. Rather than building representations bottom-up from sensory data, the brain is primarily a top-down prediction generator. At every level of the cortical hierarchy, generative models produce predictions about incoming signals; mismatches generate *prediction errors* that propagate upward, prompting model revision. Perception is the brain's best hypothesis about the causes of its sensory input (Friston, 2010; Clark, 2013; Hohwy, 2013). What Seth (2021) calls "controlled hallucination" and Clark (2013) characterizes as the brain's "best guess" captures the core insight: we perceive the world through our predictions of it.

The free energy principle (FEP) formalizes this picture at a high level of abstraction. Friston (2006, 2010) proposes that self-organizing biological systems minimize *variational free energy*—an information-theoretic bound on surprise. In cognitive terms, this amounts to maintaining accurate predictive models through perceptual inference (updating the model) and active inference (changing the environment). Kriger (2026a) has argued that predictive processing is not merely one cognitive strategy among alternatives

but an evolutionarily inevitable architecture: physical constraints on energy, bandwidth, and response latency make prediction-based processing the only viable design above a threshold of environmental complexity.

For our argument, we rely on three specific commitments of minimal PP, each with substantial empirical support independent of the FEP's more ambitious formulations: (a) *Hierarchical generative models*: the cortex implements a hierarchy where lower levels predict fine-grained sensory features and higher levels predict abstract, temporally extended regularities (Bastos et al., 2012; Keller and Mrsic-Flogel, 2018). (b) *Precision-weighting*: the brain assigns estimated reliability (precision) to both predictions and incoming signals, determining whether prediction errors lead to model revision or are suppressed (Feldman and Friston, 2010; Auksztulewicz and Friston, 2016). (c) *Social generative modeling*: humans model other agents as predictive systems, and cultural practices serve to align and stabilize inter-agent predictions (Kilner et al., 2007; Veissière et al., 2020).

2.2 Criticisms of the FEP: Classic and Recent

The FEP has attracted important criticisms that we must address transparently, since our credibility depends on not overclaiming what PP can deliver.

Classic criticisms. Colombo and Wright (2017) argue that the FEP, in its most general form, is unfalsifiable because any behavior can be redescribed as free energy minimization. Klein (2018) presses a related point: if the FEP explains everything, it explains nothing, since it lacks specificity to distinguish between possible cognitive architectures. Bruineberg et al. (2018) raise the "dark room problem": if organisms minimize surprise, why do they not simply seek the most predictable environment?

Post-2020 intensifications. These criticisms have not been resolved but sharpened. Colombo and Palacios (2021) argue that FEP faces a fundamental *generality–biological plausibility trade-off*: in its most general form it imposes no strong mechanistic constraints, and when specified enough to be mechanistically informative it may not be uniquely correct. Williams (2021) argues that FEP does not constrain process theories as strongly as its proponents suggest—multiple incompatible process models can be consistent with FEP. The question of whether FEP is best understood as a regulative ideal, a weak heuristic, or a substantive mechanistic theory remains actively debated (Nave, 2025). Active inference, the FEP's action-oriented extension, continues to face challenges with the frame problem and scope limitations in complex environments.

Our response. We take these criticisms seriously and have designed our argument to survive them. We do *not* claim that the FEP "provides the formal backbone" of our theory in the sense that our conclusions are deduced from it as axioms. Rather, we treat the FEP as a *heuristic organizing framework* and anchor our specific claims in the

three empirically supported commitments listed above—hierarchical generative models, precision-weighting, and social generative modeling—each of which has independent empirical support from neuroimaging, electrophysiology, and behavioral studies. If the FEP were tomorrow shown to be merely a regulative ideal rather than a substantive theory, our three specific claims would remain standing because they are supported by their own empirical evidence base. What the FEP provides for our purposes is not deductive force but *unifying coherence*: it explains why these three commitments belong together as aspects of a single cognitive architecture. This is a weaker but more defensible use of the framework.

We acknowledge that this modesty limits the strength of our conclusions. We cannot claim to have *derived* the necessity of metaphor, myth, and ritual from first principles. What we can claim is that the specific PP mechanisms we invoke generate specific, testable predictions about these phenomena that existing frameworks (CMT, sociology of knowledge, science studies) do not generate on their own, and that the PP framework provides a unifying explanation of why they co-occur.

3. Defining Mythological Structure and Ritual Function

The terms "myth" and "ritual" carry colloquial connotations that must be carefully managed. We do not use "myth" in the colloquial sense of "false belief," and we do not use "ritual" evaluatively. These are *cognitive formats* and *social-functional structures*, not epistemic failings. We use them in the structural-anthropological tradition (Lévi-Strauss, 1955; Eliade, 1963; Blumenberg, 1985), refined for our purposes as follows.

3.1 Mythological Structure: Four Features and a Continuum

We define a *mythological narrative* as a narrative that possesses the following four structural features:

(i) **Cosmogonic framing**: the narrative addresses an origin, positing a transition from a prior undefined state to the structured present.

(ii) **Agentive causation**: the narrative attributes causal efficacy to agents rather than to impersonal processes alone, even when the phenomena are not intrinsically agentive.

(iii) **Eschatological orientation**: the narrative implies a terminal state—a resolution or completion toward which the process is directed.

(iv) **Identity-constitutive function**: the narrative defines the identity, boundaries, and values of a community.

We recognize that this definition is deliberately permissive: many scientific narratives (Darwinism, plate tectonics, origin-of-life research) can be mapped onto it without much strain. This is not a defect but a feature of our argument. We explicitly adopt a *continuum* model: scientific discourses exhibit mythological structure to varying degrees, from minimal (a routine experimental report, which typically lacks cosmogonic framing and eschatological orientation) to maximal (a paradigmatic origin narrative like the Big Bang, which displays all four features at full intensity). The interesting empirical question is not whether a given discourse is "mythological or not" (binary) but *to what degree* and *along which dimensions* it exhibits mythological features, and what cognitive and social functions these features serve.

This continuum approach answers the objection that the definition is too permissive: we do not claim that all science is equally mythological, but that the cognitive architecture described by PP will produce increasingly mythological structure as discourse addresses questions of greater temporal depth, greater social scope, and greater paradigmatic significance.

3.2 Ritual: Over-Determination and Precision-Stabilization

We distinguish *ritual* from *social practice* by two jointly operative criteria: (a) *formal over-determination*: the practice persists in a specific form even when that form is not required by the function it ostensibly serves; and (b) *precision-stabilizing function*: the practice serves to align and stabilize interpersonal predictions within a community, reducing social uncertainty. A practice is ritualistic to the extent that it satisfies both criteria simultaneously. Like mythological structure, ritual exists on a continuum: a casual seminar is weakly ritualistic; a doctoral defense is strongly ritualistic.

We acknowledge that almost any institutional practice can, with sufficient interpretive effort, be described as over-determined. The precision-stabilizing criterion provides the necessary constraint: a practice is ritualistic in our sense only if its over-determined form is specifically explained by its role in stabilizing interpersonal predictive models.

4. The First Pillar: Metaphor as Generative Model Transfer

4.1 Two Traditions: CMT and Structure-Mapping

Conceptual metaphor theory (CMT; Lakoff and Johnson, 1980, 1999) argues that metaphor is cognitive, not merely linguistic: we understand abstract domains by mapping structure from embodied source domains. Structure-mapping theory (SMT; Gentner, 1983; Gentner and Markman, 1997) provides a more formally precise account: analogy involves the alignment and transfer of *relational structure*, with systematicity—the preference for interconnected relation systems—as the key quality constraint. Both traditions support

the claim that scientific concept formation is constitutively metaphorical; PP integrates and extends them.

4.2 What PP Adds: Three Testable Predictions

Prediction 1: Hierarchical level matching. PP's hierarchical generative models encode fine-grained features at lower levels and abstract regularities at higher levels. This predicts that *productive scientific metaphors transfer structure at the hierarchical level matching the target phenomenon.* When a metaphor transfers structure from the wrong level—e.g., mapping a sensorimotor schema like "explosion" onto a high-level cosmological process—it will generate systematic prediction errors (the erroneous intuition that the Big Bang happened *at a point in space*). Neither CMT nor SMT makes this hierarchical-level prediction.

How this could be tested. One approach would use corpus-linguistic methodology: identify the dominant metaphors in a scientific field (via systematic metaphor analysis of textbooks and review articles), classify them by the hierarchical level of their source domain (sensorimotor, object-level, relational-abstract), and correlate this with measures of the metaphor's productivity (frequency of citation, generation of new research questions) and its documented failure modes (persistent misconceptions in pedagogy). A finding that sensorimotor-source metaphors generate more misconceptions when applied to highly abstract target domains would support Prediction 1.

Prediction 2: Precision-dependent persistence. High-precision predictions resist revision. This predicts that *metaphors embedded in high-confidence regions of the generative model will persist despite disconfirming evidence*, because precision-weighting suppresses anomalous signals. The persistence of the "genetic code" metaphor long after the discovery of epigenetics exemplifies this: the metaphor had acquired such high precision that bidirectional and networked phenomena were treated as noise rather than signal (Keller, 2000).

Prediction 3: Prediction error drives metaphor change. Model revision occurs when prediction errors are sufficiently large and precise to overcome the prior's inertia. This predicts that *metaphor shifts are triggered by accumulated high-precision prediction errors*, not by the mere availability of alternative metaphors or by social factors alone. The shift from "genetic blueprint" to "genetic network" in molecular biology can be analyzed as a response to accumulated prediction errors (epigenetic inheritance, regulatory RNA, gene-environment interaction) that the blueprint metaphor could not accommodate.

4.3 Case Studies in Scientific Metaphor

The constitutive role of metaphor can be demonstrated across the sciences. "Natural selection" borrowed from Malthus's political economy and breeders' practice, framing nature as a competitive arena. This framing directed a century of research toward competitive dynamics and away from cooperative phenomena—a bias that researchers such as Margulis (1970) and Nowak (2006) had to work against by proposing alternative framings. In PP terms, the competitive metaphor occupied a high-precision position, and cooperative phenomena were treated as low-precision anomalies.

Similarly, the "genetic code" metaphor imported from information theory a model of unidirectional information flow (Keller, 2000). In our framework, it transferred structure at the wrong hierarchical level: the linear sequential structure of a code maps well onto the base-pair sequence but fails to capture the higher-level, context-dependent regulatory processes that govern gene expression.

4.4 Why the Metaphorical Substrate Cannot Be Eliminated

One might object that metaphors are heuristic scaffolding replaced by literal mathematical description. Lakoff and Núñez (2000) argue that mathematics itself is metaphorically grounded. This claim has been contested (Azzouni, 2010). We do not need the strong version: even if formalisms achieve autonomy from their origins, the *cognitive acts* of grasping and deploying them require metaphorical grounding. More fundamentally, Kriger (2026b) argues that representational isolation—the fact that organisms interact with internal models rather than unmediated reality—is a necessary consequence of bandwidth and latency constraints. If the organism always works with representations, the question is not whether its concepts are metaphorical but which metaphors it employs.

5. The Second Pillar: Mythological Narrative as Temporally Deep Prediction

5.1 From Narrative to Myth: The Boundary-Uncertainty Mechanism

Narrative is the cognitive format for temporally extended prediction (Turner, 1996; Bruner, 1986, 1991). Within PP, narrative cognition corresponds to the construction of temporally deep generative models. But not all narratives are myths. Our four-feature definition (Section 3) and PP provide the mechanism.

When a generative model is extended to maximal temporal depth—modeling a domain from origin to present or future—it confronts maximum uncertainty at its *boundaries*. At the lower boundary (origin), the brain deploys its highest-level priors, which are characteristically *agentive*: the most powerful predictive models in the human repertoire are

those evolved for predicting agent behavior (Kilner et al., 2007). Cosmogonic framing and agentive causation (features i and ii) emerge because the brain's deepest priors are agent-models, deployed when other resources are exhausted. At the upper boundary (future), the brain posits closure—a terminal state resolving uncertainty—producing eschatological orientation (feature iii). Any generative model encompassing a community's central activity acquires identity-constitutive function (feature iv).

This mechanism predicts a *gradient*: narratives of greater temporal depth and boundary uncertainty will display stronger mythological features. A laboratory report (narrow scope, low boundary uncertainty) will be minimally mythological. A disciplinary origin story (broad scope, high boundary uncertainty) will be strongly mythological.

5.2 The Structural Distortion Principle

Kriger (2026c) formalizes the Structural Distortion Principle: bounded cognitive systems actively maintain coherent world-models through selective attention, narrative smoothing, and inconsistency suppression. When a generative model encounters prediction errors threatening global coherence, the system faces a choice between local revision and global stabilization. Bounded systems, with limited computational resources, systematically favor global stabilization when errors are small relative to the model's scope but would require disproportionate restructuring. This produces "narrative smoothing": the systematic rounding of causal accounts toward greater coherence, stronger agency, and clearer directionality—precisely the features constituting mythological structure.

5.3 Mythological Structures in Science

The structures predicted by our mechanism are readily identifiable: cosmogonic narratives (the Big Bang, the RNA world, the Cambrian explosion), heroic hagiography (Einstein, Darwin, Curie—narratives of lone genius satisfying agentive causation), and eschatological promises (the Theory of Everything, the complete connectome, the "solution" to consciousness). We develop these through extended case studies in Section 7.

6. The Third Pillar: Institutional Ritual as Social Predictive Stabilization

6.1 Precision-Weighting in Social Prediction

PP's precision-weighting mechanism provides a specific account of institutional ritual. When an individual is assigned high *social precision*—high expected reliability as a source of predictions—their pronouncements are treated as high-precision priors, resistant to revision by contradictory evidence. This is a computational claim with behavioral pre-

dictions: authority transfer should be strongest when the receiving domain lacks well-established internal precision estimates, and weakest when it has them. The Veissière et al. (2020) "THINK model" situates cultural practices as mechanisms for aligning inter-agent predictions, providing independent support.

6.2 Taxonomy of Scientific Ritual

6.2.1 Initiation

The doctoral defense is a rite of passage (van Gennep, 1909/1960) whose ceremonial form exceeds what epistemic evaluation requires. The ceremony publicly recalibrates the community's precision estimates about the candidate's status, producing shared high-precision predictions that reduce social uncertainty.

6.2.2 Hierarchy and Authority Transfer

The Nobel laureate acquires high social precision that transfers across domains—Pauling's vitamin C advocacy, Mullis's AIDS denialism. PP predicts this as a consequence of precision-weighting that does not distinguish domain-specific from domain-general reliability. The prediction is testable: authority transfer should correlate inversely with the precision of existing evidence in the receiving domain.

6.2.3 Taboo

Scientific taboos function as precision floors: high-precision predictions that certain topics are not to be investigated, suppressing prediction errors that might otherwise motivate inquiry. PP predicts taboos will be strongest where inquiry would generate errors threatening the entire discipline's generative model.

6.2.4 Sacred Texts and Heresy

Canonical citation (citing Kuhn, Darwin, Popper) serves precision-alignment: it signals that the speaker's model shares community priors. Exclusion mechanisms respond to the *systemic scope* of prediction error, not its empirical magnitude—boundary violations generate systemic error, triggering disproportionate response.

6.3 Why Ritual Is Functionally Indispensable

These structures are the social infrastructure of collaborative prediction. Without initiation, no mechanism for status-calibration. Without hierarchy, no efficient precision-weighting. Without taboo, a computationally unmanageable hypothesis space. Ritual is the social analogue of a Bayesian prior: it constrains inference and makes tractable prediction possible. We reiterate: these are functionally indispensable cognitive and social

structures, not cultural contingencies or epistemic failings. Not every ritual is optimal—some suppress productive inquiry—but the *category* cannot be eliminated without loss of collaborative capacity.

7. Two Case Studies

7.1 Big Bang Cosmology

7.1.1 Metaphor: The Explosion That Wasn't

The term "Big Bang" was coined by Fred Hoyle in a 1949 BBC broadcast as a dismissive label. It was adopted because it provides a sensorimotorically grounded predictive model: an explosion scattering material outward. This is a hierarchical-level mismatch (Prediction 1): the sensorimotor schema of an explosion maps poorly onto geometric spacetime expansion. The mismatch generates documented prediction errors: the widespread intuition that the universe expands *into* something, that there is a center, and that the singularity was an event *in* space (Lineweaver and Davis, 2005). Science education research consistently finds these misconceptions resistant to instruction (Prather et al., 2002)—consistent with our prediction that hierarchically mismatched metaphors produce persistent misunderstanding.

7.1.2 Myth: Four Features at Full Intensity

Big Bang cosmology possesses all four mythological features. *Cosmogonic framing*: the origin of space, time, and matter. *Agentive causation*: inflation "drives" expansion, the universe "cools" and "forms" structure—agentive language pervades even technical literature (inspection of Weinberg, 1977 reveals systematic agentive metaphor: the universe "decides," particles "find" equilibrium). *Eschatological orientation*: heat death, Big Crunch, or cyclical renewal. *Identity-constitutive function*: the narrative defines the cosmological community's project and self-understanding.

7.1.3 Ritual: Gatekeeping and Taboo

Alternative cosmologies—steady-state, plasma, cyclic models—face sociological barriers disproportionate to their evidential status. López-Corredoira (2014) documents systematic publication bias against non-standard cosmological models, and Kroupa (2012) has argued that resistance to Modified Newtonian Dynamics exhibits paradigm-protective gatekeeping exceeding empirical warrant. The open letter "Cosmology's Crisis" (2004), signed by 33 scientists and published in *New Scientist*, explicitly complained of difficulty obtaining telescope time and publication for work outside the concordance model. These

documented patterns are consistent with our prediction that alternatives generating systemic prediction errors trigger exclusion responses calibrated to the scope of the threat.

7.2 Gene-Centered Evolutionary Biology

7.2.1 Metaphor: The Selfish Gene

Dawkins's (1976) "selfish gene" transfers agentive, intentional structure onto molecular replicators. In PP terms, it deploys an agent-model at a sub-organismal level. The metaphor's extraordinary productivity is consistent with PP: agent-models are the brain's most powerful generative models. But its failure modes are equally predicted: it systematically underweights cooperative, mutualistic, and developmental phenomena (Jablonka and Lamb, 2005; Noble, 2006).

7.2.2 Myth: The Gene's-Eye View as Cosmology

The gene-centered view exhibits all four mythological features. *Cosmogonic framing*: life begins with the "replicator" in the primordial soup. *Agentive causation*: genes "want," "compete," "build" survival machines. *Eschatological orientation*: the implicit promise that gene-level selection explains all biological complexity. *Identity-constitutive function*: the view defines evolutionary biology's disciplinary identity. The Extended Evolutionary Synthesis (Laland et al., 2015), which challenges gene-centrism, provokes resistance that exceeds empirical disagreement—consistent with its status as a challenge to the discipline's mythological structure.

7.2.3 Ritual: The Adaptationism Debate as Boundary Policing

Gould and Lewontin (1979) "Spandrels" critique was met with a response exceeding empirical disagreement. Canonical texts (Williams, 1966; Dawkins, 1976) function as identity markers; adaptationist methodology serves as initiation criterion; and challenges trigger exclusion responses (Pigliucci, 2007). In PP terms, adaptationism acquired such high precision as a disciplinary prior that alternatives were treated as low-precision noise.

8. Counterarguments and Responses

8.1 The Realist Objection

Scientific realists (Putnam, 1975; Psillos, 1999) argue that science's success would be miraculous if theories did not approximately describe reality. We accept this argument's force but note it does not address our claim. We do not deny approximate truth; we argue it is achieved *through* metaphorical, narrative, and ritual mechanisms. A map is metaphorical (it uses symbols unlike the terrain) and approximately accurate (it preserves

structure). The presence of metaphor does not preclude accuracy; it is the cognitive vehicle through which accuracy is achieved.

8.2 The Structural Realist Objection

Structural realism (Worrall, 1989; Ladyman, 1998; Ladyman and Ross, 2007) holds that mathematical structure is preserved across theory transitions. This is a sophisticated position identifying a genuine pattern: the Fresnel equations survive the transition from ether theory to electromagnetism; Newtonian mechanics is recovered as a relativistic limiting case.

Our engagement is threefold. First, structural continuity is *compatible* with our thesis: the structures that survive are the deepest products of cross-domain generative model transfer—the most robust metaphorical mappings at the highest hierarchical levels. Structural realism identifies *what* endures; our account offers an explanation of *why* those particular structures endure while others do not. Second, the *recognition* of which structures are preserved is itself a cognitive act performed by the same predictive, narrative-constructing minds we describe. This does not make structural continuity illusory, but it means the narrative of continuity is a product of the same architecture. Third, following Chakravartty (2007), structural realism faces its own unresolved challenges, particularly whether structure can be ontologically fundamental independently of the entities that instantiate it. Our account is compatible with both ontic and epistemic structural realism.

8.3 The Deflationary Objection

The objection that we merely relabel ordinary processes with dramatic terms has some force, and we partially concede it: our definitions are designed to be inclusive, and we acknowledge a continuum. But the relabeling is analytically correct: Big Bang cosmology does possess all four structural features of mythological narrative, and doctoral defenses do meet our criteria for ritual. Moreover, the PP framework explains *why* these homologies exist: they are products of the same predictive architecture, and the homologies are principled, not accidental.

8.4 The Relativism Objection

Does acknowledging science's mythological dimensions license relativism? It does not. Science is distinguished by *additional* mechanisms—empirical testing, formalization, institutionalized self-correction—that constrain its metaphors. But the deeper question: *if error-correction matters, why care about the substrate?* Three reasons. First, unexamined metaphors constrain research programs invisibly. Second, unrecognized mythological

structures distort resource allocation. Third, unreflective ritual practices suppress productive inquiry. The substrate matters because it affects outcomes.

8.5 The "PP Explains Everything" Objection

If PP is used to explain metaphor, myth, ritual, doctoral defenses, and cosmological gatekeeping, does it not fall into explanatory overreach? Our defense: we explain a *specific class of phenomena*—the mythopoetic features of science—by invoking specific mechanisms (hierarchical transfer, precision-weighting, social modeling) that generate testable predictions. If those predictions fail, our argument fails. This is the difference between post hoc accommodation and prediction generation.

9. Feyerabend Reconsidered

Our argument has deep affinities with Feyerabend's (1975) epistemological anarchism, but important differences. Feyerabend argued that there is no universal method, that science's self-image is ideological, and that "anything goes" was a diagnosis, not a recommendation. Recent scholarship (Kidd, 2016; Brown, 2016; Tambolo, 2015) reads him as an advocate for epistemic pluralism rather than a relativist.

We agree with the diagnosis but offer a *cognitive* explanation where Feyerabend offered an *ontological* one. He attributed methodological pluralism to the richness of reality (Feyerabend, 1999); we attribute it to the architecture of cognition. The practical consequence: PP provides a criterion for evaluating epistemic practices that Feyerabend's anarchism could not. Practices that generate prediction errors and update models accordingly are epistemically superior to those that suppress errors. This is a naturalistic criterion that does not presuppose a fixed method.

10. Implications

10.1 For Philosophy of Science: Cognitive Constructivism

PP offers a path beyond the realism/anti-realism dichotomy. This *cognitive constructivism* is realist (prediction errors are real) and constructivist (the form of knowledge is shaped by the architecture that produces it).

10.2 For Science Communication: Metaphor Transparency

We propose *metaphor transparency*: when a concept is communicated, the operative metaphor should be named, its source domain identified, and its known limitations stated.

10.3 For Science Policy: Institutional Reflexivity

Recognizing ritual structures enables targeted reform. The goal is not to eliminate ritual—cognitively impossible and functionally catastrophic—but to make science *aware* of its ritual structures so they can be managed rather than unconsciously obeyed.

10.4 For Empirical Research: A Testing Agenda

Prediction 1 (hierarchical level matching) could be tested through corpus analysis of metaphor productivity correlated with hierarchical-level classification. Prediction 2 (precision-dependent persistence) could be investigated through behavioral experiments measuring how prior confidence modulates metaphor revision. Prediction 3 (prediction-error-driven metaphor change) could be tested through historical case studies tracking anomaly accumulation preceding metaphor shifts. The precision-weighting account of authority (Section 6) generates predictions testable in social psychology paradigms: authority effects on belief updating should vary as a function of the receiving domain's evidence strength.

11. Conclusion

Science is the most powerful epistemic enterprise in human history. Nothing in this article diminishes that achievement. What we have argued is that this achievement is produced by embodied, predictive, narrative-constructing, ritual-practicing human minds, and it bears the marks of that origin.

We have identified three mythopoetic dimensions—metaphor, mythological narrative, and institutional ritual—and argued that they exist on a continuum from weakly present to strongly structuring. Using specific mechanisms from minimal PP (hierarchical generative modeling, precision-weighting, social prediction), we have generated testable predictions: hierarchical level matching in metaphor, precision-dependent persistence of theoretical commitments, prediction-error-driven paradigm change, and precision-weighted authority dynamics. Two case studies—Big Bang cosmology and gene-centered evolutionary biology—demonstrate these mechanisms in operation.

We have been transparent about our framework's limitations. We deploy PP as a heuristic framework, not a foundational axiom. Our argument survives the major criticisms of the FEP because it is anchored in minimal PP's specific, empirically supported commitments. Whether our predictions prove correct is an empirical matter; that they are specific enough to be testable is a philosophical contribution.

The practical stakes are real. Unexamined metaphors constrain research programs. Unrecognized mythological structures distort resource allocation. Unreflective ritual practices suppress productive inquiry. The predictive mind needs its myths. The question is not whether science will be mythological, metaphorical, and ritualistic—it will, because

brains are. The question is whether science will be these things knowingly and critically, or unknowingly and dogmatically.

References

Auksztulewicz, R. and Friston, K. J. (2016). Repetition suppression and its contextual determinants in predictive coding. *Cortex*, 80:125–140.

Azzouni, J. (2010). *Talking About Nothing: Numbers, Hallucinations, and Fictions*. Oxford University Press.

Bastos, A. M., Usrey, W. M., Adams, R. A., Mangun, G. R., Fries, P., and Friston, K. J. (2012). Canonical microcircuits for predictive coding. *Neuron*, 76(4):695–711.

Black, M. (1962). *Models and Metaphors: Studies in Language and Philosophy*. Cornell University Press.

Blumenberg, H. (1985). *Work on Myth*. MIT Press.

Brown, M. J. (2016). The methodological roles of theory in science. *Erkenntnis*, 81(4):681–706.

Bruineberg, J., Kiverstein, J., and Rietveld, E. (2018). The anticipating brain is not a scientist: The free-energy principle from an ecological-enactive perspective. *Synthese*, 195(6):2417–2444.

Bruner, J. (1986). *Actual Minds, Possible Worlds*. Harvard University Press.

Bruner, J. (1991). The narrative construction of reality. *Critical Inquiry*, 18(1):1–21.

Chakravartty, A. (2007). *A Metaphysics for Scientific Realism: Knowing the Unobservable*. Cambridge University Press.

Clark, A. (2013). Whatever next? Predictive brains, situated agents, and the future of cognitive science. *Behavioral and Brain Sciences*, 36(3):181–204.

Clark, A. (2016). *Surfing Uncertainty: Prediction, Action, and the Embodied Mind*. Oxford University Press.

Colombo, M. and Palacios, P. (2021). Non-equilibrium thermodynamics and the free energy principle in biology. *Biology & Philosophy*, 36(5):1–26.

Colombo, M. and Wright, C. (2017). Explanatory pluralism: An unrewarding prediction error for free energy theorists. *Brain and Cognition*, 112:3–12.

Dawkins, R. (1976). *The Selfish Gene*. Oxford University Press.

Eliade, M. (1963). *Myth and Reality*. Harper & Row.

Feldman, H. and Friston, K. J. (2010). Attention, uncertainty, and free-energy. *Frontiers in Human Neuroscience*, 4:215.

Feyerabend, P. (1975). *Against Method*. New Left Books.

Feyerabend, P. (1999). *Conquest of Abundance*. University of Chicago Press.

Friston, K. (2006). A free energy principle for the brain. *Journal of Physiology–Paris*, 100(1–3):70–87.

Friston, K. (2010). The free-energy principle: A unified brain theory? *Nature Reviews Neuroscience*, 11(2):127–138.

Gentner, D. (1983). Structure-mapping: A theoretical framework for analogy. *Cognitive Science*, 7(2):155–170.

Gentner, D. and Markman, A. B. (1997). Structure mapping in analogy and similarity. *American Psychologist*, 52(1):45–56.

Gould, S. J. and Lewontin, R. C. (1979). The spandrels of San Marco and the Panglossian paradigm. *Proceedings of the Royal Society B*, 205(1161):581–598.

Hesse, M. (1966). *Models and Analogies in Science*. University of Notre Dame Press.

Hohwy, J. (2013). *The Predictive Mind*. Oxford University Press.

Jablonka, E. and Lamb, M. J. (2005). *Evolution in Four Dimensions*. MIT Press.

Keller, E. F. (2000). *The Century of the Gene*. Harvard University Press.

Keller, G. B. and Mrsic-Flogel, T. D. (2018). Predictive processing: A canonical cortical computation. *Neuron*, 100(2):424–435.

Kidd, I. J. (2016). Why did Feyerabend defend astrology? *Social Epistemology*, 30(4):464–482.

Kilner, J. M., Friston, K., and Frith, C. D. (2007). Predictive coding: An account of the mirror neuron system. *Cognitive Processing*, 8(3):159–166.

Klein, C. (2018). What do predictive coders want? *Synthese*, 195(8):3541–3557.

Kriger, B. (2026a). The evolutionary inevitability of predictive processing: A physical constraint argument. *Zenodo*. https://doi.org/10.5281/zenodo.18444910

Kriger, B. (2026b). Evolutionary and information-theoretic argument for the necessity of representational isolation. *Zenodo*. https://doi.org/10.5281/zenodo.18331202

Kriger, B. (2026c). The Structural Distortion Principle: A closed-loop model of perception, attention, and world-maintenance in bounded cognitive systems. *Zenodo*. https://doi.org/10.5281/zenodo.18452700

Kroupa, P. (2012). The dark matter crisis. *Publications of the Astronomical Society of Australia*, 29(4):395–433.

Kuhn, T. S. (1962). *The Structure of Scientific Revolutions*. University of Chicago Press.

Ladyman, J. (1998). What is structural realism? *Studies in History and Philosophy of Science*, 29(3):409–424.

Ladyman, J. and Ross, D. (2007). *Every Thing Must Go: Metaphysics Naturalized*. Oxford University Press.

Lakoff, G. and Johnson, M. (1980). *Metaphors We Live By*. University of Chicago Press.

Lakoff, G. and Johnson, M. (1999). *Philosophy in the Flesh*. Basic Books.

Lakoff, G. and Núñez, R. (2000). *Where Mathematics Comes From*. Basic Books.

Laland, K. N., Uller, T., Feldman, M. W., et al. (2015). The extended evolutionary synthesis. *Proceedings of the Royal Society B*, 282(1813):20151019.

Lévi-Strauss, C. (1955). The structural study of myth. *Journal of American Folklore*, 68(270):428–444.

Lineweaver, C. H. and Davis, T. M. (2005). Misconceptions about the Big Bang. *Scientific American*, 292(3):36–45.

López-Corredoira, M. (2014). Non-standard models and the sociology of cosmology. *Studies in History and Philosophy of Modern Physics*, 46:86–96.

Margulis, L. (1970). *Origin of Eukaryotic Cells*. Yale University Press.

Merton, R. K. (1968). The Matthew effect in science. *Science*, 159(3810):56–63.

Nave, K. (2025). *The Free Energy Principle: A Critical Appraisal*. MIT Press.

Noble, D. (2006). *The Music of Life: Biology Beyond Genes*. Oxford University Press.

Nowak, M. A. (2006). Five rules for the evolution of cooperation. *Science*, 314(5805):1560–1563.

Pigliucci, M. (2007). Do we need an extended evolutionary synthesis? *Evolution*, 61(12):2743–2749.

Prather, E. E., Slater, T. F., and Offerdahl, E. G. (2002). Hints of a fundamental misconception in cosmology. *Astronomy Education Review*, 1(2):28–34.

Psillos, S. (1999). *Scientific Realism: How Science Tracks Truth*. Routledge.

Putnam, H. (1975). *Mathematics, Matter and Method*. Cambridge University Press.

Seth, A. (2021). *Being You: A New Science of Consciousness*. Faber & Faber.

Tambolo, L. (2015). A tale of three theories: Feyerabend and Popper on progress. *Studies in History and Philosophy of Science*, 51:33–41.

Turner, M. (1996). *The Literary Mind*. Oxford University Press.

van Gennep, A. (1909/1960). *The Rites of Passage*. University of Chicago Press.

Veissière, S. P. L., Constant, A., Ramstead, M. J. D., Friston, K. J., and Kirmayer, L. J. (2020). Thinking through other minds. *Behavioral and Brain Sciences*, 43:e90.

Weinberg, S. (1977). *The First Three Minutes*. Basic Books.

Williams, G. C. (1966). *Adaptation and Natural Selection*. Princeton University Press.

Williams, D. (2021). Is the free energy principle useful? *Australasian Journal of Philosophy*, 99(4):726–742.

Worrall, J. (1989). Structural realism: The best of both worlds? *Dialectica*, 43(1–2):99–124.