CHAPTER 1: From Cosmos to Machine

A basic premise of modern science is that we are observers of an external world entirely independent of our observations. We can measure, predict, and manipulate this world by breaking it down into basic elements, but we participate in it only in the sense that our bodies are made of the same physical constituents found in everything else. The prevailing assumption—born from the Galilean conception and evolved into the modern scientific worldview—holds that the universe is an exclusively physical place, and that subjective experience is entirely derivative from physical processes. This view is now so deeply embedded in modern thought that it seems like common sense, but it is actually a relatively recent development.

Premodern cultures imagined the cosmos as a living, intelligent, and relational whole. It was a world defined by participation, not detached observation. Most cultures imagined that spirit or a similar notion permeated existence. Moreover, they framed it as process or flow–as an action rather than an object. A river or a mountain possessed agency; it and was a presence to be related to, possessing its own interiority and purpose. In early Chinese thought, the world was understood as a dynamic field of relations, patterns of correspondence and resonance, not discrete substances[1]—a perspective that continues through Taoist,Confucian and similar traditions.

[1] Ames, Roger T., and David L. Hall. *Thinking Through Confucius*. State University of New York Press, 1987.

People believed that they were part of an animate reality—they had a direct, unmediated relationship with a living world. It was a deeply experiential world defined by participation, in contrast to the abstractive mode that would later come to dominate Western thought.

This ancient intuition was fundamental for many of the earliest and most influential Western philosophers. Plato saw the physical world as a moving image of an eternal, intelligible reality, and the cosmos as a living creature endowed with soul and intellect—*nous*—that brought order and reason to material existence. His student Aristotle was more grounded in empirical observation, but likewise saw the world as saturated with purpose. All natural things, he argued, possess a *telos*—an innate, indwelling end toward which they strive. The telos of an acorn is to become a mighty oak, and this striving is an intrinsic part of its nature.

These metaphysical conceptions were the foundation of Western thought for two millennia. Qualities such as warmth, color, purpose, and even soul were real and irreducible features of the world. Reality was not divided into "primary" and "secondary" qualities, but was understood as a seamless whole in which mathematical relationships coexisted with meaning, beauty, and intention. The universe was intelligible because it was alive and intelligent. Owen Barfield spoke of it as original participation, a mode of consciousness in which humans experienced themselves as *participating in* the life of nature rather than standing apart from it.[2]

[2] Owen Barfield, *Saving the Appearances*, 1957.

The integrated vision of a meaningful cosmos began to fade in Western thought with the rise of Christianity, particularly during the medieval period, which shifted the locus of agency from an inherent aspect of the world toward a transcendent God who guaranteed cosmic order. The universe came to be seen as fundamentally intelligible because it was the creation of a rational, divine mind. Nature was seen as a "second book," a divine text that, like Scripture, revealed the mind of its author. This worldview found its most famous expression in the concept of the Great Chain of Being—a model that organized all of existence, from God and the angelic hosts down to the most humble stone, in a single, unbroken, value-laden hierarchy. Everything had its proper place and purpose in the divine order.

Within this framework, what we now call science was not seen as an alternative or threat to theology, but as a form of it. To study the natural world was to engage in a fundamentally spiritual act: to read the mind of God as expressed in the rational structure of creation. For the great minds of the Scientific Revolution—Johannes Kepler, Isaac Newton, Robert Boyle and others—scientific inquiry remained a deeply spiritual pursuit. When Kepler discovered the elliptical orbits of the planets, he famously exclaimed that his desire was "only to taste the flavor of seeing, if I could, with my own eyes, what I had learned from the mouth of God."[3] Similarly, Newton, a profoundly religious man who wrote more on theology than on physics, saw his discovery of universal gravitation not as evidence of a self-sufficient mechanism, but as proof of God's ongoing, rational design and dominion over the cosmos.

[3] Johannes Kepler, in a letter to Herwart von Hohenburg, 1599.

For these founders of modern science, there was no conflict between physics and faith; they were integrated paths to understanding a single, divinely ordered reality. The mathematical elegance they discovered in planetary motion and terrestrial mechanics was not mere utility—it was a glimpse into the aesthetic and rational perfection of divine creativity. Yet the very power and elegance of the system they created contained the seeds of a major transformation that would ultimately remove the creator from the picture—and, more significantly, would strip the universe of meaning, purpose, and the possibility of genuine participation.

The Galilean Reorientation

The beginnings of this transformation are often attributed to Francis Bacon and Galileo Galilei in the late 16th and early 17th centuries.

Bacon promoted an empirical, inductive method of science, while Galileo redefined science as the study of what is measurable. Galileo's move was particularly consequential. He argued that the world is fundamentally accessible only through mathematics—that the "book of nature is written in geometrical characters." This was not merely a methodological preference, a practical choice about which phenomena to study first or which tools to employ. It was a metaphorical reorientation that would reshape Western thought.

By focusing exclusively on what could be quantified and measured, Galileo created an implicit hierarchy. Quantities—mass, velocity, position—became "primary qualities" because they could be captured mathematically. Qualities like color, warmth, taste, purpose, and meaning became "secondary qualities" because they resisted mathematical description. And what resisted mathematization was gradually deemed less real, less worthy of systematic attention, ultimately not part of nature itself but mere projections of the perceiving mind.

What began as a methodological choice—*let's study what we can measure*—carried within it the seeds of an ontological claim: *only what we can measure is real.* This distinction matters because methodological choices can be pragmatic and reversible. Ontological claims are metaphysical commitments about the nature of reality itself. The Galilean conception would eventually harden into the latter.

But to understand how this happened, we must recognize something fundamental about human cognition: metaphors are not merely ways of talking about reality—they are ways of *thinking about* reality. This insight, developed extensively by cognitive linguist George Lakoff and philosopher Mark Johnson, represents an important finding in cognitive science: abstract thought itself operates through metaphorical mappings from concrete, embodied experience.

We don't just happen to speak of arguments in terms of war ("defending a position," "attacking weak points"); we actually *think about* arguments through the structure of combat. We don't just describe time as a valuable resource ("spending time," "investing hours"); we *conceptualize and experience* time itself through the logic of economic transaction. These aren't conscious choices. They're cognitive infrastructure—largely invisible frameworks that shape what we can perceive, what questions we can ask, and what answers seem reasonable.

The metaphor of the universe as a machine doesn't just change our vocabulary; it determines what we can notice. Machines have parts but not purposes. They can be disassembled and optimized but not participated in. They operate according to deterministic laws but lack interiority, meaning, or value. The metaphor makes certain inquiries natural—*How does it work? What are its mechanisms? What are the* *component parts?*—while rendering others nonsensical or naive: *What does it mean? What is its purpose? What is it like to be this?*

The philosopher and systems theorist Jeremy Lent has extended this insight to civilizational scale. In *The Patterning Instinct* and *The Web of Meaning*, Lent argues that the root metaphors animating a culture—its deepest assumptions about what reality is—shape everything from social organization to ecological relationship to conceptions of human flourishing. These are not abstract philosophical positions debated in seminar rooms but lived frameworks that determine how societies relate to nature, how they justify hierarchies, how they define progress, and ultimately whether they survive or collapse.

A metaphor of nature as dead matter to be exploited generates a profoundly different civilizational trajectory than a metaphor of nature as a living web in which humans are embedded participants. The choice of root metaphor is never merely intellectual—it cascades into institutional structures, ethical frameworks, technological development, and the felt quality of human life.

The transformation from Galileo's methodological innovation to the modern scientific worldview was gradual, almost imperceptible across generations. Newton himself, a profoundly religious man who wrote more on theology than physics, saw his discovery of universal gravitation not as evidence of a self-sufficient mechanism but as proof of God's rational design. Yet the very elegance and power of his mathematical system made a different interpretation increasingly plausible.

The stunning success of mathematical physics in predicting planetary motions and explaining mechanical systems created an implicit standard: real knowledge produces mathematical laws that enable precise prediction. If mathematics could reveal the "true" behavior of planets and pendulums with such precision, perhaps it revealed the true nature of the universe itself. The success of the quantitative approach generated an implicit bifurcation—what could be measured and predicted was "objective" and real, while phenomena that couldn't be mathematized were marginalized as "not scientific," ultimately as not quite real.

By the time Pierre-Simon Laplace, the French mathematician, presented his vision of a "clockwork universe" to Napoleon in the early 19th century, the transformation was nearly complete. Asked where God fit into his cosmic system, Laplace famously replied, "I had no need of that hypothesis." He had articulated a vision of a perfect, deterministic machine that, once set in motion, required no ongoing divine agency, no purpose, no meaning beyond its own mechanical operation.

This marks what Alfred North Whitehead would later call the "bifurcation of nature"—the decisive cleaving in two of what had been experienced as a seamless, meaningful whole. The experiential way of being—participation, connection, relationship—gave way to an abstractive mode characterized by detachment, manipulation, and symbolic representation. We became observers and manipulators rather than participants, knowing the world through measurements and models rather than through direct experience and relationship.

The drift was so gradual that each generation of thinkers could reasonably see themselves as simply building on their predecessors' work, not fundamentally altering humanity's relationship to reality. Yet by the mid-20th century, the transformation was complete: the animate cosmos of the ancients, alive with meaning and purpose, had been replaced by particles and forces mindlessly operating according to mathematical laws, with consciousness relegated to the status of an emergent accident.

This history matters not because we should attempt to return to premodern worldviews—we cannot unknow what we have learned—but because recognizing the metaphorical foundations of the modern scientific worldview opens space for examination. The Galilean conception was never simply a neutral reading of nature. It was a choice about which aspects of reality to privilege, which questions to pursue, which phenomena to study. That choice generated spectacular success within certain domains while systematically excluding others.

We cannot prove which metaphysical framework is ultimately "true"—such proof may be impossible or even incoherent given that all frameworks rest on unexplained primitives. But we can examine their consequences. We can ask: Which framework better accounts for the full range of evidence we encounter? Which supports more sustainable relationships with the natural world and with other conscious beings? Which addresses the contemporary meaning crisis that many recognize as a defining feature of modern life?

The question is not whether the mechanistic worldview is "wrong" but whether it is *sufficient*—whether a framework built on the metaphor of the universe as machine, however powerful within its domain, can adequately encompass consciousness, meaning, purpose, and the possibility that other species might manifest forms of interiority as rich as our own. These are pragmatic questions about how competing frameworks perform in practice, not metaphysical claims about ultimate reality.

This pragmatic approach—what we might call "living as if"—will guide our inquiry throughout. Rather than claiming to have discovered the true nature of reality, we will explore what follows from taking continuum frameworks seriously as alternatives to the dominant mechanistic view. The test is not metaphysical proof but practical consequences: Does this framework allow richer engagement with evidence? Does it generate productive questions? Does it lead to better outcomes for human and planetary flourishing?

A Particular Template

The spectacular success of physics in predicting planetary motions and explaining mechanical systems created an implicit standard: real science produces mathematical laws that enable precise prediction. This became the model against which all other forms of inquiry would be judged.

But this template fits some domains far better than others. Physics succeeds brilliantly when applied to closed, reversible systems with few variables—pendulums, planets, particles in controlled conditions. Biology operates differently. The history of biological discovery is largely a story of accident, experiment, and narrative coherence rather than theoretical prediction. Darwin didn't develop evolutionary theory by forming hypotheses and making falsifiable predictions; he observed patterns in nature, collected specimens, and constructed a narrative that made sense of the evidence. Most major biological breakthroughs follow similar paths: Fleming's accidental discovery of penicillin, the stumbled-upon structure of DNA, the unexpected finding of jumping genes.

Evolutionary biology's explanatory power comes not from physics-style mathematical prediction but from its ability to weave disparate observations into coherent narratives. We cannot predict which mutations will occur or which organisms will thrive, yet evolutionary theory remains rigorous science—judged by whether its narratives accommodate evidence, generate productive research, and prove practically useful. The life sciences succeed precisely because they don't limit themselves to what physics-style methods can capture.

Why, then, do we demand that consciousness studies meet standards that biology itself rarely meets? Part of the answer lies in a historical accident: the invention of "the scientific method" as a rigid template.

As historian Jessica Riskin has documented, what we teach schoolchildren as the scientific method—hypothesis, prediction, experiment, confirmation—was less a description of how science works than a late 19th-century branding tool. When Charles Sanders Peirce introduced the term in 1878, he meant something far more general: forming beliefs through evidence rather than authority or a priori reasoning. But over subsequent decades, popularizers transformed this into a rigid five-step template modeled explicitly on physics, then imposed this template on all disciplines as the criterion for "real science."

This created a peculiar distortion. Biology, which advances primarily through observation, experiment, and narrative synthesis, found itself judged by physics-derived standards it rarely meets. The "scientific method" taught as universal was actually particular—appropriate for inanimate physical systems but mismatched to the complexity of living things. Yet this physics-styled template became the public-facing gatekeeper for what counts as legitimate scientific inquiry.

Consciousness studies face this same mismatch, but more acutely, as the variables associated with consciousness vastly exceed those of basic biology. If evolutionary biology succeeds through narrative coherence despite life's resistance to mechanistic reduction, consciousness studies—dealing with even greater complexity and immeasurable interiority—cannot reasonably be held to physics-style falsification. The question is not whether continuum frameworks can meet physics standards, but whether they offer a more coherent narrative for the full range of evidence than the emergence stories that dominate current thinking.

Demanding that all legitimate knowledge follow a template invented as branding and modeled on one particular domain represents not scientific rigor but historical contingency. It mistakes methodological success in physics for universal adequacy, and treats a marketing innovation as if it were a discovered law of nature.

This is not to diminish biology's achievements but to recognize their actual character. The life sciences have succeeded magnificently, but not primarily through the kind of falsifiable prediction that works so well in physics. Evolutionary biology, ecology, and consciousness studies operate by a different logic—one based on narrative coherence, explanatory power, and consilience across multiple lines of evidence.

The difference matters because physics and biology study fundamentally different kinds of systems. Physics achieves its extraordinary predictive power by focusing on closed, reversible, exterior phenomena. A physicist can isolate variables, repeat experiments under identical conditions, and generate predictions accurate to twelve decimal places. The planetary orbits that so impressed Newton, the quantum mechanics that enabled modern electronics—these work because they describe systems that can be isolated from their environments and treated as if time were reversible.

But life is not like that. Living systems are open—constantly exchanging energy and matter with their environments. They are irreversible—each moment represents genuinely novel emergence that cannot be rewound and replayed. And crucially, they exhibit what can be interpreted as goal-directedness—even the simplest organisms respond to their environment in ways that suggest purpose rather than mere mechanical reaction. Whether this reflects genuine interiority or emerges from mechanistic processes remains contested, but biology confronts beings whose behavior resists purely exterior description in ways that physics does not face.

Consciousness takes these features to their logical extreme. If biology already exceeds what physics-style methods can fully capture, consciousness—the ultimate interiority, the paradigm case of irreversible, context-dependent emergence—cannot reasonably be held to standards designed for reversible, isolated, purely exterior systems. The attempt to force consciousness studies into a physics template is not methodological rigor but category error.

The lesson is not that consciousness studies should abandon empirical methods or rigorous investigation. It's that the standards of rigor must match the phenomenon being investigated. For consciousness, as for biology, rigor means coherence across multiple lines of evidence, explanatory power for diverse observations, productive research programs, and practical utility. These are exactly the standards by which continuum frameworks should be evaluated—not whether they produce physics-style mathematical predictions, but whether they make better sense of everything we know about consciousness, evolution, and experience.

Institutional Entrenchment

Yet even as these attempts revealed their limitations—biology succeeding through different methods, consciousness resisting mechanical explanation entirely—Western culture chose not to recognize these boundaries but to double down through deliberate institutional restructuring. The 18th century saw the beginning of a division between sciences and humanities that would accelerate dramatically over the next two centuries. What had been integrated domains of inquiry—natural philosophy encompassing both physical study and questions of meaning, purpose, and value—were systematically cleaved apart.

The 19th century campaign to establish "hard" sciences as superior to humanities was not a natural evolution but a deliberate project, driven by advocacy journalism and institutional restructuring rather than scientific consensus. When C.P. Snow delivered his famous "Two Cultures" lecture in 1959, he wasn't lamenting a regrettable division between scientists and literary scholars. He was arguing that technological and scientific knowledge should dominate education and policy, scolding those who questioned whether such knowledge alone was sufficient for human flourishing.

By the mid-20th century, this institutional split had become complete. Universities organized into separate colleges of sciences and humanities, funding agencies prioritized quantifiable research over qualitative inquiry, and "scientific" became synonymous with "legitimate" across vast domains of culture. The mechanistic worldview became self-perpetuating—not because it had proven adequate to explain consciousness or meaning, but because institutions had been restructured to favor only the kinds of questions it could answer.

The question facing us is not which metaphysical account is true—an impossible determination—but which framework helps us engage most fully and responsibly with reality as we encounter it. This 'living as if' approach will guide our inquiry throughout. We will explore continuum frameworks not as revealed truth but as working hypotheses, evaluating them by their consequences for understanding consciousness, recognizing diverse minds, addressing the meaning crisis, and guiding ethical action. The test is pragmatic: Does this framework allow richer engagement with evidence? Does it generate productive research? Does it lead to better outcomes for human and planetary flourishing? These are the questions we can meaningfully ask and attempt to answer.

To see why this approach matters, consider the world we inherited: a cosmos understood through mathematical laws but stripped of meaning and purpose, with consciousness relegated to an uncomfortable anomaly that neither fits the framework nor can be ignored. The institutional structures that elevated and sustain this worldview persist even as its inadequacies become increasingly apparent. The spectacular success of physics in its proper domain—closed, reversible systems amenable to mathematical description—has been mistaken for a universal means of achieving knowledge about everything.

The costs of this overreach and entrenchment are profound. The immense spectrum of consciousness has been excluded, meaning has been dismissed, and the humanities marginalized—these are not abstract philosophical problems but lived realities that manifest throughout contemporary culture. Understanding those costs, and why they demand a response, is where our story turns next.