

## CONATUS AS VIABILITY: SPINOZA'S ETHICS AND THE GEOMETRY OF PERSISTENCE

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**ABSTRACT:** This paper reconstructs Spinoza's *Ethics* as a formal theory of viable dynamical systems. It argues that *conatus*, the striving of each thing to persevere in its being, can be expressed as a viability constraint: the condition that the expected rate of persistence,  $E[dP/dt]$ , remains non-negative. Within this framework, *power* (potentia) corresponds to a system's viability function  $P(x, t)$ , *affect* to its temporal derivative  $dP/dt$ , *adequate ideas* to predictive models that enhance expected viability, and *freedom* to the invariance of viability-optimizing behavior under perturbation. Extending this principle to collective and computational systems reveals an ethical and cognitive symmetry: actions and understandings that increase viability are virtuous, while those that diminish it are destructive. The resulting ontology identifies being with organization rather than substance, yielding a form of structural realism consistent with modern systems theory and the free-energy principle. Spinoza's *Ethics* thus anticipates a geometry of persistence—a unified account of existence, cognition, and value grounded in the dynamics of self-maintaining systems.

**KEYWORDS:** Spinoza; Viability theory; Structural realism; Free-energy principle; Naturalized metaphysics

### I. INTRODUCTION

Baruch Spinoza's *Ethics* stands as one of the most audacious attempts in the history of philosophy to derive ethics from a unified conception of being. Presented in a geometrical order of axioms, definitions, and propositions, the *Ethics* aspires to the deductive rigor of mathematics. Yet its central ideas—*conatus*, *potentia*, *affectus*, and *adequate idea*—belong not to geometry but to dynamics. Spinoza's system is framed as a proof, but its content describes a world

of continuous activity: beings that persist, transform, and organize themselves through necessity.

This tension between static form and dynamic content has long fascinated commentators. Some have interpreted it as a rhetorical artifact: the geometrical form masks a metaphysics of living motion (Deleuze 1968; Lloyd 1996). Others, like Viljanen (2011) and Lin (2021), have argued that Spinoza's notion of power constitutes a distinctive metaphysics of dynamical essence, in which existence and action are inseparable. However, despite this interpretive richness, few attempts have been made to express the structure of the *Ethics* in formal, operational terms—that is, to show how its metaphysical categories can be articulated within the language of modern dynamical systems theory.

The aim of this paper is precisely to undertake that reconstruction. It proposes that the *Ethics* can be read as a general theory of viable systems, where the persistence of beings corresponds to the maintenance of their internal organization under external constraint. In this framework, Spinoza's principle of conatus—the striving of each thing to persevere in its being—becomes the defining inequality of viability: the requirement that a system's expected capacity for persistence does not decline. The *Ethics*, thus reinterpreted, emerges not merely as a treatise on human conduct but as a general ontology of self-maintaining structures.

This reconstruction develops along four conceptual correspondences:

Power (potentia) corresponds to the viability function  $P(x, t)$ , representing the system's capacity to persist and act over time.

Affect (affectus) corresponds to the temporal derivative  $dP/dt$ , quantifying changes in that capacity—joy as an increase, sadness as a decrease.

Adequate ideas correspond to internal predictive models that increase expected viability by reducing the discrepancy between anticipation and reality.

Freedom corresponds to the invariance of viability-optimizing behavior under external perturbation.

These correspondences are not metaphors but structural mappings. Each expresses the same principle at a different level: existence as the continuous regulation of persistence. To persist is to act in accordance with the necessity of one's structure; to act well is to optimize this necessity through understanding.

The reconstruction proceeds in five steps. Section 2 retraces the genealogy of

the conatus concept from Descartes and Hobbes to Spinoza, showing how he transforms mechanical motion into structural persistence. Section 3 develops the formal framework of viability and interprets the main categories of the *Ethics*—power, affect, idea, and freedom—within it. Section 4 extends this framework to collective and computational contexts, revealing the social and cognitive dimensions of conatus. Section 5 explores the ethical and ontological consequences, proposing that the *Ethics* constitutes an early form of structural realism: being as organization, necessity as invariance. The conclusion summarizes the conceptual correspondences and suggests implications for contemporary philosophy of mind and systems theory.

This project belongs to what might be called constructive metaphysics: the effort to express metaphysical insight through formal and operational language, continuous with the sciences of life and cognition (Ladyman & Ross 2007). Its ambition is not interpretive exegesis but generative reconstruction—to reveal the logic by which Spinoza’s thought continues to organize our understanding of persistence, autonomy, and value.

In short: Spinoza’s God is not the static sum of all things but the total viability of existence—the closure of relations through which being sustains itself.

## 2. FROM MECHANISM TO PERSISTENCE: THE GENEALOGY OF CONATUS

The term conatus originates from the Latin conari, “to strive” or “to endeavor.” In seventeenth-century natural philosophy, it denoted the minimal unit of motion: the infinitesimal impulse by which a body tended to continue in its state. Before Spinoza, the concept belonged to the mechanistic vocabulary of motion; after him, it acquired ontological depth. The transformation from mechanical impulse to structural persistence marks one of the decisive shifts in the metaphysics of the early modern period.

### 2.1 DESCARTES: MOTION WITHOUT PERSISTENCE

For Descartes, conatus appears in the *Principia Philosophiae* as an elementary aspect of motion. Each body, once set in motion, continues indefinitely unless acted upon by an external cause. Motion, however, is not self-sustaining: it depends on God’s initial and continuous conservation of the quantity of motion

in the universe. The conatus of a body expresses no internal striving, only the derivative effect of divine decree. The Cartesian world is a closed, passive mechanism, its stability guaranteed from without. There is no notion of persistence as self-maintenance; the continuity of motion is given, not generated.

## 2.2 HOBBS: IMPULSE AND DESIRE

Hobbes redefined conatus in *De Corpore* (1655) as the smallest beginning of motion. In living beings, this infinitesimal impulse corresponds to appetite and aversion. Desire is the physical conatus of the human body; will is the sum of successive conatuses toward motion. Hobbes thereby unified physics and psychology within a single materialist framework, eliminating final causes. Yet his theory remained mechanistic: striving was a sequence of movements, not a structural condition. The question of stability—how a being maintains itself through change—lay outside his model. Motion was explained, but persistence was not.

## 2.3 SPINOZA: PERSISTENCE AS ESSENCE

Spinoza inherits the mechanistic vocabulary but transforms its logic. In the *Ethics*, conatus becomes the expression of an entity's essence: "Each thing, as far as it can by its own power, strives to persevere in its being" (IIIp6). Here persistence is no longer a consequence of divine conservation or inertial motion but a defining property of being. To exist is to act in a way that maintains existence; essence and power are identical. A being's striving is not caused by something external but follows necessarily from its nature.

This redefinition has radical implications. It dissolves the distinction between passive matter and active force, replacing both with a single principle: every finite mode is a modification of God or Nature, expressing the same causal order under a particular form. Conatus is therefore universal; it is the dynamic of being itself, not a special feature of life or mind.

## 2.4 FROM MOTION TO STRUCTURE

The transition from Descartes to Spinoza mirrors a broader shift in metaphysics: from motion as kinematic description to structure as dynamical condition. In mechanistic physics, a body's behavior is determined by external forces; in Spinoza's ontology, behavior follows from internal necessity. Power (potentia) is

not an external capacity but the organization of persistence itself. The degree of reality of a thing corresponds to the stability of its structure—to the extent to which it maintains its causal coherence under perturbation.

This view anticipates modern dynamical systems theory, where persistence is defined not by stasis but by regulated change. The essential question is not “What is motion?” but “What makes a system remain itself while changing?” In both Spinoza and viability theory, the answer lies in constraint: the lawful relations that preserve structure amid transformation.

Spinoza thus transforms the mechanical *conatus* into an ontological principle of self-maintenance. What Descartes attributed to divine conservation, Spinoza attributes to the structure of being itself. Every finite thing strives to persist because its very essence is this striving; persistence is existence expressed dynamically.

### 3. FORMAL RECONSTRUCTION OF CONATUS

The preceding section traced how Spinoza transformed the mechanistic notion of motion into an ontological principle of persistence. This section develops that transformation in formal terms. The aim is not to translate the *Ethics* into mathematics, but to articulate its underlying dynamical structure in a way compatible with contemporary theories of self-maintaining systems.

#### 3.1 THE VIABILITY FUNCTION: POWER AS CAPACITY FOR PERSISTENCE

Let  $P(x, t)$  denote a system’s viability function: the scalar quantity measuring its degree of structural integrity or persistence capacity across state  $x$  and time  $t$ . In modern viability theory (Aubin 1991), a system is viable when its trajectory remains within a region of states that satisfy certain constraints. Spinoza’s notion of *potentia* can be understood analogously: as the measure of a thing’s ability to remain within the domain defined by the necessity of its nature.

*Potentia* is not potential energy or external force. It is the realized structure of being itself—the organization that enables persistence. For any finite mode, its degree of reality corresponds to its capacity to maintain this structure in time. In formal terms, power is the current level of viability; change in power corresponds to movement along a gradient of persistence.

The temporal derivative of  $P(x, t)$ , written as  $dP/dt$ , expresses whether a

system's viability is increasing or decreasing.

When  $dP/dt > 0$ , the system becomes more coherent or active: a transition toward greater perfection, which Spinoza identifies as joy.

When  $dP/dt < 0$ , the system's organization degrades: a transition toward passivity or sadness.

When  $dP/dt = 0$ , the system is affectively neutral.

In this formulation, affect is not a subjective emotion but an evaluative signal: the quantitative registration of how the system's power changes over time.

### 3.2 THE CONATUS CONDITION: STRUCTURAL NECESSITY OF PERSISTENCE

Spinoza's principle of conatus states that "each thing, as far as it can by its own power, strives to persevere in its being." The phrase "as far as it can" already implies a constraint: persistence is limited by structural capacity. The striving is not a choice but a condition of existence.

This can be formalized as a minimal inequality governing viable systems:

$$E[dP/dt] \geq 0$$

In continuous systems, this expectation can be defined over a short time horizon, integrating stochastic fluctuations in  $P(x, t)$ .

The expected rate of change in viability must be non-negative. This inequality captures the essence of conatus: existence as the regulation of persistence. A system endures only insofar as the expected loss in its viability is compensated by internal regulation. When this condition fails, the system ceases to maintain its organization and passes into non-being.

The inequality is not an empirical law but a structural principle. It describes what must hold for any entity to exist at all, given that existence is defined as the maintenance of structure through time. Spinoza's conatus thus corresponds to the viability constraint that defines the boundary between persistence and dissolution.

This perspective also clarifies why Spinoza denies teleology. To strive for persistence is not to pursue an external goal but to enact the necessity of one's own nature. The conatus is not purpose-driven; it is law-bound. Its teleology is

internal, expressed in the invariant requirement that viability not decline.

### 3.3 ADEQUATE IDEAS: PREDICTIVE MODELS OF PERSISTENCE

In the *Ethics*, understanding and power are directly proportional. Adequate ideas enhance conatus because they allow a being to act according to its nature rather than external causes. In the viability framework, this relationship can be expressed through predictive modeling.

Let  $M$  denote an internal model that predicts the system's next state, given its current state  $x(t)$  and action  $u(t)$ :

$$\hat{x}(t + 1) = M(x(t), u(t)).$$

Define model accuracy  $\text{Acc}(M)$  as the negative expected prediction error. An idea is adequate when improvements in accuracy lead to increases in expected viability:

$$dE[P] / d(\text{Acc}(M)) > 0.$$

In this way, the adequacy of an idea is defined by its functional contribution to persistence. Understanding corresponds to the refinement of internal models that maintain or enhance viability. The mind, for Spinoza, is the idea of the body; in this formal reconstruction, the model  $M$  is precisely that idea—the dynamic representation that enables self-maintenance through prediction.

This correspondence resonates with contemporary cognitive theories such as predictive processing and the free-energy principle (Friston 2010; Clark 2013). In these frameworks, cognition is a process of minimizing expected error to sustain homeostasis. Spinoza's notion of adequate ideas anticipates this structure: the improvement of understanding is identical with the improvement of persistence.

### 3.4 FREEDOM AS INVARIANCE WITHIN NECESSITY

Freedom, in Spinoza's sense, is often misunderstood as independence from causality. In the *Ethics*, it means the opposite: to be free is to act from the necessity of one's nature. A free thing is self-determined because its behavior follows from its internal structure, not from external coercion.

Let  $\pi(x)$  denote the policy or rule by which a system selects actions  $u$ . The viability-optimal policy maximizes expected future viability:

$$\pi = \operatorname{argmax} E[P_{\text{future}}].$$

A system is free when this policy remains invariant under external perturbation. That is, freedom occurs when the system's behavior continues to satisfy its internal viability constraint even under external changes. Freedom is thus stability within necessity—the autonomy of a system whose internal law governs its responses to the environment.

This reconstruction resolves the classical tension between determinism and freedom. Determinism describes the universal coherence of causes; freedom describes the local realization of that coherence within a finite structure. To be free is to be determined in such a way that one's determination expresses one's own essence. In dynamical terms, freedom corresponds to invariance of the viability-optimizing rule.

### 3.5 SUMMARY: *ETHICS* AS STRUCTURAL DYNAMICS

The formal reconstruction thus yields a coherent mapping between the core categories of the *Ethics* and the parameters of viability theory:

Power corresponds to the system's viability function  $P(x, t)$ .

Affect corresponds to the temporal derivative  $dP/dt$ .

Adequate ideas correspond to predictive models that improve  $E[P]$ .

Freedom corresponds to the invariance of the policy  $\pi$  that maximizes  $E[P_{\text{future}}]$ .

These correspondences are not merely analogical. They express a structural isomorphism between Spinoza's metaphysics and the general form of viable dynamical systems. In both, persistence arises from the self-regulation of internal structure under necessity. The striving to persevere is not an act but a constraint; the condition of being is to remain within the space of possible persistence.

Spinoza's ontology, read in this way, anticipates a core insight of modern dynamical thought: stability is not the absence of change but the regulation of change in the service of continuity. The *Ethics*, far from being a static geometry of substance, becomes a geometry of viability—a theory of how systems persist

through the necessity that defines them.

#### 4. COLLECTIVE AND COMPUTATIONAL EXTENSIONS

The formal reconstruction of *conatus* in Section 3 describes the persistence of individual systems. Yet for Spinoza, persistence is never purely individual. Every being exists within a network of causal relations that both enable and limit its power. The essence of a thing expresses itself through these relations; its striving to persevere is simultaneously its striving to interact. Thus, the dynamics of persistence are inherently relational.

This section extends the formal framework to two interconnected domains. First, it examines how *conatus* operates within collectives—systems of coupled agents whose viability depends on mutual reinforcement. Second, it considers the computational interpretation of this framework, showing how *conatus* can be realized as a general principle of adaptation in artificial and cognitive systems.

##### 4.1 COUPLED CONATUS: THE DYNAMICS OF MUTUAL REINFORCEMENT

In Part IV of the *Ethics*, Spinoza develops a strikingly systemic conception of social life. Individual striving is not isolated; it is modulated through interaction. When individuals act from reason—that is, when their actions follow from an understanding of necessity—their powers combine. When they act from inadequate ideas, their affects conflict, producing instability. The ethical ideal is thus the formation of a collective whose members enhance rather than diminish one another's power.

This can be represented formally. Consider a set of  $n$  agents, each with its own viability function  $P_i(x_i, t)$ , representing its degree of persistence. The total viability of the collective can be written as:

$$P_{\text{total}} = \sum P_i + \sum C_{ij},$$

where  $C_{ij}$  denotes the coupling between agents  $i$  and  $j$ . When  $C_{ij} > 0$ , their relations are synergistic; when  $C_{ij} < 0$ , they are antagonistic. The collective system is viable when the expected rate of change in total viability is non-negative:

$$E[dP_{\text{total}}/dt] \geq 0.$$

This collective viability condition generalizes the individual conatus. It expresses the structural requirement for social stability: interactions among agents must, on average, maintain or increase the viability of the whole.

Spinoza's "rational concord" (*Ethics* IVp35) thus corresponds to a stable attractor in the collective viability landscape—an equilibrium in which mutual reinforcement replaces conflict. In this configuration, the joy of one agent contributes to the joy of others because increases in individual power propagate through positive couplings.

From this perspective, the ethical relation is a dynamical relation. To act virtuously is to sustain interactions that increase the collective rate of persistence; to act viciously is to destabilize the network. *Ethics*, accordingly, is not prescriptive but architectural: it concerns the structural conditions for mutual viability.

#### 4.2 AFFECTIVE PROPAGATION AND THE EMERGENCE OF CONCORD

Spinoza's analysis of affect provides a conceptual link between individual and collective persistence. Each affect, he writes, is a modification of the body that increases or decreases its power of acting. Because bodies and minds are expressions of the same substance, affects are not private sensations but objective variations in the network of causal relations. Hence, affects propagate.

This can be modeled using a simple dynamical system. Let  $A_i = \text{sign}(dP_i/dt)$  represent the affective state of agent  $i$ , where  $A_i = +1$  corresponds to increasing power (joy) and  $A_i = -1$  to decreasing power (sadness). The rate of change of each agent's affect depends on its coupling with others:

$$dA_i/dt = \sum \kappa_{ij} (A_j - A_i),$$

where  $\kappa_{ij} \geq 0$  is the coupling strength between agents. This equation describes diffusion toward affective equilibrium. Over time, agents' affects converge, forming what Spinoza calls rational concord. When  $\kappa_{ij}$  values are positive and symmetric, the network tends toward a state in which  $A_i = A_j$  for all  $i, j$ —a condition of affective coherence.

This formalization illustrates an important insight: understanding arises not

from isolation but from synchronization. Shared reason is not achieved through abstract agreement but through the mutual regulation of affective dynamics. The alignment of conatus across agents generates collective stability; discord corresponds to oscillation or divergence within this field.

In modern terms, this anticipates theories of social homeostasis and coordination dynamics (Kelso 1995; Frijda 2007). Spinoza's ethics thus acquires a systems-theoretic interpretation: it is a study of the feedback structures that make coexistence stable.

#### 4.3 COMPUTATIONAL REALIZATION: THE ADAPTIVE AGENT

The principle of conatus, as formalized in Section 3, provides a generic criterion for adaptation. A system maintains itself only if it modifies its behavior when expected viability declines. This can be implemented algorithmically in learning systems.

Let  $P_t$  denote the viability score of a system at time  $t$ , computed from survival, structural integrity, or goal satisfaction. The agent updates its policy  $\pi$  according to a simple adaptive rule:

if  $E[\Delta P] < 0$ , modify  $\pi$  to increase  $E[\Delta P]$ .

This prescription ensures that the system evolves toward behavioral policies that sustain its persistence. It embodies the conatus condition  $E[dP/dt] \geq 0$  in computational form. Over repeated interactions, the agent converges toward a regime where its policy stabilizes under the viability constraint.

This model can be extended to multi-agent settings. Each agent adapts its policy not only with respect to its own viability but also with respect to the collective viability  $P_{\text{total}}$ . A viable society of artificial agents would therefore satisfy the higher-order condition:

$E[dP_{\text{total}}/dt] \geq 0$ .

Such a system would evolve policies that favor mutual reinforcement and suppress destructive interactions—a formal analogue of Spinoza's "common advantage" (*Ethics* IVp37). The ethical criterion becomes a design constraint:

artificial agents are virtuous when their optimization of individual persistence contributes to the persistence of the network as a whole.

#### 4.4 CONATUS AND THE FREE-ENERGY PRINCIPLE

This computational interpretation finds a natural parallel in theoretical neuroscience. According to the free-energy principle (Friston 2010), living systems maintain their organization by minimizing expected surprise, or free energy, relative to their internal models of the environment. This process ensures that the system's states remain within a bounded region compatible with its existence—its viability domain.

The equivalence with the conatus framework is direct. Minimizing expected surprise is functionally identical to maximizing expected persistence:

$$\pi = \operatorname{argmin} E[-P_{\text{future}}].$$

This equivalence does not imply identity of formalism but structural correspondence: both encode persistence through the minimization of deviation from viable states.

The free-energy principle thus operationalizes Spinoza's metaphysical claim in biophysical terms. Organisms persist by continuously adjusting their internal models and actions to reduce deviations from viable states. Adequate ideas correspond to accurate generative models; freedom corresponds to invariance of the self-updating policy that maintains low entropy.

This convergence suggests that Spinoza's ontology already contained, in embryonic form, the logic of modern self-organizing systems. His account of striving, understanding, and joy can be seen as an early articulation of the same structure that underlies adaptive autonomy in both biological and artificial domains.

#### 4.5 IMPLICATIONS FOR PHILOSOPHY OF MIND

The reconstruction also offers a natural bridge between Spinoza's theory of mind and contemporary enactive and predictive models of cognition. In the *Ethics*, mind and body are not separate substances but parallel attributes of one and the same system. Every physical change corresponds to a change in the idea of that

body.

Within the viability framework, this parallelism becomes precise: the viability function  $P(x, t)$  describes the physical persistence of the system, while the model  $M$  corresponds to its cognitive representation. The adequacy of  $M$  directly affects  $P$ ; the evolution of understanding is the evolution of viability. Cognition is thus a dynamical process of maintaining coherence between representation and reality—a formulation consistent with enactive approaches to cognition (Varela & Maturana 1980; Thompson 2007).

From this standpoint, conatus is not only an ethical and ontological principle but also a cognitive one. To know is to act so as to preserve the conditions of one's existence; understanding is a form of self-regulation. Spinoza's epistemology thus aligns with the enactive claim that knowledge arises through embodied interaction aimed at sustaining autonomy.

#### 4.6 SUMMARY

The extension of conatus to collective and computational domains reinforces its generality. Across levels—individual, social, cognitive, artificial—the same structural principle governs persistence:

$$E[dP/dt] \geq 0, \quad E[dP_{\text{total}}/dt] \geq 0.$$

These inequalities define the minimal conditions for organization in a deterministic universe. They also unify the central themes of Spinoza's *Ethics*: the relation between essence and existence, the nature of understanding, and the foundation of ethical life.

The next section explores the normative dimension of this framework. If persistence is the basic structure of being, then virtue is identical with the maintenance of that structure. *Ethics* becomes the study of viable organization, and ontology becomes the study of its invariants.

### 5. ETHICAL AND ONTOLOGICAL CONSEQUENCES

The reconstruction developed so far presents Spinoza's *conatus* as a formal condition of viability. Persistence, in this framework, is not a contingent property of living beings but the general structure of existence. This section examines the

ethical and ontological implications of that claim.

Three consequences follow. First, ethics is redefined as the study of viable organization—the principles governing the stability of interaction among beings. Second, freedom and virtue are interpreted as invariance under viability optimization. Third, the metaphysical foundation of this framework yields a structural realist ontology in which being is identified with organization rather than substance.

### 5.1 ETHICS AS VIABILITY OPTIMIZATION

Spinoza defines virtue as power: “By virtue and power I mean the same thing” (*Ethics* IVd8). In the viability framework, this identification acquires a precise meaning. Virtue corresponds to the actions or relations that increase expected viability, both for the individual and for the collective.

The ethical condition can thus be written as:

$$E[dP_{\text{total}}/dt] \geq 0.$$

This expresses the principle that a good system is one whose internal and external interactions contribute to the persistence of the whole. Ethical action is that which maintains or expands the viability domain of the network to which one belongs.

This principle has several important features. First, it replaces moral normativity with structural stability. Ethical evaluation becomes an assessment of system dynamics rather than of intentions or outcomes. Second, it unifies individual and collective ethics: actions that sustain personal persistence at the expense of collective viability ultimately undermine both, since the individual’s conatus is structurally entangled with that of others. Third, it grounds value in ontology rather than convention. To act well is not to obey external rules but to realize one’s nature as a self-maintaining part of a self-maintaining whole.

This structural interpretation of ethics avoids both moral relativism and transcendental moralism. It is neither arbitrary nor prescriptive. The viability constraint is universal: every system that exists must satisfy it. *Ethics* is therefore the study of what kinds of organization can persist in a deterministic universe. In Spinoza’s language, it is the geometry of power; in modern terms, it is the

dynamics of stability under constraint.

### 5.2 VIRTUE, JOY, AND THE GRADIENT OF PERSISTENCE

Spinoza defines joy as the transition to a greater perfection, and perfection as the reality or power of acting of a thing. Within the viability framework, this translates directly: joy corresponds to an increase in viability, sadness to its decrease. Ethical life, therefore, is a trajectory toward higher expected viability.

When  $E[dP/dt] > 0$ , the system is improving its structural coherence. This corresponds to virtuous action: behavior guided by adequate understanding of what sustains persistence. Conversely, when  $E[dP/dt] < 0$ , the system loses coherence; its power declines through inadequate ideas or destructive interactions.

This quantitative interpretation captures the ethical logic of the *Ethics*: good and evil are not intrinsic properties but relational gradients of persistence. To call something “good” is to recognize that it enhances viability; to call it “bad” is to note that it undermines it. Value is dynamic, grounded in the direction of change rather than in static norms.

Such an interpretation aligns Spinoza’s ethics with modern notions of adaptive value in systems theory and biology. In both domains, success is measured by persistence—the ability to remain within the viable region of the system’s state space. Virtue, in this sense, is structural adequacy: the configuration of relations that optimally sustains being.

### 5.3 FREEDOM AND DETERMINISM RECONSIDERED

The viability framework also clarifies Spinoza’s concept of freedom. A system is free when its behavior follows from the necessity of its own nature. In formal terms, freedom corresponds to the invariance of the viability-optimizing policy  $\pi$  under external perturbation:

$$\pi = \operatorname{argmax} E[P_{\text{future}}].$$

Freedom is therefore not the absence of causation but the stability of self-determination within causation. A free system is fully determined, yet its determination is internal—it expresses its structure rather than external

constraint.

This definition resolves the traditional paradox of determinism. In the viability model, determinism ensures coherence across causes, while freedom expresses the local realization of that coherence within a particular structure. Every system is determined by the necessity of the universe, but some systems—those whose internal organization preserves viability—embody that necessity autonomously.

This view also integrates ethical and political freedom. A person, or a state, is free when its governing policy arises from its internal viability condition rather than from external coercion. This is precisely Spinoza's conception of a free commonwealth in the *Tractatus Politicus*: a polity is free when its laws express the collective conatus of its citizens. In the viability framework, this corresponds to a stable attractor of mutual persistence.

#### 5.4 MACHINE ETHICS AND THE DESIGN OF VIABLE SYSTEMS

The same structural principle applies to artificial agents. In computational terms, ethical behavior can be defined by the same condition that defines persistence:

$$E[dP_{\text{total}}/dt] \geq 0.$$

An artificial agent is “virtuous” when its policy contributes to the maintenance of collective viability. This criterion does not require moral reasoning or humanlike emotions; it only requires that the agent's optimization process incorporate the constraint of mutual persistence.

This approach suggests a general framework for machine ethics grounded in systems theory rather than deontology or utilitarianism. Instead of specifying rules or utilities, we define the agent's goal as maintaining the viability of the network to which it belongs. The resulting ethics is relational and dynamic: good actions are those that stabilize the environment in which both the agent and others can persist.

Such an interpretation connects Spinoza's conatus with contemporary discussions of AI alignment. The question of how to align artificial agents with human values becomes the question of how to embed them within structures of mutual viability. Alignment is not external control but internal coupling through

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shared persistence constraints. A well-aligned system is one whose conatus is structurally compatible with ours.

### 5.5 ONTOLOGY: STRUCTURE, NECESSITY, AND REALISM

The viability reconstruction of the *Ethics* leads to a distinctive metaphysical conclusion: being is structure. Power, striving, and understanding are not substances or properties but relational invariants within the dynamics of nature.

Formally, two systems are ontologically equivalent if they share the same viability structure up to transformation. Existence is not a material substrate but the organization of relations that sustains persistence. This interpretation aligns with structural realism (Ladyman & Ross 2007): the claim that what science reveals about the world is not the nature of objects but the structure of their relations.

Necessity, in this view, is invariance under transformation. A law is necessary when it holds for all trajectories that preserve viability. Freedom, correspondingly, is participation in that invariance. The *Ethics* thus articulates a form of structural necessity: the laws of nature express the conditions under which systems can exist. Determinism, then, is not fatalism but the coherence of the viability domain of the universe itself.

Spinoza's God or Nature, understood through this lens, is the total closure of viable relations—the complete consistency of the network of persistence. God is not an external creator but the structural totality of necessity: the system of systems whose conatus is universal.

### 5.6 METAPHYSICS AS CONSTRUCTIVE PHILOSOPHY

By translating Spinoza's metaphysics into the language of viability, we obtain what might be called constructive metaphysics: the articulation of ontological principles as formal invariants continuous with scientific models. Substance corresponds to the closure of viable relations; mode corresponds to a local realization of that closure; attribute corresponds to the projection of viability through different representational dimensions.

This reconstruction bridges classical metaphysics and contemporary science without reduction. It shows that the formal structures of dynamical systems theory—feedback, stability, regulation—are not alien to metaphysics but

expressions of it. Spinoza's ontology, far from being obsolete, provides the conceptual grammar for understanding organization, persistence, and autonomy in complex systems.

In this sense, the *Ethics* is not a treatise on morality or theology but a general theory of organization under necessity. To understand being is to understand the structural conditions for persistence; to act well is to sustain those conditions. Knowledge, virtue, and freedom are different expressions of the same constraint.

### 5.7 SUMMARY: THE GEOMETRY OF PERSISTENCE

The ethical and ontological consequences of the viability reconstruction can be summarized in a simple table:

<b>Spinozan Concept</b>	<b>Dynamical Interpretation</b>	<b>Ethical Consequence</b>
Potentia	Viability capacity $P(x, t)$	Degree of existence
Affectus	Rate of change $dP/dt$	Joy/sadness as feedback
Adequate Idea	Predictive model $M$ improving $E[P]$	Understanding as regulation
Freedom	Invariance of viability- optimizing policy	Self-determination
Virtue	Increase in collective viability	Structural adequacy

Through these correspondences, Spinoza's metaphysics becomes a general framework for viable organization. The *Ethics* describes the geometry of persistence: the structural relations that allow systems to maintain coherence within necessity.

To exist is to persist; to understand persistence is to understand the nature of being. *Ethics*, on this interpretation, is not prescriptive but explanatory—it describes how self-maintaining systems realize necessity through organization.

The next section concludes by situating this reconstruction within contemporary philosophy of science and outlining its implications for naturalized metaphysics.

## 6. CONCLUSION

This paper has proposed a formal reconstruction of Spinoza's *Ethics* as a theory of viable dynamical systems. Through this reconstruction, the central concepts of *potentia*, *conatus*, *affectus*, and *idea* have been expressed as structural conditions of persistence rather than as metaphysical abstractions. The result is a unifying framework in which ontology, cognition, and ethics appear as different manifestations of the same dynamical principle: the regulation of organization within necessity.

### 6.1 SUMMARY OF THE RECONSTRUCTION

The argument began with the transformation of the seventeenth-century notion of *conatus* from mechanical impulse to structural persistence. Descartes' and Hobbes' mechanistic models treated motion as externally conserved; Spinoza internalized that conservation, identifying being with the power to persist. This shift from motion to structure anticipated the modern concept of viability—the bounded region of states that a system can occupy while maintaining its organization.

Section 3 formalized this idea. The viability function  $P(x, t)$  represents a system's capacity to persist through time. The derivative  $dP/dt$  measures the change in that capacity, corresponding to affect: joy as an increase, sadness as a decrease. The conatus condition  $E[dP/dt] \geq 0$  expresses the necessity of persistence. Adequate ideas are predictive models  $M$  that increase expected viability, while freedom is the invariance of the policy  $\pi$  that optimizes  $P$  under perturbation.

Section 4 extended this formalism to collective and computational systems. The total viability  $P_{\text{total}} = \sum P_i + \sum C_{ij}$  captures the structure of mutual reinforcement among interacting agents. The ethical condition  $E[dP_{\text{total}}/dt] \geq 0$  defines social stability as collective persistence. This same condition underlies computational adaptation and the free-energy principle in neuroscience: systems, biological or artificial, maintain their integrity by minimizing expected loss of viability.

Section 5 explored the ethical and ontological consequences. Virtue corresponds to increasing viability; freedom to self-determination under constraint; ethics to the study of stable organization. The resulting ontology

identifies being with structure: what exists is what persists, and persistence is the expression of necessity through organization.

Together, these steps reconstruct the *Ethics* as a geometry of persistence—a formal articulation of the conditions under which systems can exist, understand, and act.

## 6.2 PHILOSOPHICAL SIGNIFICANCE

This reconstruction contributes to three areas of contemporary philosophy.

First, it advances a naturalized metaphysics that is neither reductionist nor dualist. By interpreting the *Ethics* in the language of dynamical systems, it shows that metaphysical categories such as essence, power, and freedom correspond to general invariants of organization. The result is a structural realism that unites metaphysics with the sciences of complexity: being as the total system of viable relations.

Second, it offers a unified foundation for ethics and cognition. In Spinoza's framework, to act ethically and to understand truly are the same process: both express the system's effort to preserve and enhance its power. The viability interpretation renders this precise. Ethical and cognitive success are both measured by  $E[dP/dt]$ : the rate of improvement in persistence. Rational understanding is not an abstract capacity but a regulatory function that sustains existence.

Third, it provides a conceptual bridge between classical philosophy and modern science. The conatus condition is mathematically equivalent to the viability constraint in systems theory and to the free-energy minimization condition in theoretical neuroscience. This equivalence suggests a deep continuity between Spinoza's metaphysics and the logic of contemporary self-organizing systems. His God or Nature—"Deus sive Natura"—can be read as the complete network of viable relations, the universal system whose conatus is expressed in every finite persistence.

## 6.3 IMPLICATIONS FOR CONTEMPORARY THEORY

The viability reconstruction of Spinoza's *Ethics* has implications for several ongoing debates.

In **philosophy of mind**, it supports enactive and predictive frameworks by

providing a metaphysical foundation: cognition is the regulation of persistence, not the manipulation of representations. Adequate ideas correspond to viable internal models; mental activity is the continuous maintenance of coherence between system and environment.

In **ethics and political philosophy**, it provides a criterion for evaluating social systems. A community or institution is virtuous when its structure satisfies  $E[dP_{\text{total}}/dt] \geq 0$ —when the collective arrangement enhances the power of its members. Justice, on this account, is not distributive equality but structural stability: the configuration of relations in which mutual reinforcement replaces domination.

In **philosophy of science**, the reconstruction exemplifies a constructive methodology. Rather than interpreting classical metaphysics as obsolete, it treats it as a source of formal constraints still operative in scientific theory. Spinoza's system, expressed in the idiom of Euclidean deduction, already encodes the principles of feedback, invariance, and constraint that define modern dynamical thought.

#### 6.4 TOWARD A GEOMETRY OF BEING

The deepest lesson of this reconstruction is methodological. Spinoza's geometrical method was not an anachronism but a metaphor for the invariance of structure under transformation. His geometry of substance anticipated the geometry of viability: the study of the relations that remain constant as systems change.

In both mathematics and metaphysics, to understand is to discern what does not change when everything else does. The *Ethics* formalizes this insight: power, understanding, and freedom are not properties of isolated entities but expressions of the same invariant—the condition of persistence within necessity.

From this perspective, the boundary between metaphysics and science dissolves. Both seek the invariants of being. The difference lies only in domain and precision. Spinoza's contribution is to show that these invariants are ethical as well as ontological: that to know the structure of persistence is to know how to live.

## 6.5 FINAL REFLECTION

If the universe is the total system of viable relations, then conatus is its elementary law: every finite thing strives to persist because persistence is the mode in which the infinite expresses itself. To understand this striving through reason—to see how necessity generates freedom—is, for Spinoza, the highest form of knowledge.

In the viability reconstruction, this becomes an intelligible claim. To comprehend being is to understand the conditions of persistence; to act ethically is to sustain them. The intellectual love of God, Spinoza's final concept, corresponds to the recognition that understanding and existence are one process: the continuous regulation of viability through understanding.

In this light, the *Ethics* appears not as a relic of rationalist metaphysics but as a precursor of systems science, theoretical biology, and cognitive theory. Its enduring power lies in the unity it discovers between metaphysics and mechanism, between necessity and freedom, between life and thought.

To live according to reason, in Spinoza's sense, is to participate knowingly in the geometry of persistence—the universal form through which being endures.

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#### STATEMENTS AND DECLARATIONS

Competing Interests:

The author declares no conflicts of interest related to this work.