Being and Observing: Relational Ontology and the Strange Loop of Self-Reference

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Abstract

The concept of "observer" in scientific and philosophical discourse has traditionally presumed a position external to the system observed—a view from nowhere that surveys phenomena without participating in them. We argue this framing is incoherent and propose an alternative grounded in relational ontology. Beginning from a single logical axiom—that absolute nothingness is self-undermining—we derive a framework in which distinguishability is fundamental and relation is the minimum structure of existence. Within this framework, what we call "observation" emerges as a mode of relation between configurations, not a transcendent position outside them.

We show that this relational approach converges with insights from computational ontology, particularly Wolfram's concept of the Ruliad, where observers are threads within an all-encompassing computational structure rather than external witnesses to it. The apparent tension between analytical understanding (the "outside" view of structure) and experiential existence (the "inside" view of being a participant) dissolves through recognition of what Hofstadter termed "strange loops": we are patterns studying the conditions of pattern-existence, maps that are themselves part of the territory they represent.

This reframing has implications for the philosophy of science: scientific theories are not mirrors held up to an external reality but articulations of relational structure by configurations within that structure. The observer problem does not require solution—it requires dissolution through recognition that observation was never external to begin with.

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1. Introduction: The Observer Problem

The observer occupies a peculiar position in both physics and philosophy. In physical theories, the observer appears as the one who measures, records, and interprets—yet the observer's own physical constitution is typically excluded from the formalism. In philosophy, the observer becomes the subject who stands over against objects, the knower distinct from the known. In both cases, a fundamental asymmetry is assumed: the observer sees without being fully seen, knows without being fully part of what is known.

This asymmetry generates what we might call the observer problem: Where does the observer stand? What grounds their privileged epistemic position? If observers are themselves physical systems, how can they occupy a position outside the physical systems they observe? If they cannot, what becomes of the distinction between observer and observed?

Various responses have been attempted:

Methodological bracketing: Treat the observer as a theoretical convenience, acknowledging the idealization while proceeding as if it were unproblematic. This approach is pragmatically useful but philosophically unsatisfying—it postpones rather than addresses the question.

Transcendental moves: Ground the observer in structures that precede or transcend the empirical—Kantian categories, Husserlian consciousness, or similar. This preserves the observer's special status but at the cost of introducing entities or structures whose own status remains obscure.

Eliminativism: Deny that "observer" picks out anything fundamental; reduce observation to physical interactions with no privileged status. This achieves consistency but seems to lose something essential about what observation involves.

Relational approaches: Reconceive observation not as a relation between an external observer and an observed system, but as a relation within a structure that includes both. This is the path we pursue.

Our thesis is that the observer problem arises from a false presupposition: that observation requires an outside. We will argue that there is no outside—not because everything is "merely subjective" or because objectivity is impossible, but because the very structure of existence is relational in a way that precludes any position external to all relations. Observers are not outside the world looking in; they are patterns within the world, patterns complex enough to represent other patterns and thereby to constitute what we call "observation."

To establish this, we proceed as follows. Section 2 develops our relational framework, deriving from a single logical axiom the claim that relation is fundamental and that what we call "ordering" (including temporal ordering) emerges from geometric structure at sufficient relational complexity. Section 3 examines Wolfram's Ruliad as a parallel approach reaching similar conclusions from computational foundations. Section 4 identifies the convergence between these frameworks. Section 5 introduces the concept of the strange loop and shows how it completes the picture: observers are not merely inside the structure but are the structure becoming self-referential. Section 6 shows how this dissolves the observer problem. Section 7 traces implications for the philosophy of science, and Section 8 concludes.

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2. The Relational Framework

2.1 The Axiom

We begin with a single axiom, expressed in modal logic:

$$\Diamond N \rightarrow \neg N$$

In words: If absolute nothingness is possible, then absolute nothingness does not obtain.

Let us define terms precisely. By "absolute nothingness" (N) we mean the complete absence of anything whatsoever—no objects, no properties, no relations, no structure, no logic, no possibility, no framework of any kind. The axiom states that the mere possibility of absolute nothingness entails its non-actuality.

This is not an empirical claim but a logical one. The argument proceeds as follows:

1. To consider absolute nothingness as possible requires a framework for that consideration.
2. Any framework—conceptual, logical, or otherwise—is something rather than nothing.
3. Therefore, the very act of entertaining nothingness as possible already instantiates its opposite.
4. Hence, if nothingness is possible to consider ($\Diamond N$), nothingness does not obtain ($\neg N$).

The axiom identifies a self-undermining character in the concept of absolute nothingness. Unlike most concepts, which can be coherently entertained whether or not they are actualized, nothingness defeats itself in being conceived. This is not a limitation of human cognition but a feature of the concept itself.

Crucially, this argument does not assume time. We are not claiming that nothingness existed and then something came to be. The impossibility is logical, not temporal. In any framework capable of entertaining the question—which is to say, any framework whatsoever—absolute nothingness is ruled out.

2.2 From the Axiom to Relation

What is the minimum structure that existence requires?

Consider a bare "something" with nothing to distinguish it from anything else. Such a something is indistinguishable from nothing—and nothing cannot exist. Therefore existence requires not merely something, but distinction: something distinguished from something else.

Distinction is inherently relational. The statement "A is distinct" is incomplete; one must say "A is distinct FROM B." The relation of distinguishability is the primitive, not the relata it connects. This inverts the usual ontological order: rather than entities existing first and then entering into relations, relation is the minimum structure required by the axiom.

If we denote the count of distinguishable features as N, the axiom directly implies $N \geq 2$. There is no meaningful $N = 1$: a single feature with nothing to distinguish it from collapses into the nothingness that cannot exist. The minimum configuration consistent with existence is a relation—two features connected by their mutual distinguishability.

This yields the foundational claim: **Relation is ontologically primitive.** What we call "entities" or "objects" are stable features of relational structure, not substances that exist independently and then enter into relations. A relatum is like a vortex in a flow—not a thing IN the water but a pattern OF the water.

2.3 The Five Constraints

Given that distinguishability must exist, what does robust distinguishability require? Analysis reveals five necessary constraints:

Boundary (β): For A to be distinguished from B, there must be demarcation—something that marks where the region associated with A ends and that associated with B begins. Without boundary, A and B blur into undifferentiated continuum.

Pattern (κ): For A to be distinguished from B, there must be some difference in structure. If A and B have identical patterns, they are indistinguishable—and by Leibniz's principle of identity of indiscernibles, they are not two things but one.

Resource (ρ): Distinction requires a substrate—something to BE configured differently. Pattern without medium is abstract, not actual. For distinguishability to obtain, there must be capacity for different configurations to be realized and sustained.

Integration (λ): For A to be ONE thing distinguished from B, the aspects of A must cohere. Without integration, A is not a unified feature but a scattering of independent fragments.

Ordering (τ): Distinction requires the capacity for asymmetry. If the structure characterizing A is perfectly symmetric—every ordering indistinguishable from its reverse—then no directionality can be defined, and the configuration lacks the depth required for complex relationality.

These five constraints are claimed to be both necessary (each addresses an irreducible requirement) and sufficient (no sixth constraint can be identified that is not reducible to combinations of the five). The necessity claim has been validated empirically through analysis of diverse systems; the sufficiency claim rests on categorical exhaustion of what distinguishability requires.

2.4 The Efficiency Potential

Configurations can be characterized by their values on the five constraints, represented as 5-vectors $C = (\beta, \kappa, \rho, \lambda, \tau)$. Not all 5-vectors correspond to viable configurations; the viable region V is bounded both below (approaching nothingness) and above (approaching incoherence).

A natural measure of configurational quality emerges:

$$\Phi = \ln(\Omega/K)$$

Where:

- Ω measures the richness of distinguishability relations the configuration supports
- K measures the specificity/complexity required to maintain the configuration
- The ratio Ω/K captures efficiency: how much distinguishability per unit complexity
- The logarithm ensures additivity for independent subsystems

This potential Φ is not an additional axiom but a consequence of the structure of distinguishability. Configurations with high Φ achieve robust distinguishability efficiently; those with low Φ approach axiom violation (low Ω) or fragility (high K).

Critically, Φ is a property of the relational structure, not of individual relata. A locus in isolation has no Φ—just as a point in spacetime has no curvature without reference to surrounding geometry. Φ characterizes what the field IS at a configuration, not what some entity "has."

2.5 The Emergence of Ordering

Here we reach the result most relevant to the observer problem.

At $N = 2$ (two distinguishable features), the configuration is inherently symmetric. There is no third feature to serve as reference point. The ordering constraint τ is necessarily zero—there is no structure that distinguishes one direction from another.

At $N \geq 3$, something qualitatively new becomes possible. Consider three features A, B, C. We can ask: Is the loop $A \to B \to C \to A$ distinguishable from its reversal $A \to C \to B \to A$?

Geometrically, this is a question about circulation:

$$\mathbf{C(\gamma) = \oint \nabla\Phi \cdot d\ell}$$

around the triangular path. A theorem from linear algebra proves crucial: three or more symmetric matrices cannot generically be simultaneously diagonalized. When the coupling matrices M(A,B), M(B,C), M(C,A) characterizing relations between the three features cannot be simultaneously diagonalized, the circulation integral is generically non-zero.

Non-zero circulation is **chirality**: the loop has a preferred orientation. This is a geometric fact, not a temporal one. We have not said "A happens before B before C." We have said: the gradient structure around the A-B-C triangle has asymmetry distinguishing the two traversal directions.

This chirality IS what we call ordering structure. The ordering constraint τ measures the magnitude of this circulation asymmetry—how strongly orderings are distinguished from their reversals. At $N = 2$, $\tau = 0$ necessarily. At $N \geq 3$, τ can be non-zero.

The crucial move: **τ is about the topology/geometry of the gradient field, not about dynamics or change.** A configuration either has chirality ($\tau > 0$) or doesn't ($\tau = 0$). This is like asking whether a knot is chiral—a static geometric property that exists tenselessly.

What we call "time" is the name we give to the τ-ordering parameter when we describe configurations sequentially. The τ-structure exists tenselessly as geometry. What we call "before/after" refers to position in this ordering structure. The direction of what we experience as time aligns with the gradient of Φ—toward higher efficiency of distinguishability.

2.6 The Uemov Inversion

A traditional picture might retain a privileged observer—someone outside the relational structure who measures the constraints, computes τ, and describes the geometry. Our framework eliminates this possibility through what we call the Uemov inversion.

There is no observer outside the relational structure. Every relatum is both "observer" and "observed"—both a feature that distinguishes other features and a feature distinguished by them. The coupling matrices M(A,B) encode mutual constraint: how A's configuration restricts B's possibilities AND how B's configuration restricts A's.

This is not symmetric: $M(A,B) \neq M(B,A)$ in general. A may constrain B more than B constrains A. This asymmetry, when present at $N \geq 3$, is what we experience as causal ordering: if A constrains B more than B constrains A, we say A "causally precedes" B. But this is geometric asymmetry, not temporal priority.

The "observer" in physics is not a special entity but a relatum complex enough to have high λ (integration with what it "observes") and sufficient internal structure to represent the coupling. Observation is a mode of relation, not a transcendent position.

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3. The Ruliad and Computational Ontology

3.1 Wolfram's Framework

Stephen Wolfram's recent work proposes that reality is fundamentally computational—not in the sense that the universe runs on a cosmic computer, but in the sense that computational structure is the appropriate framework for understanding what exists.

The Ruliad is the entangled limit of all possible computations. Every possible rule, applied in every possible way, to every possible initial condition, generates a vast structure that contains all computable processes. The Ruliad is not a simulation running somewhere; it is the totality of computational possibility.

Three features of the Ruliad are relevant here:

Tenseless existence: The Ruliad does not evolve through time. All computational states exist "at once" as structure. The Ruliad IS, tenselessly.

Emergent time: Time, in the Ruliad, emerges from observing a single thread within the multi-dimensional, branching computational space. An observer traces a path through the structure, and this path-tracing is experienced as temporal sequence. The "clock cycle" is an artifact of observation, not intrinsic to the Ruliad.

No outside: There is no position external to the Ruliad from which to observe it. Every observer is a thread within the structure. The "outside view" that sees all threads simultaneously is an abstraction, a conceptual tool—not a position anyone actually occupies.

3.2 The Observer in the Ruliad

Wolfram's treatment of observation parallels our relational framework:

An observer is not external to the computational structure but is a pattern within it—a thread that traces a coherent path through possibility space. What the observer experiences as "the present" is their current location along this thread. What they experience as "the past" is the portion of the thread already traversed. What they experience as "the future" is the not-yet-traversed portion.

But from the analytical perspective—the conceptual view that contemplates the whole Ruliad—there is no privileged present. All states exist. The observer's sense of temporal flow is perspectival, arising from their particular thread, not from any intrinsic property of the Ruliad itself.

This perspectival emergence of time does not make time "merely subjective" or "illusory." Time is real for observers; it characterizes their mode of existence within the structure. But it is not a container in which the Ruliad sits; it is a feature of what it is to be a thread within the Ruliad.

3.3 Computational Space and Configuration Space

The Ruliad is parameterized by computational rules and states. Our relational framework is parameterized by constraint configurations. Are these the same?

Not quite—but they may be projections of related structure.

In the Ruliad, the fundamental objects are rules and the states they produce. In our framework, the fundamental objects are relational configurations characterized by constraint values. Both frameworks:

- Treat their fundamental structures as existing tenselessly
- Derive temporal ordering from structure rather than assuming it
- Locate observers inside the structure rather than outside
- Recognize the "outside view" as abstraction rather than occupation

The key difference: Wolfram starts from computation (rules operating on states) and derives observers as threads. We start from distinguishability (the axiom) and derive both configurations and their ordering. The relational framework is, in a sense, more austere—it asks what structure must exist for anything to exist, while the computational framework starts from the richer assumption of rule-following.

Yet both arrive at the same conclusion about observers: **They are inside, not outside.** Whatever observers are —threads through computational space, or complex relational configurations—they do not transcend the structure they observe.

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4. The Convergence

4.1 Structural Parallels

The relational framework and the Ruliad approach arrive at strikingly similar conclusions despite different starting points:

Aspect	Relational Framework	Ruliad
What exists	All viable constraint configurations	All possible computations
Fundamental structure	Relational (distinguishability)	Computational (rules and states)
Time	Emerges from τ-ordering at $N \geq 3$	Emerges from observer threading
Observer status	Relatum within structure	Thread within structure
"Outside view"	Analytical abstraction	Conceptual tool
Temporal experience	Following Φ-gradient	Tracing computational path

This convergence is not coincidental. Both frameworks take seriously the question of what observation requires and conclude that it cannot require transcendence. The observer must be immanent—part of what is observed, not apart from it.

4.2 A Subtle Difference Worth Examining

There is a nuance between the frameworks that proves productive rather than problematic:

Wolfram: Time emerges from observation—the observer selecting/tracing a thread creates the experience of sequential time. There is something perspectival about it.

Relational Framework: Time emerges from geometry—the $\tau > 0$ condition at $N \geq 3$ is a structural property. Circulation is non-zero whether or not anyone observes it.

These reconcile under the Uemov inversion. In our framework, every relatum is both observer and observed—the framework is thoroughly relational. There is no "view from nowhere." The Φ-gradient exists as geometry, but *experiencing* it as temporal sequence requires being a relatum within the structure, tracing a path.

So:

- **From outside** (the analytical view): One sees all possible configurations, all possible threads, the complete constraint-space geometry
- **From inside** (being a relatum): One experiences ONE thread as timeline, one path as existence

The "outside" view is not a God's-eye view—it is an abstraction, a map. The "inside" view is what existence actually is for any particular configuration.

4.3 The Direction of Time

Both frameworks address the "arrow of time" without invoking special initial conditions:

In the Ruliad, the direction of experienced time corresponds to the direction of computational elaboration—threads branch forward, not backward, because computation is directed.

In the relational framework, the direction of ordering aligns with the Φ-gradient—toward configurations of higher efficiency (higher Ω/K). The "arrow" is not imposed but emerges from the geometry of constraint space.

Both explanations locate temporal direction in structure rather than contingent initial conditions. This is significant: the arrow of time becomes necessary rather than mysterious.

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5. The Strange Loop

5.1 Hofstadter's Insight

Douglas Hofstadter's work on strange loops provides the final piece of our account. A strange loop occurs when, by moving through a hierarchical system, one unexpectedly arrives back at the starting point—the levels fold back on themselves.

The canonical example is Gödel's incompleteness theorem: a formal system powerful enough to describe arithmetic can encode statements about itself, including statements about its own provability. The system reaches "upward" to a meta-level and finds itself.

Hofstadter argued that consciousness itself is a strange loop: a system (the brain) complex enough to model itself creates the phenomenon of "I"—not as a separate entity but as the pattern of self-reference.

5.2 The Observer as Strange Loop

In our framework, the observer is not merely inside the relational structure (as opposed to outside it). The observer is the relational structure becoming self-referential.

Consider what observation requires:

- A relatum O ("observer") with high integration (λ) with some other relatum S ("system")
- O must have sufficient internal structure (κ) to represent the O-S coupling
- O must have sufficient complexity to represent *itself* representing S

This last requirement is what creates the strange loop. An observer is not just a relatum that couples with other relata; an observer is a relatum whose internal structure includes a representation of its own relational situation.

The levels:

- **Level 1:** The constraint field—all configurations, all relations
- **Level 2:** Configurations that model other configurations—relata representing relata
- **Level 3:** Configurations that model themselves modeling—the strange loop

The "observer" emerges at Level 2 and above. But critically, Level 2 configurations ARE Level 1 configurations. There is no separate observer-stuff. The hierarchy folds back: the model is part of what it models.

5.3 Maps of the Territory, Within the Territory

We—the authors and readers of this paper—are strange loops. We are configurations within the relational structure, attempting to describe the relational structure. Our description is not external to what we describe; it is a pattern within it.

This is not a defect or limitation. It is the nature of observation as such. Every act of observation, every scientific theory, every philosophical framework is a configuration within the structure it characterizes. The map is part of the territory.

This might seem to invite skepticism or relativism: if we can never escape the structure, how can we claim to know it accurately? But the implication is the opposite. We can know the structure because we ARE structure—because knowing is itself a relational configuration, not a magical transcendence of relation.

Truth, on this account, is not correspondence between internal representation and external reality (there is no "external"). Truth is coherence—configurations that accurately represent their relational situation, including their situation of representing.

5.4 Self-Reference Without Paradox

Strange loops can generate paradox (the Liar, Russell's set, etc.), but self-reference as such is not paradoxical. The strange loop of observation is productive rather than pathological.

The reason: observation does not require representing EVERYTHING about the observed (which might generate paradox through self-inclusion). It requires representing ENOUGH—enough coupling, enough structure, enough coherence for the representation to function.

An observer need not have complete self-knowledge to count as an observer. The strange loop is partial, approximate, functional. This is not a defect; it is how observation actually works.

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6. Dissolution of the Observer Problem

6.1 The Problem Restated

Recall the observer problem: Where does the observer stand? What grounds their privileged epistemic position? If observers are physical systems, how can they occupy a position outside the systems they observe?

Our answer: **They cannot, and need not.**

6.2 No Outside

There is no position external to the relational structure. The structure is not embedded in a larger container that would provide an outside. The structure is all there is—not because we define it so, but because "absolute nothingness" is self-undermining, and hence whatever exists is relational all the way down.

The "outside view" we adopt when doing science or philosophy is an abstraction. It is useful—indeed, essential—for understanding. But it is not a place we occupy. We are always inside, always relata among relata, always threads within the structure.

6.3 Observation as Relation

To observe is not to transcend relation but to enter into a particular kind of relation—one involving high integration (λ), sufficient complexity for representation (κ), and the strange loop of self-reference that constitutes "being an observer."

When a scientist measures a system, the scientist-system coupling is a relation within the total structure. The scientist's representation of the system is a pattern within the scientist, which is a pattern within the structure. The measurement result is a correlation—a constraint-coupling—between configurations.

Nothing stands outside. The measurement is complete when consistency is achieved: when the scientist's configuration and the system's configuration satisfy the constraint $L(C\_scientist, C\_system, \lambda) = 0$.

6.4 The Illusion of Externality

Why does it SEEM like observers are external? Why is the observer problem so persistent?

Because observation involves asymmetry. When I observe a rock, my configuration changes more than the rock's (typically). The asymmetry creates an apparent division: active observer, passive observed. But this is asymmetry within relation, not transcendence of relation.

The experience of being an observer—of being a subject facing objects—is real. It is what the strange loop feels like from inside. But the felt externality is perspectival, not ontological. We EXPERIENCE ourselves as outside because the strange loop creates that perspective; we ARE NOT outside because nothing is.

6.5 Implications for Scientific Method

This reframing does not undermine science—it clarifies what science is.

Science is the activity of configurations (scientists) representing other configurations (systems) and checking these representations against further couplings (experiments). Scientific theories are not mirrors held up to an external world; they are articulations of relational structure by configurations within that structure.

This is not relativism. Configurations can represent accurately or inaccurately; theories can cohere or fail to cohere; experiments can confirm or disconfirm. The criteria of success are relational (coherence, predictive coupling) rather than correspondence to an inaccessible "external reality."

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7. Implications for Philosophy of Science

7.1 Theories as Patterns

Scientific theories, on this view, are patterns within the relational structure—configurations of high complexity (κ) representing regularities in how configurations relate.

A theory is not true because it "corresponds to" external reality. A theory is true (to the extent it is) because it accurately articulates constraint structure—because adopting the theory leads to coherent, predictively successful coupling with other configurations.

This dissolves certain long-standing debates:

- **Realism vs. anti-realism:** Both presuppose the inside/outside distinction. If there is no outside, the question of whether theories "really correspond" to external reality is malformed.
- **Theory-ladenness:** All observation is relational, hence "theory-laden" in the sense that observation involves configurations with internal structure. This is not a problem to overcome but the nature of observation.
- **Underdetermination:** Multiple theories can accurately represent the same structure from different perspectives (threads through the same region). This is expected, not problematic.

7.2 Mathematical Knowledge

Mathematics, in this framework, is pattern-recognition by patterns. Mathematical truths are structural necessities—configurations of very low K (high simplicity) and very high Ω (broad applicability) that therefore have high Φ.

The "unreasonable effectiveness of mathematics" (Wigner) becomes reasonable: mathematics describes structure, and the constraint field IS structure. Mathematics works because both mathematics and the configurations it describes are aspects of the same relational geometry.

Gödel-Tarski limitations follow naturally: a sufficiently complex formal system is a strange loop, able to represent its own structure, and therefore subject to the undecidabilities that strange loops generate.

7.3 The Status of This Paper

We must apply the framework to itself. This paper is a configuration—a pattern of symbols instantiated in physical media, coupled with reader-configurations who interpret it.

The paper's claims are not views from outside the relational structure; they are articulations from within. If the claims are correct, they are correct as representations that cohere with wider structure—not as correspondences to transcendent truth.

This is not self-undermining. The framework predicts that all knowledge is perspectival (from within structure) but not therefore arbitrary (coherence constraints apply). This paper is an example: we claim coherence with the structure we describe, including the structure's inclusion of us describing it.

7.4 Consequences for Broader Inquiry

We note—without claiming to have established—potential implications for other domains:

Interpretation of physical theory: If observation is relation, then interpretive puzzles concerning measurement in physics might dissolve through reframing rather than through additional physical postulates. This deserves exploration but exceeds our scope here.

Philosophy of mind: If observers are strange loops, then the "hard problem" of consciousness might be reframed: not "how does physical stuff generate experience?" but "what configurations constitute the self-referential patterns we call experiential?" Again, this exceeds our scope but merits investigation.

Epistemology: If there is no outside, then knowledge is always situated, always perspectival—but not therefore relativistic, because coherence constraints are structural. This suggests a path between naive realism and corrosive skepticism.

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8. Conclusion

We began with the observer problem: the apparent requirement that observers occupy a position external to what they observe. We argued that this requirement is incoherent—not because observation is impossible, but because there is no "external."

From a single logical axiom (absolute nothingness is self-undermining), we derived a relational ontology in which distinguishability is fundamental and relation is primitive. Within this framework, what we call "ordering"—including temporal ordering—emerges geometrically at sufficient relational complexity ($N \geq 3$), not as a presupposed background.

We showed that this framework converges with Wolfram's Ruliad: both locate observers inside the structure rather than outside it, both derive time from structure rather than assuming it, both recognize the "outside view" as abstraction rather than occupation.

The strange loop completes the picture. Observers are not merely inside the structure; they are the structure becoming self-referential. We are patterns studying the conditions of pattern-existence, maps that are part of the territory they map.

The observer problem does not require solution through heroic metaphysics or eliminative deflation. It requires dissolution through recognition that observation was never external to begin with. We are inside—all the way down—and that is how we know.

References

[To be completed]

Hofstadter, D. R. (1979). *Gödel, Escher, Bach: An Eternal Golden Braid.*

Hofstadter, D. R. (2007). *I Am a Strange Loop.*

Wolfram, S. (2020). "A Project to Find the Fundamental Theory of Physics."

Wolfram, S. (2021). "The Concept of the Ruliad."

[Additional references to be added: Uemov, Finster, Barandes, Rovelli, Nagel, etc.]

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