The Ruliad, Gödel, Lorenz, and the Missing Self-Model of Language

Why a theory of 'everything' needs a theory of language

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Abstract

This paper critically examines Stephen Wolfram's concept of the Ruliad as a proposed foundational "theory of everything" grounded in computational totality. Engaging with Gödel's incompleteness theorems and Lorenz's work on deterministic nonperiodic flow, it argues that the Ruliad's claim to encompass all computationally possible structures overlooks the prior role of finite, measured language and symbolic practice. A "Geofinite" perspective is advanced, which places the conditions of measured symbolisation at the foundation rather than treating computation as metaphysically prior. This approach offers a more coherent way to hold classical mathematics, formal systems, and ambitious computational models while recognising inherent incompleteness and uncertainty.

1 Wolfram's Claim of Computational Totality

Stephen Wolfram's Ruliad is presented as the entangled limit of everything computationally possible: the result of following all possible computational rules in all possible ways (Wolfram, 2021). In this framing, particular sciences, particular mathematical theories, particular physical laws, and particular observer-experiences are not final realities in themselves. They are samplings or coordinatisations of a larger computational totality. Wolfram's framework therefore attempts to move beneath conventional formal systems and beneath conventional physics into a deeper computational universe from which all specific descriptions can, in principle, be extracted.

This gives the Ruliad an extraordinary philosophical ambition. It functions as a proposed meta-container. The apparent diversity of formal systems, physical laws, mathematical structures, and observer-bound descriptions can all be understood as partial views of the same underlying computational object. It gives computational science a metaphysical expansion: computation is no longer merely a method used by observers to model the world; computation becomes the generative foundation of the world as experienced.

But this is also where the first philosophical difficulty appears. The Ruliad is described as containing everything computationally possible. Yet the words "everything," "possible," "computation," "rule," "observer," and "description" are themselves not computational results until they have already been admitted into language. The Ruliad is spoken before it is computed. It is named before it is entered. It is carried as a finite symbolic claim before it can be received as a formal structure. This means that the theory already depends on a prior language-world, even when it seeks to place computation beneath language.

2 The Historical Problem of Formal Completeness

The desire to give a complete foundation is not new. The history of mathematics contains a long movement from Euclidean construction, through symbolic algebra, through formal logic, towards the dream of a fully controlled axiomatic system. In the modern period, this dream is closely associated with the formalist programme around Hilbert: the hope that mathematics could be placed on secure formal foundations, with axioms and rules sufficiently explicit that mathematical truth could be domesticated by symbolic procedure.

Gödel interrupted this dream. His incompleteness theorems concern the limits of provability in formal axiomatic theories. The first incompleteness theorem states that, in any consistent formal system strong enough to carry out a certain amount of arithmetic, there are statements in the language of that system that can neither be proved nor disproved within that system (Gödel, 1931). The second theorem states that such a system cannot prove its own consistency, assuming it is in fact consistent.

This does not mean that all reasoning fails. It means something more precise and more damaging to totalising formal ambition: sufficiently strong formal systems cannot close over themselves in the way the dream of completeness required. They can operate. They can generate proofs. They can be extended. They can be interpreted from outside. But they cannot, from within themselves, fully secure their own completeness and consistency.

Gödel therefore marks a boundary in the history of formalisation. A formal system can be powerful, but its power brings self-reference. Once a system can encode enough arithmetic, it can in effect speak about its own statements and proofs. At that point, the system's internal symbolic machinery can generate statements whose status cannot be settled by the system itself. The formal system becomes unable to complete its own self-account.

This is crucial for any theory that presents itself as complete. If the Ruliad is treated as a formal system, then the Gödelian question presses immediately: what is the language of the system, what are its rules, what counts as proof, and can the system state and secure its own completeness? If the Ruliad is not treated as a formal system, but as a meta-container of all formal systems, then a different question appears: in what language is this meta-container being stated, and how does that language measure, distinguish, and stabilise what the Ruliad is claimed to contain?

3 Wolfram's Response to Gödel

Wolfram does not simply deny Gödel. He tends to reinterpret incompleteness through computation. In his writing on Gödel, he connects undecidability and incompleteness with computational irreducibility, suggesting that richness arises where behaviour cannot be reduced to short symbolic summaries (Wolfram, 2002). In this view, Gödelian limitation is not merely a failure of mathematics; it is a sign that sufficiently rich systems generate behaviour that cannot always be compressed into a simple proof or formula. Incompleteness and undecidability are treated as expected and even productive features of complex computational processes rather than defects to be overcome.

This is an important move. Wolfram shifts the emphasis from incompleteness as a wound in formal mathematics to irreducibility as a general feature of complex systems. The resistance to compression is part of what makes the system rich. There are processes whose outcomes cannot be known by a shortcut. One must run the computation, or simulate it, or follow the sequence of states.

From this perspective, Gödel is not an external refutation of the Ruliad. Gödel becomes one inhabitant of the larger computational picture. A particular formal system may be incomplete, but the Ruliad, as the totality of all computational possibilities, contains that system, its extensions, its alternatives, its undecidable statements, and the formal trajectories that pass around it.

Yet this reframing raises a further question. If incompleteness is simply another computational phenomenon contained within the Ruliad, then the burden of selecting which trajectories are meaningful, measurable, or relevant to finite observers is shifted onto the sampling process itself. Containment of all possible paths does not yet tell us how a finite observer distinguishes a stable, admissible description from the vast background of equally contained but irrelevant or unstable ones. Here the distinction between computational possibility and measured accessibility becomes important.

4 Lorenz and the Prior History of Irreducibility

The historical perspective also matters because computational irreducibility did not arise in a vacuum. Before Wolfram's computational framing, Lorenz had already shown that deterministic systems could become practically unpredictable because small differences in initial conditions may grow into large differences in later states. Lorenz's 1963 paper on deterministic nonperiodic flow described finite systems of deterministic nonlinear differential equations whose bounded nonperiodic solutions were unstable with respect to small modifications of initial state (Lorenz, 1963). Slightly different initial states could evolve into considerably different later states.

Lorenz's result was not a computational theory of everything. It was a measured and mathematical discovery about nonlinear systems, weather, phase space, and predictability. But its philosophical implication was enormous. Determinism did not guarantee practical prediction. A system could be deterministic and yet inaccessible to long-range finite prediction, because the measured present state could not be known with infinite precision.

This is close to the heart of the Geofinite reading. Lorenz does not merely show that calculation may be long. He shows that measurement matters. The initial condition is not an abstract exact point available to an infinite intellect. It is a measured state with finite resolution. The future trajectory depends on distinctions finer than the measurement can supply. Therefore, the gap is not only computational. It is metrological.

Wolfram's computational irreducibility generalises part of this insight, but it also changes its centre of gravity. Where Lorenz places instability within measured dynamical systems, Wolfram places irreducibility within the universe of computation. This can be fruitful, but it risks semantic capture. A measured phenomenon, historically developed in nonlinear dynamics, is re-described as a computational principle and then absorbed into a larger computational cosmology.

The Geofinite objection is not that Wolfram has no right to generalise. Generalisation is a legitimate intellectual act. The objection is that the generalisation may obscure the prior role of measurement. Lorenz teaches that finite observers do not possess exact initial conditions. Wolfram teaches that some computations cannot be shortcut. These overlap, but they are not identical. Computation may explain why a trajectory must be followed, but measurement explains why the trajectory cannot be possessed in advance as exact symbolic certainty.

5 The Missing Self-Model of Language

The central difficulty with the Ruliad is therefore not simply Gödel, nor simply Lorenz. The deeper difficulty is language. The Ruliad is introduced in language, explained in language, defended in language, and received by readers through language. Yet computation is placed at the foundation, while language is not given an equally explicit foundational treatment.

Wolfram does discuss observers. He argues that observers extract reduced representations from the complexity of the world, and that observation involves equivalencing many detailed states into something that can fit within finite minds. He also acknowledges that observers like us communicate their impressions socially, and that without such communication coherent languages could not be set up.

This is important, but it does not yet amount to a full model of language. It gives a computational observer-theory sketch, but it does not fully explain how finite symbols acquire extent, how marks become admissible tokens, how tokens become shared words, how words retain provenance, how uncertainty travels through symbolic use, how consensus stabilises meaning, or how a formal system is held inside the language that states it.

This is where many people struggle with the Ruliad. The difficulty is not merely that the concept is large. Many large concepts can be understood if they have clear anchors. The difficulty is that the Ruliad is a totalising computational object whose access conditions are linguistic, but whose theory does not begin from language. The reader is asked to accept "all possible computations" as a coherent object, but the symbolic machinery by which "all," "possible," and "computation" are themselves stabilised is not made foundational.

Every formal system is text-within-text. An axiom system is not merely a mathematical object floating in pure abstraction. It is written, read, copied, taught, interpreted, and agreed upon. Its symbols have finite inscriptions. Its rules are held in statements. Its admissible transformations are recognised by observers. Even when formal mathematics abstracts away from ink, pixels, sound, and memory, those finite carriers remain the only way the system enters the measured world.

A formal system therefore needs a self-model of language if it wishes to make foundational claims. It must say not only what its symbols mean inside the system, but how those symbols are held, distinguished, measured, transmitted, and recognised as symbols at all. Without this, the system uses language while failing to account for the language it uses.

6 The Geofinite Entry

From a Geofinite perspective, the starting point is not computation but measured symbolisation. A symbol is finite. It has extent. It must appear somehow: as ink, pixel, sound, pressure, memory trace, gesture, or other measurable difference. It must be distinguished from its background. It must cross a threshold of recognisability. It must be carried by a finite medium. It must be received by a finite observer.

This does not reduce mathematics to psychology or sociology. It does not say that mathematics is merely opinion. It says that mathematics, as practised and communicated, enters the world through finite measurable symbols. Proofs are not divine vapours. They are finite symbolic trajectories. They can be checked, copied, disputed, repaired, formalised, mechanised, and agreed upon. Their authority depends not only on internal rule-following but on the admissibility of the symbolic path.

In this model, language is not an afterthought. Language is the measured container through which formal systems become available. A computational system can be described only after symbols have been stabilised enough to describe it. A rule can be followed only after it is represented. A program can be run only after its states, transitions, and outputs have been distinguished. Computation itself is therefore not prior to symbolisation in the measured world. It is one powerful form of symbolic trajectory within it.

This reverses Wolfram's hierarchy. Wolfram places computation beneath language and treats observers as samplers of a computational totality. Geofinitism places measured symbol-use beneath formal computation. Computation becomes a special case of finite symbolic transformation, not the metaphysical source from which symbolic meaning automatically follows.

The advantage of this reversal is that incompleteness and uncertainty are not treated as embarrassments. They are built in from the start. A measured symbol has finite extent and finite resolution. A language has history, drift, ambiguity, repair, and social stabilisation. A formal system has boundaries. A proof has a length. A computation has a trajectory. A reader has a position. A model has a domain. Nothing enters as total certainty.

This perspective also carries concrete implications for practice. In mathematics, proofs are treated not as ideal objects whose validity is settled once and for all by formal rules alone, but as finite symbolic trajectories whose reliability depends on the measurable conditions of their inscription, checking, and transmission. In physics, models are understood to carry explicit metrological uncertainty rather than idealised limits that finite observers can never attain. Both disciplines remain powerful, but their authority is understood to rest on the stabilised practices of finite symbol use rather than on an assumed prior computational completeness.

7 Gödel Revisited Through Measurement

Gödel's theorems can then be read not as isolated logical curiosities but as formal signs of a wider condition. Any sufficiently rich formal system that can encode arithmetic can generate self-reference, and self-reference prevents full internal closure. The system cannot complete itself from within. Its own consistency cannot be secured by its own resources alone (Gödel, 1931).

It is important to distinguish here between the strictly syntactic result Gödel established — that sufficiently strong formal systems cannot prove all truths expressible within their own language — and the broader uncertainties that arise once those systems are embedded in actual measured and interpreted practice. Geofinitism extends the lesson into the measured world. If a formal system cannot be formally complete in Gödel's sense, then a measured language-system cannot be materially complete either. It carries uncertainty at every level: in inscription, distinction, interpretation, use, memory, transmission, and agreement. There is no final language outside all language from which the completeness of language can be declared without residue.

This does not destroy knowledge. It clarifies its condition. Knowledge becomes a stabilised symbolic achievement under finite constraints. Mathematics becomes a highly disciplined region of symbolic practice. Physics becomes measured symbolic modelling of interaction. Computation becomes controlled symbolic transformation. None of these need to be dismissed. They need to be placed.

The Ruliad can still be admitted, but not as a completed foundation. It can be admitted as a measured symbolic proposal: a powerful computational image, expressed in finite language, supported by examples, diagrams, analogies, programs, and arguments. It is not "everything" in itself. It is a finite symbolic trajectory that claims to point towards a total computational object.

8 Text-Within-Text as Meta-Container

The phrase text-within-text is useful here. A formal system appears inside a language that describes it. That language appears inside a wider cultural and historical language. That language appears inside measured marks and acts of reading. A mathematical proof may be formal internally, but its formal status is carried externally by text, notation, institution, pedagogy, memory, and consensus.

This gives us a meta-container, but not a magical one. The Geofinite meta-container does not claim to be complete in the classical formal sense. It does not say, "Here is the final system that contains all systems and proves its own completion." Instead, it says: every system we can use is a measured symbolic system; every formal object we admit is admitted through finite symbols; every model we carry has uncertainty; every claim of completeness must itself be measured as a claim.

This is why Geofinitism can hold classical mathematics and the Ruliad more coherently than a totalising computational model can hold itself. It does not need to deny classical mathematics. It can treat classical mathematics as a historically stabilised, internally powerful, finite symbolic practice that admits ideal objects under rules. Nor does it need to deny the Ruliad. It can treat the Ruliad as a computationally expansive symbolic model, perhaps fruitful, perhaps beautiful, perhaps overextended, but still a measured artefact within language.

The key is that neither classical mathematics nor the Ruliad is admitted as complete in itself. Each is admitted as a measured form. Classical mathematics is a measured symbolic tradition that often works by suppressing the finite extent of its symbols. The Ruliad is a measured symbolic construction that attempts to totalise computation while relying on language to state the totalisation. Both can be held, but only once their incompleteness and uncertainty are recognised.

9 The Word Game and the Need for Cohesion

It may be said that this is a game of words. But foundational philosophy is always, in part, a game of words, because the words are the access points to the model. The issue is not whether words are being used. The issue is whether they are being used with enough construction, discipline, provenance, and self-awareness to make the model cohesive.

The Ruliad struggles because its largest words are under-anchored. "Everything" is not a small word. "All possible computations" is not a small phrase. "Observer" is not a small role. "Sampling the Ruliad" is not a transparent operation. If these terms are not given a measured account, they become rhetorically powerful but foundationally unstable.

A cohesive model must therefore include its own language conditions. It must explain how its symbols are formed, how its rules are recognised, how its claims are measured, how uncertainty is retained, how disagreement is handled, and how admission into the model occurs. It must not simply use language as a ladder and then pretend the ladder was computation all along.

This is the Geofinite demand: do not begin with the infinite object and then ask the finite observer to accept it. Begin with the finite symbol. Begin with the mark. Begin with measured distinction. Begin with uncertainty. Begin with the fact that every theory, even a theory of everything, must arrive as a finite symbolic trajectory.

10 Conclusion: The Ruliad as Measured Claim, Not Complete World

Wolfram's Ruliad is one of the most ambitious computational metaphors of the present age. It attempts to gather mathematics, physics, observers, laws, and possible worlds into a single computational totality. Its strength is its scope. Its weakness is also its scope. By claiming to contain everything computationally possible, it risks mistaking inclusion for explanation and totality for grounding.

Gödel shows that formal systems cannot, once sufficiently powerful, close over themselves in complete consistency and proof (Gödel, 1931). Lorenz shows that deterministic systems can remain unpredictable to finite observers because measured initial conditions are never infinitely exact (Lorenz, 1963). Wolfram reinterprets these difficulties through computational irreducibility and treats them as features of rich computation rather than obstacles. Yet the Geofinite perspective sees a deeper continuity: both Gödel and Lorenz expose the limits of finite access to total structure, limits that persist even when incompleteness is reframed as computational richness.

The missing foundation is language. Any formal system presented to us must be held in language. Any computational universe described to us must be carried by symbols. Any claim of completeness must itself be a finite measurable inscription. Therefore a theory that claims foundational status must include a self-model of language and representation. It must account for how finite symbols hold formal systems, how observers measure and stabilise meaning, and how uncertainty remains present even in the most disciplined symbolic practice.

By placing measurement at the basis, Geofinitism does not need to compete with the Ruliad as another totalising theory of everything. It offers a different kind of container. It can hold classical mathematics, formal logic, computation, nonlinear dynamics, and the Ruliad itself as measured symbolic trajectories. They are not complete worlds. They are admissible forms within finite symbolic practice.

The Ruliad says: everything is there.

Geofinitism asks: by what measured symbols, in what language, with what uncertainty, and under what conditions of admissibility, can "everything" be said?

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