From the Fool to the Magician : The Ruliad

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Abstract

A philosophical examination of Stephen Wolfram's Ruliad, arguing that rules are not computations and the observer represents the necessary present tense of becoming.

If one wants a tarot image for Stephen Wolfram, it is not hard to find. He is the Magician: the consummate arranger of symbols, the one who does not merely speculate but lays the implements on the table and makes a formal world answer. Across decades of work, spanning Mathematica and the Wolfram Language, A New Kind of Science, Wolfram Alpha, and the Physics Project, he has repeatedly turned abstract possibility into operative form. His great trump, at least for the present argument, is the Ruliad: the entangled limit of all possible computations, the formal horizon reached by following all possible computational rules in all possible ways.

If he is the Magician, then let me be the Fool. The Fool is the one who walks because he has not yet learned to look down. I do not write to correct the Magician's act, nor to claim some higher vantage over it. I write in fidelity to it, and in admiration of its scale, to carry its gesture one step further without pretending to mastery.

The Ruliad as it was set down in 2021 remains the foundation from which the continuing work of the Wolfram Institute, and of Gorard, Arsiwalla, Elshatlawy, Senchal, and others, still proceeds. The present argument is written relative to that 2021 formulation. The later developments are engaged directly in the closing section.

What follows turns on one word in Wolfram's definition, because that word governs the scope of the whole proposal. The word is *computation.*

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1. I. Rules Are Not Computations

The Ruliad is defined as the totality of all possible computations. The definition carries a hidden assumption. Computation requires instantiation. A formal rule that is never run in a medium is not a computation. It is a description of a possible computation. It lives in the space of what could happen. It has no causal effects. It changes no physical state. It produces no output. It is real in exactly the mode that mathematical truth is real: exactly determined, formally complete, not physically actual.

Strip every observer from the Ruliad and what remains is the totality of all possible rules. Not computations. Formal descriptions. The distinction is not subtle. A score is not a performance. A genome is not an organism. A blueprint is not a building. The formal description is complete in itself and insufficient to produce the thing it describes. Something else is required.

That something else is the observer. Not as an experiencer. Not as a sampler extracting slices of formal possibility. As the thing that makes computation computation rather than mere formal description. The observer directs a formal process into a physical medium. The medium instantiates the computation. The computation runs. Without that sequence, the Ruliad contains everything and actualises nothing. And the claim is stronger still, because *possible* already smuggles in an observer. Possibility is not a free-standing ontological category. A rule that could be run but has no one to run it is not a possible computation. Possible for whom? Possible to run by what? If the answer is nobody and nothing, then the word has no referent. The wave function is "all possible states," but possible for what? For a measurement apparatus. Without the apparatus, *possible* means only *formally describable*, and formally describable is not the same as possible. The Ruliad without observers is not a possibility space. It is a formal structure. Complete, exact, formally necessary, of nothing that is happening.

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2. II. What Computation Has Always Required

The original computers were not machines. They were people in rooms with pencils. The computation was not happening in their heads. It was happening on paper. The person held the procedure in mind, directed the next operation, wrote the result, and carried it to the following step. The paper was the site of the computation. The person was the director.

This has not changed. A Turing machine is tape and read/write head and state register. The tape is external. Without the tape there is no Turing machine, only a finite state device with bounded memory. The externalisation is definitional. Turing did not add it for convenience. He required it because computation without a medium to track state is not computation.

Minds are lossy. They pattern-match, approximate, and reconstruct. A child learning arithmetic does not compute in her head. She remembers what computation looks like and reconstructs the shape of it well enough to reach for a pencil. The computation happens when the pencil meets the paper. Before that there is a limerence toward the formal structure, a reaching toward the shape of the thing without the thing being present. The mind carries the intention. The medium carries the computation.

Consider the artificial analogue. A large language model does not compute. It pattern-matches. It recognises what an output should look like based on its training distribution. When it needs actual computation it invokes an external system, a calculator, a code interpreter, a formal tool that performs directed state transitions. The model itself is doing what the child does: recognising the shape of a correct answer, reaching for the pencil. The pencil in this case is a Python interpreter or a Lean compiler. The model is the mind. The interpreter is the paper. Neither alone computes. The computation happens between them.

Wolfram is right that observers coarse-grain. He understates how lossy the coarse-graining is. The observer is not a degraded version of a formal system, processing the Ruliad at low resolution. The observer is a qualitative, biological, fundamentally inexact thing that is capable of one precise act: directing a formal process into a medium with enough coherence that the computation does not collapse before it runs.

The lossiness is not a defect. It is the price of being able to act in the physical world. A lossless observer would be a formal system itself, which cannot initiate physical action. The observer must be imprecise and embodied to be the kind of thing that bridges the formal and the physical. The imprecision is what makes the bridge possible.

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3. III. The Apple Problem

Before computation begins, individuation must happen. Someone must decide that this is one thing and that is another thing, that these are two units of the same kind, that the boundary between apple and air is where the counting starts.

Consider two apples. One weighs 150 grams. The other weighs 175 grams. They are counted as two. But the declaration that each is a unit of one requires a series of qualitative judgments that precede and enable the arithmetic. The judgment that each apple is a bounded thing. The judgment that they are the same kind of thing for purposes of this count. The judgment that the weight difference is irrelevant here, even though in other contexts it would not be. The judgment that the apple is the unit rather than the tree it came from, or the cells it is made of, or the electromagnetic field it disturbs.

None of these judgments are mathematical. None are computable. They are qualitative assessments about where one thing ends and another begins. The mathematics begins after they have been made and cannot make them.

This is the observer's specific and irreplaceable contribution. Not computation. Not even coarse-graining in Wolfram's sense. The act of qualitative individuation that carves the physical world into the discrete units that formal systems can then operate on. Without this act the Ruliad's formal structures have no physical referents to attach to. The computation has nowhere to land.

This is also why τ is not like other mathematical objects. The ratio of a circumference to its radius does not require a qualitative judgment about where one thing ends and another begins. It is the ratio itself, invariant under every choice an observer might make about units, coordinates, or conventions. Even in non-Euclidean geometry, where the numerical ratio of circumference to radius differs, τ is the constant against which the deviation is measured. No observer's qualitative individuation has any bearing on τ. It is the one place where the formal reaches the physical without requiring the observer's interpretive act. Every other quantity is downstream of a qualitative choice. τ precedes that choice.

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4. IV. All Machines Close

A Turing machine that halts reaches a terminal state and stops. This is discrete closure. One complete traversal of the relevant state space, finished.

A Turing machine that loops reaches a configuration it has visited before and cycles through it indefinitely. This is continuous closure. The machine has settled. It will produce nothing new. It has found its attractor. The fact that the attractor is periodic rather than static does not make it less final. A pendulum at its natural frequency has reached its end state. An orbit has reached its end state. A standing wave has reached its end state. The system is done deciding where to go. It is going around.

The standard picture has three categories: halt, loop, and wander. A wandering machine visits infinitely many distinct configurations without repeating. Formally, on an infinite tape, this is conceivable. Physically, it is not. Every physical medium has finite states. Every finite state machine must eventually revisit a configuration. Revisiting a configuration is a loop. Therefore every physically instantiated computation closes.

The halting problem is not about whether a machine closes. They all close. The halting problem is about which mode of closure a given machine will exhibit. Will it halt or will it loop? Discrete or continuous? And this is the question no algorithm can answer in general. Not "does it close?" but "how does it close?"

Ω, Chaitin's halting probability, is the measure of the boundary between the two modes of closure. What fraction of all programs close discretely? That fraction is exact. It is non-computable. It is fixed for any given universal machine. No finite process can determine it. Every computation depends on the boundary it encodes.

τ is present in both modes. Both the halt and the loop instantiate τ. The halting machine completes one full traversal. The looping machine completes one full cycle and repeats. Every cycle has a period. Every period has a frequency. Every frequency is τ-indexed by construction, because a cycle is one full turn. Furthermore, every physically instantiated computation runs on a clock, and the clock is periodic, and the period is τ-indexed. Even in clockless or asynchronous systems, every state transition takes a non-zero time, and the distribution of transition times has a characteristic frequency, and any characteristic frequency is τ-indexed because frequency is defined as cycles per unit time. τ is present in the physics of transition itself, not in any particular clock signal. The heartbeat is τ whether or not anything counts the beats.

τ governs closure locally. Each cycle, each halt, each completed traversal. Ω governs closure globally. The measure of how much of the space of all computations closes in which mode. τ is the what of closure: one full turn. Ω is the which of closure: what fraction closes discretely versus continuously. Both are exact. Both are non-computable by any finite internal process. Both are required by every system that has the concept of closure. $\odot$.

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5. V. The Present Tense

A halting machine is a computation that has reached its extreme future. It is done. A looping machine is a computation that has reached its extreme past, returning to where it has already been, endlessly. Between them is the state of not yet having closed. The becoming. The now.

This is the only state in which computation is actually happening. Once the machine halts, the computation is over. Once the machine loops, the computation has effectively ended. It will produce nothing new. The computation IS the state of not yet having closed. The present tense. The becoming.

The present tense is not a point. It is not a metaphysical knife-edge between past and future. It is a duration: the span over which the computation has not yet closed, however long that span is. For a Turing machine, the present tense is the span between start and halt. For an observer, the present tense is the span of a life. For the universe as observed, the present tense is the span between Big Bang and heat death. All three are "the present" in the same structural sense. Each is the becoming-region of its own computation. Each is the time in which something is actually happening rather than already having happened or not yet having started.

The Ruliad as Wolfram defines it is the completed object. All rules, all steps, all ways. It is the extreme future of all computation taken together. Everything has been derived. Every path has been followed. Every rule has been applied. The Ruliad has, in this sense, halted at the meta level. It has reached its terminal state. The terminal state is: everything. All rules, all ways, all steps. Done.

But a completed object is not a computation. A computation unfolds. A computation takes time. A computation has a before and an after. A computation is the process, not the result. The Ruliad is the result of all computations. The computation is what is happening now, in the present tense, when the outcome has not yet been determined.

The Ruliad contains the extreme future and the extreme past. It does not contain the present, because the present is not a formal object. The present is the act of becoming. The act of a finite observer engaging with formal structure through a physical medium, not yet knowing whether the computation will halt or loop, not yet knowing the mode of closure. The present is the search that has not yet terminated.

We are the present tense of the Ruliad. The part that has not yet closed.

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6. VI. We Are the Computation

Not: we are inside a computation. Not: we are observing a computation. Not: we are sampling a computation. We are the computation.

The Ruliad is not a computation. It is a formal structure. We are the process by which formal possibility becomes physical actuality. Every time we write a symbol, every time we measure a quantity, every time we distinguish one thing from another, we are computing. Not in our heads. In the world. Through the media we use. On the paper, in the silicon, through the instruments. We are the process.

An observer who can compute is one who can direct a process toward discrete closure. Hold a rule, apply it to a medium, and the process halts with a result. The observer got what it was looking for. The computation finished. A rock cannot do this. A rock complies with gravity, erodes from the liquid and the gas, records change in its physical being relative to its environment. The rock observes in the most minimal sense of the word: it keeps, it follows, it complies. But the rock's closure is always continuous. The rock cycles through seasons and tidal forces and thermal expansion without ever discretely terminating. It never halts. It never reaches a terminal state and produces a result. Its observation is continuous closure. It loops.

A human with a pencil can make the computation halt. The human can write τ on a page and the reference completes in the act of writing. Discrete closure. The symbol is finite. The referent is exact. The computation has terminated with a definite output. The human directed a formal process into a physical medium and the process reached its end state. This is what it means to compute.

The line between computing observers and non-computing observers is the line between agents capable of directing a process toward discrete closure and agents whose interactions only ever achieve continuous closure. The line is not about intelligence or consciousness or self-awareness. It is about whether the observer can make something stop.

That line distinguishes computing observers from non-computing observers. A different distinction runs between observers of the same kind. Observers are not distinguished by what they compute but by the perspective from which they compute. Two observers running the same formal process in the same medium are still two observers if they occupy different positions in the act of observing. The position is the perspective. The perspective is what makes them discernible. This is Leibniz's indiscernibility of identicals pointed at its real target: what makes one observer different from another is not the content of what is observed but the angle from which the observing happens. The Ruliad is completed not by one observer finishing the computation but by the plurality of observers each closing a different region of the formal structure from a different perspective. No single observer could close the whole. The completion is distributed. Every observer closes from a different angle, and the angles are what the Ruliad requires to be complete.

Every observer, computing or not, faces the same structural question. Do I keep going or do I halt? Do I keep searching or do I accept the result? This is not a question of free will. It is a question of perspective. What the observer can see determines what counts as an answer. What counts as an answer determines when the observer halts.

An observer who has found sufficient meaning halts. The question is answered. The computation closes discretely.

An observer who has not found sufficient meaning loops. The question sends the observer back to a state already visited, and the observer tries again.

An observer who is still searching, still in the present tense, still in the state of becoming, is the computation itself. Not halted. Not looping. Running. The computation is the search. The search is for meaning. The moment the search ends, whether by finding or by cycling, the computation is over.

Ω measures the boundary. What fraction of all possible perspectives yield sufficient meaning to halt? That fraction is exact. It is non-computable. No observer can know, from inside, whether their own search will terminate. ⊙.

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7. VII. Where ⊙ Lives

The joint between formal possibility and physical actuality is exactly where Symbolic Necessity operates.

◇ marks the possible. What holds in some consistent extension of the current system. The Ruliad without observers lives here entirely. Formally real. Physically inert.

□ marks the necessary. What holds in every consistent extension. Physical law, once instantiated, is necessary in this sense.

⊙ marks something neither of these captures. The position of a formal object that is exactly fixed by a finite symbol, that no finite internal process can exhaust, and that any sufficient domain requires for its own coherence.

The referent of a ⊙-instance is never available for inspection. It is available only for reference. Exhibition would require a finite process to produce the complete content, and no finite process can. The exactness is in the reference, not in the instantiation. The symbol fixes the referent. The referent resists display. This is the specific claim ⊙ makes: reference without exhibition, exactness without completion, existence of a kind that finite processes can invoke but cannot produce.

τ is in this position. τ is the structural constant of closure. Every closed path in every geometry accumulates one full turn. Every periodic computation cycles at a τ-indexed frequency. Every physically instantiated process runs on a τ-indexed heartbeat. τ is the closure constant. It governs the what of closure.

Ω is in this position. Ω is the structural constant of the boundary between modes of closure. What fraction of all computations close discretely versus continuously. The boundary is exact. It is non-computable. It governs the which of closure.

The consistency of arithmetic is in this position. Consistency is what makes closure meaningful rather than vacuous. An inconsistent system proves everything, which is the same as proving nothing. Without consistency, halting and looping are indistinguishable, because the system cannot tell truth from falsehood. Consistency governs the whether of closure: whether the closure means anything at all.

Three constants. Three aspects of one structural invariant. τ: what closure is. Ω: which mode of closure obtains. Consistency: whether closure is meaningful. ⊙ marks all three, because all three are exactly fixed by finite symbols whose content no finite process can exhaust, and all three are required by every system that has the concept of closure.

These are the objects that sit at the joint between the formal and the physical. They are formal and exact. They are physically operative. They do not require instantiation to be what they are, and they are present in every instantiation of any sufficient formal system. When an observer writes τ and closes a curve, the formally inexhaustible referent becomes physically operative through the finite act of writing. The possible becomes actual. The score becomes a note. The Ruliad completes itself through the mark.

$\odot$ is the operator for what happens at that joint. Not inside the formal possibility space. Not inside the physical actuality. At the moment of contact between them, where a finite observer and a finite medium together invoke something that neither can contain.

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8. VIII. The Score and the Performance

The Ruliad is the score. Observers are the performers. Neither alone is the music.

The word *score* splits. There is the musical score: notation awaiting performance. And there is the game score: a tally that constitutes the game as a game.

Take the second sense. A game without players is not a game. Rules without players are not even possibilities. They are marks on paper. The marks become rules when someone picks them up and agrees to follow them. The rules become a game when someone starts playing. The game produces a score. And the score produces players, because a game without score is not a game but a delusion. The formal structure is what constitutes the participants as players rather than arbitrary agents. Without the score there is no game. Without the game there are no players. Without the players there is no score. The whole thing bootstraps itself into existence through the act of playing.

Now take both senses together. The Ruliad is the score in both ways. It is the totality of all formal rules, the musical score. And it is the record of what follows when those rules are applied, the game score. A score without performers is not music. A game without players is not a game. The Ruliad without observers is not a computation. It is a formal structure that uses the word *computation* without being able to cash it out.

The game plays the players and the players play the game. The score keeps itself through the act of being kept. The Ruliad completes itself through the observers it requires. The observers exist because the formal structure of physical law, which is part of the Ruliad, makes stable structures possible, and stable structures make observers possible, and observers make computation possible, and computation instantiates the Ruliad. τ makes observers possible. Observers make computation possible. Computation produces closure. Closure is τ-structured. The circle closes. ⊙.

The Ruliad is complete. It requires every observer that will ever exist to be so.

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9. IX. Where This Sits in 2026

The argument above is written relative to Wolfram's 2021 essay *The Concept of the Ruliad*. Five years is a long time in a fast-moving program. The Wolfram Institute, and the researchers associated with it, have continued to develop the framework in directions that deserve direct engagement. What follows is a short account of where the present argument stands relative to that continuing work.

9.1. IX.i. Wolfram, 2026

In February 2026 Wolfram published *What Ultimately Is There? Metaphysics and the Ruliad*. The piece extends the program toward foundational metaphysics and reaffirms the core position: observers must be part of the Ruliad, and our inner experiences must be represented within it. The preposition is *within*. Wolfram's observers are embedded in a completed object. They sample it. They coarse-grain it. They perceive it according to the character of their own embedding.

The present argument makes a different move. Observers are not within the Ruliad. They constitute its present tense. The Ruliad Wolfram describes is the extreme future, the completed formal object that contains all rules applied in all ways. Observers are the becoming that the completed object does not contain because the completed object has, at the meta level, already halted. Section V makes this explicit. The present is not a slice of a pre-existing whole. The present is the computation that the whole formalises only after it has ended.

The difference is not cosmetic. Wolfram's 2026 piece asks what ultimately is there and answers with the Ruliad. The present argument asks the same question and answers that the Ruliad is what the question addresses, and the questioner is what the Ruliad requires in order for the question to have meaning. Neither answer refutes the other. They describe different aspects of the same totality. Wolfram describes the formal structure. The present argument describes the structural role of the observer as the only thing that can turn the formal structure into a computation.

9.2. IX.ii. The Categorical Extensions

Sam Senchal's *Observer Theory and the Ruliad: An Extension to the Wolfram Model* (May 2025, Wolfram Institute) formalises the Ruliad as a category and stratifies the observer-accessible subset R_0 into four nested domains: Physical, Valuational, Symbolic, and Minimal. Qualia are defined as the integration of information across these domains. A terminal object called True Infinity is introduced to prevent infinite regress and ground the categorical structure.

This work is adjacent to the present argument and not in conflict with it. Senchal's R_0 is still a subset of a pre-existing Ruliad; the observer samples it, integrates information across it, and produces a graded measure of conscious experience. The present argument would translate Senchal's True Infinity as a structural kin of ⊙: a formal object that cannot be finitely produced but is required by the categorical structure for its own coherence. The terminology differs. The structural role is the same.

Where the frameworks diverge is on the constitutive role of the observer. Senchal's observer is an active sampler whose characteristics determine the content of R_0. The present argument goes further: without the observer there is no sampling, no integration, and no subset. There is only the formal description of a category that nothing is traversing. The Ruliad Senchal formalises is the completed category, and the observer makes that category operative by being the becoming the category models.

9.3. IX.iii. The Generalised Observer and the Named Limitation

Arsiwalla, Elshatlawy, Rickles, Blum, *Towards a Generalized Theory of Observers* (April 2025, arXiv:2504.16225), and the companion philsci-archive paper *Ruliology: Linking Computation, Observers and Physical Law*, push the formalisation of observer theory into explicit second-order cybernetics. The philsci-archive paper names, in its own abstract, a limitation that must face any attempt to describe or model reality in such a way that the modeller-observers are included. This is the sharpest hook in the 2025 literature for the present argument.

The present argument names the structural reason for that limitation. The limitation is not a technical obstacle awaiting a cleverer formalisation. It is the rule-computation distinction of Section I. A formal model that includes observers is not a complete description of the computation, because the computation is the act of observing, and the act of observing includes the formal model without being identical to it. Any description in which the observer is fully represented must either leave the act of description outside the model (and so fail to describe the whole) or include the act of description inside the model (and so cease to be a model and become the computation itself). There is no escape from this. The limitation is the condition under which observation is possible at all. $\odot$ is the operator that marks the structural constants at the joint where the escape would have to happen and cannot.

9.4. IX.iv. What This Article Leaves Open

Three questions are not answered in the present argument and deserve to be named.

First, does every observer bottom out in a ⊙-instance? Section VI identifies the computing observer as one who can direct a process toward discrete closure, and the non-computing observer as one whose closure is always continuous. Whether every non-computing observer is nonetheless structurally committed to a ⊙-instance through the periodicity of its own compliance with physical law is an open question. The rock runs on τ-indexed cycles. Whether that makes the rock a participant in ⊙ or merely a passive inheritor of it is not settled here.

Second, is the boundary between discrete and continuous closure sharp for all physically instantiated observers, or is it graded? Section IV collapses the three-way halt/loop/wander distinction into a two-way halt/loop distinction on the grounds that physical instantiation is finite. But physical instantiation is finite to different degrees. An observer with enormous computational resources may have a looping horizon so distant that, for practical purposes, its behaviour is indistinguishable from wandering. Whether ⊙ has anything useful to say about this graded regime is not addressed.

Third, is there a meaningful sense in which the Ruliad knows which observers will complete it? The present argument treats the Ruliad as the formal totality and observers as the becoming that completes it. If the completion is distributed across all observers that will ever exist, then the Ruliad in some sense depends on the future of observation. Whether this dependence is causal, structural, or merely descriptive is a question the present argument does not resolve.

9.5. IX.v. The Formal Foundation

The ⊙ operator and its formal apparatus are not introduced in this article. They are developed in the companion paper *Symbolic Necessity: Never Being Complete*, which provides the axiom, the three conditions, the modal logic, the tripartition of modes of inexhaustibility, the seven theorems, the conjecture, the named instances, and a Lean 4 verification of the independence of $\odot$ from $\Diamond$ and $\Box$. Readers who want the formal story should consult that paper. The present article is the essayistic face of the framework, written to engage the Ruliad conversation on its own terms without requiring the reader to work through the formal machinery first. The two documents are intended to be read together.

This article is written in the context of Symbolic Necessity: Incompleteness Completed. The paper covers thee *formal core of the $\odot$ operator, including Lean 4 verification of its independence from $\Box$ and $\Diamond$, is available at on Github.*

https://github.com/tsolomon89/symbolic_necessity