Posted by u/kiwi0fruit 3 days ago

On natural selection of the laws of nature, Artificial life and Open-ended evolution, Universal Darwinism, Occam's razor

Greetings,

I seek advice or any other help available regarding creating a specific mathematical model. It's origin is at the intersection of the following areas:

- fundamental physics (a bit),
- the theory of evolution (a lot),
- metaphysics (a lot),
- foundations of mathematics and computability (should be a lot).

The problem I'm trying to solve can be described as to ***create the simplest model possible in which the evolution of the laws of nature arises from the natural selection of structures***. This approach implies indeterminism and postulates random and spontaneous nature of some events. It is also assumed that the universe had the beginning (the first moment of existence). This task is meant to provide the tychism doctrine by Charles Peirce with a mathematically accurate dynamic model.

The mathematical model is intended to describe the process of changing of a discrete structure (like graph, consisting of

interconnected atomic parts). Moreover, it should be the process of development and complication of the structure (it should be capable of producing even complex “intelligent” agents after some presumably great time). And this discrete structure is a medium on which the natural selection works on (there can be selected individuals and environment, natural selection postulates hold).

The idea is attractive because it assumes that the beginning of the Universe was simple and self-justifying and can be described by the mathematical model that is obvious in the retrospective: just like Darwin's idea of evolution and natural selection: they are obvious, but until they were formulated it was really hard to assume them. This research program is a special case of the *Artificial life* / *Open-ended evolution* problem (OEE) that has extra constraints that come from metaphysics (I also hope they may help to solve OEE problem).

P.S. (on computability)

The only connection to computability is that individuals in the model to build presumably should incorporate recursive algorithms that change the environment (that is presumably the other individuals). I tried to imagine lambda functions or primitive recursive functions as basic ontological atoms (to incorporate to graph-like space) but failed miserably.

UPD

The whole article is a description of the research program aimed to create an atrificial universe in which we can answer any questions like "why is the present is this way not another?" (it's a better formulated ancient question "Why is there something rather than nothing?"). And this universe formulation should be enough simple and self-justifying to be a candidate for model of the our real universe.

And there are two main intuitions-constraints for this universe: 1) the start from the simple enough state (the beggining of time), 2) the complexity capable of producing sentient beings (after

enormous simulation time of cource) comes from natural selection. And natural selection postulates hold in the universe formulation.

Both these intuitions give hope that the model to build would be simple and obvious in retrospect like postulates of natural selection are simple and obvious in **retrospect**. So there is a hope that it's feasible task.

The "only" thing is left is to precisely define what are individuals and environment in the model (environment should be other individuals presumably - again from simplicity considerations) and how the process of their replication and death takes place. At the moment I'm not even sure if the individuals should be bult-in or to be emergent... (but I lean to the first option).

And sadly I have not moved far to this goal. I'm still in the situation of "I feel like the answer the this grand question can be obtained this particular way".

...

There is the article with complete description of the research problem: https://kiwi0fruit.github.io/ultimate-question

GitHub repository of the article: https://github.com/kiwi0fruit/ultimate-question

...

- *other comments on Reddit*
- *other comments on GitHub*

sagaciux 10 points · 3 days ago

I think your problem as currently stated is too open ended. Since your goal is to build a specific mathematical model, you're going to need a precise definition of what you want to achieve. Right now, the phrase "create the simplest model possible in which the evolution of the laws of nature arises from the natural selection of structures" is too ambiguous for me to unpack: what laws of nature are you looking to express? What structures are you selecting from? How do you define the process of evolution/natural selection? How would you know if your model was simpler or more complex?

The problem may become more clear if it is separated into smaller parts. I think philosophy can be open-ended and contradictory, but a model needs precise definitions. At minimum, a model needs rules and an initial state. Before trying to figure out these things, I would want to know: what do I want my model to demonstrate? Given a particular state, what should the next state look like? If the model should be simple, then I would want to include only the most relevant behaviors and states. What information does my model at minimum to function, and how much of it?

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kiwi0fruit 1 point · 3 days ago

The most of problems you mention (if not all) I tried to address or at least mention in the section 0 of the article. And in particular in the 0.1 subsection. I'm aware that I'm still far from understanding...

> what do I want my model to demonstrate?

It should be the model of open ended evolution (artificial life) (OEE). OEE means that individuals in the model with natural selection don't stop on some fixed

level of complexity but keep evolving (like life kept evolving from unicellular life to homo sapiens). But at the same time the model should be simple enough to be (like) self-justifying from philosophical reasoning (that was addressed in the mentioned section 0.1).

> Given a particular state, what should the next state look like?

If I'm to know the answer to this question then I've already had understood the model workings and I simply need to write them down in some language. That's clearly not the case now as I still lack understanding of how it should work in details.

As about "separating into smaller parts"... I have problems with that.

The name of the article is not mentioned here but it's "The Ultimate Question of Life, the Universe, and Everything". And there is a reason for it. Well enough justified (from philosophical point of view) model of open ended evolution would be a very good candidate to answer The Question. And I have no hope that such a question can be solved by splitting to smaller parts. I also can tell that all that I know about this problem suggests that it cannot be split to smaller components. But it's only my intuition so it's not an argument...

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sagaciux 3 points · 3 days ago

Reading through section 0, I still feel there is too much ambiguity to approach the problems in section 0.1. For example, what is an individual? You postulate that natural selection begins with individuals and their environment, then later you describe natural selection as the change of the model's structure over time. I'm not entirely sure

how you define structure, but I'm going to guess that it's the state of the model at a given time - a bunch of numbers, presumably. As time advances, you apply some rules and get a new state/structure. How can you identify individuals within this state/structure? Are there multiple individuals, or just one? How are individuals created/destroyed? I understand you're not sure about this either, but I think before you can even begin to answer your later questions, you need to solve the smaller problem of how to define individuals and their environment. Presumably, both are separate entities, yet they exist in a common state/structure.

I think it's impossible to answer a big general question without breaking it down into easier to manage parts. It's a bit like asking, "what is love?" There are multiple and even contradicting answers to such a question because it is too vague, and so we have to ask, what kind of assumptions can we make before answering? I may have an intuition about love which guides my answer towards a certain direction, but I can't just appeal just to intuition to generate and communicate my answer. If I want others to understand what my answer, or even my question, is, I need to precisely explain what I mean, and why I choose to make certain assumptions.

In your article, you assume for example, that a) the complexity of the universe is a result of evolution, and b) evolution is a product of natural selection, heredity, and variation. I'm not saying your assumptions are right or wrong, but you have to admit that if they are true, there must be individuals who can undergo evolution in your universe. Thus, "what is an individual?" is not merely speculative for

your model - it is a mandatory question that is required for your model to work. On the other hand, if you change your assumptions and say that the state/structure as a whole can undergo "evolution" (how would you even define evolution in this case?), then you don't need a definition of individuals at all! And what if there's some mechanism other than evolution which can increase the complexity of the universe? These are some of the questions which come to my mind when reading your ideas.

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kiwi0fruit 1 point · 3 days ago

> And what if there's some mechanism other than evolution which can increase the complexity of the universe?

I would be curious to learn about such mechanism. I guess there can be imagined some. But I guess they would fall somewhere between natural selection postulates (plus something yet unknown that would allow to precisely define what is an individual) and between sentient god that created the universe this morning with me unshaven.

The more complex structures we introduce as axioms to generate open ended dynamic universe the more we would feel the need to answer "Why these particular structures?" question.

By the way, if we ever to create the general artificial intelligence then it could be possible to make an assumption that the Universe started with a such an AI precisely defined (plus something to drive process).

But still I feel like starting with something as simple as possible is much preferable.

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sagaciux 1 point · 1 day ago

Here's a trivial example of a system that "increases the complexity of the universe". Suppose I define a universe in which there exists only a mathematical machine that outputs the digits of pi. Over time, the universe fills up with the machine's output - successive digits of pi. This universe is getting more complex over time, because pi never repeats. But this is obviously not an interesting universe, let alone a model of our universe. It does not have self-conscious individuals, for example.

My point is, there are plenty of possible universes (infinite, even) that get more complex over time. You are going to need a more precise definition of the complexity that you are looking for. A general artificial intelligence is a good candidate for generating "comlexity" because it is self-referential and self-modifying - except this is a very hard problem that hasn't been solved yet. If such an AI is the foundation of the solution to your problem, that suggests your problem is even harder than the problem of general AI.

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kiwi0fruit 1 point · 3 days ago

> but I think before you can even begin to answer your later questions, you need to solve

> the smaller problem of how to define individuals and their environment

I guess I failed to say it properly. And it's a good point to note **but** the all metaphysical considerations, all guesses and other questions are there for only one purpose: to help find out what should be the individuals (environment should be other individuals presumably - again from simplicity considerations) so that their dynamic would lead to natural selection with open ended evolution that does not stop on fixed level of complexity.

I/we should answer this only question and then make a research if open ended evolution is the case in a formulated model (how to do it is another question).

So again. The most of the assumptions I made are for philosophical self-justification that take form of choosing the simplest structures. I guess I choose them also because it's easier to work with them :)

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kiwi0fruit 1 point · 3 days ago

The whole article is a description of the research program aimed to create an atrificial universe in which we can answer any questions like "why is the present is this way not another?" (it's a better formulated ancient question "Why is there something rather than nothing?"). And this universe formulation should be enough simple and self-justifying to be a candidate for model of the our real universe.

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sagaciux 1 point · 1 day ago

I feel the entire problem still comes down to defining your individuals and their environment. For example, is there physical distance in your model? What are your individuals trying to maximize (what is their goal)? Natural selection presumably means

some of these individuals will die or otherwise fail to reproduce. What are the fitness criterion that govern this? How do your individuals decide what to do? Are they governed by a computer code? What actions does this code allow? If there is reproduction and variation, these codes would have to be combined in a way that doesn't break their functionality.

I imagine there are countless ways to define a model, most of which don't result in "complexity". If someone magically gave you a "solved" model that does what you want, it would be trivial to prove or disprove each of your intuitions and assumptions by comparing it with the solved model. But finding that model *is* the problem. As they say, the devil is in the details.

When I find myself stuck on a problem, it's usually a sign I need to take a break, rethink my goals, and learn about different approaches. Similarly, if I am having trouble communicating my ideas to someone, it is usually because I don't understand it clearly myself.

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kiwi0fruit 1 point · 19 hours ago · *edited 18 hours ago*

It seems to me that I at least managed to communicate the problem :)

Yep, the devil is in details. Even using all metaphysical assumptions I've got it still isn't enough to figure out what would individuals look like. And randomly create models and test them is not an option. I

still lack some pieces for the puzzle (assuming it's the right puzzle and it exists).

As about some of your questions:

- I would start from something like enchanced grapf like structure. So the distance is an emergent property. And the basic entity that form space is a link that means the possibility of action-impact
- Individuals don't have a goal but they have free-will that is simply a random choice from available actions-impacts to their neighbors (or to themselves even)
- I think that there should not be environment only individuals that are environment to each other. And the finness criteria comes from the Red Queen hypothesis.
- The most tricky part is that the individuals should somehow contain an algorithm that defines impacts on the neighborhood. So that algorithm changes neighbors' algorithms. Or even the algorithm changes itself also.
- **UPD** Or maybe there still should be some medium in which the algorithms with individuals emerge...

By the way, I'm on a break from this problem since summer 2016. And I still hold frustration for it...

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sagaciux 1 point · 7 hours ago · *edited 7 hours ago*

Perhaps you could start by building a simple model that demonstrates limited evolution. For example, you might include:

- **Individuals** containing **algorithm(s)** and **properties**
- A **genotype** or **algorithm** containing a **code** governs how individuals behave, which also defines a **population** of individuals sharing the same genotype/algorithm
- The universe's **rules**, which dictate how individuals are added, removed, or otherwise altered
- The universe's structure: some kind of graph or grid on which individuals have a location

A very simple model that contains some of these elements is John Conway's "Game of Life". There are individuals (cells) that live on a grid (a kind of graph), and they have one property: whether they are alive or dead. The universe's rules are: for every timestep, depending on the number of adjacent live cells, a cell either remains dead, becomes alive, stays alive, or becomes dead. This model exhibits very complex behavior with the right starting

conditions - in fact, it has been demonstrated to be Turing complete.

However, this model is missing the genotype or algorithm governing each individual's behavior, and thus lacks natural selection. Here's a way you might extend this model. First, each individual needs some properties that can be manipulated. For example, each cell might have a property - a number - called "energy". Second, each cell needs an algorithm and actions it can choose. For example, this algorithm might be written in a code which executes one instruction per timestep, looping back to the beginning when completed. The instructions might be WAIT, which does nothing, and GROW, which spends energy to bring a (random) adjacent cell to life. Finally, the universe's rules need to have interesting tradeoffs, so that it's not too easy or too hard for individuals to survive. For example, each cell might lose a certain amount of energy per timestep to stay alive. Each cell might also receive a certain amount of energy per timestep which depends on the number of adjacent live and dead cells. By tweaking these rules, you could make a universe in which cells have to spend energy strategically to stay alive.

Even though the model I've outlined so far lacks evolution, you can already demonstrate some interesting things.

For example, you could generate random genotypes, put an initial population of that genotype in an empty universe, and see which genotypes produce the most individuals or the highest energy individuals after a certain number of timesteps. You could pit different genotypes against each other by populating them in the same universe. You could repeat these experiments on universes with varying rules, and see how those rules affect the resulting complexity of the model.

The Red Queen hypothesis isn't a fitness criterion - it simply states that individuals can become more complex by competing against each other. You need to actually define a way to measure the fitness of an individual. For example, individuals might compete by growth, in which case you are looking for a population that outnumbers the rest. To express this fitness criterion, your universe might have a rule which kills x individuals every n timesteps. Or, individuals might compete by amassing the most energy. To express this, you might have a rule killing off individuals with less than y energy.

The final missing piece for evolution is reproduction. You need rules for how genotypes can be altered within the universe. The simplest would be asexual variation - when a new cell is born,

simply randomize the code that is copied. Sexual reproduction would require more complex rules for how genotypes are passed from cell to cell.

A few notes on the genotype/algorithm: first, in my outline I said each instruction takes one timestep to complete. I chose this because it gives instructions a cost, namely time, which makes shorter, simpler genomes more competitive against longer genomes. Second, if you want complex behavior to emerge out of your genomes, you'll probably want the code to be Turing complete, which means it must include branching and recursion. I haven't really thought about what code would be minimally Turing complete, but as a quick sketch, you could expand the code above to include:

- Branching: IF{a certain neighbor cell is alive/dead}, do {one action}, else do {another action}
- Recursion: GO_BACK{a certain number of instructions}

All of this would be quite interesting to build, but of course doesn't guarantee that the resulting universes would be worth studying. For example, I suspect many universes would end up in a fixed or repeating state. On the other hand, you might build a universe that gets more complex for a while, but then simply stops. In fact, even the universe

we live in might have a finite limit on complexity! It is simply impossible to know - unless you can run your model for an infinite amount of time, which is also impossible (see the halting problem). As for building a universe that ends up like ours, well, personally I'm not very optimistic. Either this perfect model of our universe would have the same rules as ours, in which case we can just look at our real universe to discover them, or the model has (drastically) different rules, in which case it would be a very interesting philosophical object, but of what relevance to our universe? I can only say to you, good luck.

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WeirdEidolon 5 points · 3 days ago

NEAT might check a lot of the boxes you're looking for (I haven't browsed through your link yet)

https://en.m.wikipedia.org/wiki/Neuroevolution_of_augmenting_topologies

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HelperBot_ 1 point · 3 days ago

Non-Mobile link: https://en.wikipedia.org/wiki/Neuroevolution_of_augmenting_topologies

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HelperBot v1.1 /r/HelperBot_ I am a bot. Please message /u/swim1929 with any feedback and/or hate. Counter: 204972

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WikiTextBot 1 point · 3 days ago

Neuroevolution of augmenting topologies

NeuroEvolution of Augmenting Topologies (NEAT) is a genetic algorithm (GA) for the generation of evolving artificial neural networks (a neuroevolution technique) developed by Ken Stanley in 2002 while at The University of Texas at Austin. It alters both the weighting parameters and structures of networks, attempting to find a balance between the fitness of evolved solutions and their diversity. It is based on applying three key techniques: tracking genes with history markers to allow crossover among topologies, applying speciation (the evolution of species) to preserve innovations, and developing topologies incrementally from simple initial structures ("complexifying").

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Rococoon 3 points · 3 days ago

When do you want to start working on it? I think it is super interesting and I would like to help you think about it, however I am super busy right now... I do think that I might be able to help though given my background.

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kiwi0fruit 1 point · 3 days ago · *edited 3 days ago*

Actually I worked on it till summer of 2016. The article by link is a compilation of what I was able to figue out (mostly guesses and questions with details) - I've recently added final bits to the 2016 article and started

to search for help once again - I feel like I've reached my limit or burnt out.

If you feel like you have thoughts or anything useful please do not hesitate to comment here or even make a pull request to the repo (or communicate any other way you like).

I'm also going to be busy from now on but "It does not matter how slowly you go as long as you do not stop" :)

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kiwi0fruit 1 point · 2 days ago

You might be interested in the **UPD** section I added to the main post. There is a short description of the assumptions that make the task look feasible. They are the core of the research idea.

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pdxdabel 3 points · 3 days ago · *edited 3 days ago*

I'd suggest taking a look at Les Valiant's paper on Evolvability -- it investigates questions relevant to your agenda about the relationship between computation and evolution, grounded in Valiant's early framework for understanding machine learning from a theoretical perspective, PAC Learning.

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UnderTruth 3 points · 3 days ago

Sounds like you should talk with /u/userdna46 -- see if you two can come to consensus.

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noam_compsci 2 points · 3 days ago

Page not found on the kiwi link

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kiwi0fruit 2 points · 3 days ago

thanks! fixed.

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noam_compsci 1 point · 3 days ago

Thanks! Looking forward to reading.

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Voidwarped 2 points · 3 days ago

The Origins of Order: Self-Organization and Selection in Evolution.

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kiwi0fruit -2 points · 3 days ago · *edited 3 days ago*

After few years of research (2014-2016 mostly) I think about all **books** on the topic with a **great** scepsis. May be you know if there is an article on the topic? But still thank you!

UPD

Shame on me: I've forgot that such books in most cases have assosiated article(s) - for example books by Lee Smolin about time have a nice short article on the same topic: "Temporal naturalism".

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daermonn 5 points · 3 days ago

Hey! I think some of my readings in recent years are relevant to what you're trying to do. It's a really fascinating space.

Generally, agency is a thermodynamic engine that consumes resources to produce work that's invested in the agent's future productive capabilities, with the side-effect of entropy production. From the perspective of the universe, entropy production hastens time and renders the universe a simpler computational object, so entropy-maximizing paths - including abiogenesis - are more likely to be realized. There's deep math in information theory, thermodynamics, and (quantum) physics that I don't understand well enough yet, but that's the overall picture.

Here are some links to authors/concept that might be valuable to you:

- Causal Entropic Forces - Wisner-Freer & Gross: a formal model of agency roughly along the lines sketched above, where an agent produces/disperses entropy to maximize future freedom of action
- Friston's free energy model of agency: another formal model of agency from a neuroscientific perspective, with a focus on free energy in the system
- Empowerment: An agent-centric model of control - Klyubin et al.: another model of agency, with a focus on the throughput velocity of information through an agent's sensor-actuator circuit
- Jeremy England's work on the entropic gradient that incentivizes abiogenesis

Some other folks writing in the space that I'm much less familiar with:

- Ilya Prigogine, of course, who won the Nobel for his work on the nature of time, irreversibility in thermodynamic systems, far-from-equilibrium dynamics, and dissipative structures
- Alfred Lotka, a 20thC physicist who wrote extensively on the relationship between evolution and physics
- Rod Swenson, who is apparently regarded as a bit of a crackpot, but whose ideas seem very interesting
- Chaisson's Energy Rate Density as a Complexity Metric & Evolutionary Driver is another work in this space I'm not terribly familiar with
- Philosophers like Bataille, Deleuze & Guattari, contemporary accelerationists, etc have interesting ideas around this from the perspective of continental philosophy, which is just as hard to parse as the math but along a different dimension

Check out also, e.g., the quantum source of spacetime, which casts space as quantum entanglement networks and time as the breaking of entanglement, which is apparently a big improvement in the complexity of the math we use to represent spacetime, and which provides a path forward for quantum gravity as the density of entanglements. This is important because entropy is in some sense a measure of entanglement or causal relationships; think about entropy as information-theoretic uncertainty within a causal model of epistemology for an intuition pump here.

It sounds like you're less interested in, e.g., specific models of agency,

At the end of the day, I don't really know. I wish I could be more helpful. Most generally, there's some super-deep, super-important underlying unity between thermodynamics, information theory, physics and cosmology, evolutionary processes, machine learning and optimization, linear algebra and topology, markets and efficiency, etc etc etc, but I don't have the mathematical maturity of conceptual clarity to really explicate it.

Godspeed, let me know what you find!

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kiwi0fruit 1 point · 3 days ago

Oh my macaroni! That would be a hard read through (when I get free time and motivation). Thanks a lot as it seems like there can be something very useful.

If not my metaphysical hopes I would have dropped this task long ago. And hopes are about that the desired model should be simple enough to imagine and create (even for me): start from the simplest state of finite and discrete space (presumably that consist of atomic agents that can influence/change each other), laws that govern change of the space are immanent to agents and not much more complex than natural selection postulates, and etc.

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daermonn 1 point · 3 days ago

Haha yeah, it's a lot, I sympathize as I never do the readings I should.

And yeah, sounds like you will be most interested in the underlying thermodynamics/information theory/statistical mechanics.

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Voidwarped 2 points · 3 days ago

I'm not aware of too many articles, but you could try this one co-authored by Kaufmann a few years before the book was published.

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kiwi0fruit 1 point · 3 days ago

Thanks!

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GayMakeAndModel 2 points · 3 days ago · *edited 3 days ago*

Divise a Universal Search algorithm that utilizes a select set of modern programming techniques.

Then devise a Universal Search (US) algorithm for Universal Searches.

Edit: clarity and to add that bonus points are awarded for using a finite, partially-ordered set of Hermitian operators to move from time(0) to time time(N)

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harrisonr98 2 points · 3 days ago · *edited 2 days ago*

Hello, the title of this post caught my eye. I knew it would be some sort of ultimate question about everything.

I love how ambitious you are - trying to define the problem and solve it in one post on reddit). Perhaps you're underestimating the complexity of both processes.

This topic, or problem, you're talking about is so complex that it's extremely hard to define it in words that would describe its true nature. It's interesting how people can still understand what you're talking about. It seems to me you're looking for a not just a theory, but a mathematical model of everything. It is important to note that this question deals with consciousness because the nature of universe consists of objective nature (quantitative) and subjective nature (qualitative).

Let's start by defining the problem correctly...

Some people who have commented claim that your original question is too ambiguous to be the definition of the problem being solved by a computational model. You mention "evolution of laws of nature" and "natural selection of structure" and it doesn't seem clear to me what exactly you're talking about.

You seem to be trying to define current state of the world, universe, or everything. With this information you could predict how it originated and how exactly it will change in the future. This is the "simple" model you're looking for.

I think a better way of phrasing this problem is to be less ambiguous and more precise with what you're talking about. If you want a simple answer, ask a simple question.

How - exactly - does everything operate, based on the current state of everything?

Despite the lack of specificity, would you agree that this a more well-defined problem? To me, using the word "everything" is easier and more useful than trying to define everything because we all can agree on what we're referring to when we say "everything": the universe. The universe is an example of a complex system. A complex system is any system featuring a large number of interacting components (agents, processes, etc.) whose

aggregate activity is nonlinear (not derivable from the summations of the activity of individual components) and typically exhibits hierarchical self-organization under selective pressures Saying the laws of nature and structure leads one to think these systems are separate when they are in fact both part of one complex system we can refer to as “everything”. Understanding exactly what everything means requires an unimaginable amount of power. Everything includes every single thing in existence and everything at once - everything that has ever existed and everything that will exist. Everything is an objective thing with quantifiable features like the laws of physics that is only observed through subjective things like human beings and other biological organisms. It is important to note that the definition of “everything” is different from person to person, however everyone can agree that the word makes sense to represent everything in their world (or perception).

So, you might ask, if everything is so hard to define, what would be computed to predict the future?

Well, some things just don’t need to be defined by all of its physical attributes to be used for some purpose. Usually, complex systems are defined by emergent properties that come about because of interactions among the parts. A classic traffic roundabout is a good example, with cars moving in and out with such effective organization. How can people predict the flow of traffic to drive safely to their destination? This seems obvious if you have experience driving on a populated roadway. These drivers don’t know everything about this roundabout (how it was built, the names of the drivers in the other cars), but they know how they function. This only requires part of an understanding of a roundabout. Another example the phenomenon of life as studied in biology - it is an emergent property of

chemistry, and psychological phenomena emerge from the neurobiological phenomena of living things.

From Wikipedia, “Emergence Theory” - Whenever there is a multitude of individuals interacting, an order emerges from disorder; a pattern, a decision, a structure, or a change in direction occurs.

(I’m only quoting Wikipedia because it’s an example of an emergent property of human communication and organization.)

I think you would be interested in researching complexity theory as well as computational complexity theory.

“Complexity theory is the study of complex and chaotic systems and how order, pattern, and structure can arise from them.”

“Computational complexity theory is a branch of the theory of computation in theoretical computer science that focuses on classifying computational problems according to their inherent difficulty, and relating the resulting complexity classes to each other.[1] A computational problem is understood to be a task that is in principle amenable to being solved by mechanical application of mathematical steps, such as an algorithm, which is equivalent to stating that the problem may be solved by a computer.

A problem is regarded as inherently difficult if its solution requires significant resources, whatever the algorithm used.”

Something I’ve derived from studying complexity theory: An interesting relationship between objective nature and subjective organisms is that as the environment becomes increasingly complex, so does the organism.

Also, research the hard problem of consciousness.

:)

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kiwi0fruit 1 point · 2 days ago

Assuming the length of your post I suggest it was written before I added the **UPD** to the main post. In there I put the key points of the research program (as the talk with u/sagaciux shown I scattered and buried them across the article so they are not obvious). Please see them if not already.

The two assumptions/intuitions mentioned are the reason I desided to try to try to solve this problem.

As were said here:

> Apart from various other concerns one comment: Evolution comes with an increase in complexity, whereas the physical laws evolve from (possibly) a complex unified theory at large energies etc. to arguably simpler effective theories (particles, distinct forces)

If I thought that the theory of everything would be a complex one I would never tried to find it. And so the main idea from latest **UPD** takes place:

> Both these intuitions give hope that the model to build would be simple and obvious in retrospect like postulates of natural selection are simple and obvious in retrospect. So there is a hope that it's feasible task.

I might be biased with Streetlight effect but it still seems attractive and promising to me to search for the answer in this simple form.

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WikiTextBot 1 point · 2 days ago

Streetlight effect

The streetlight effect is a type of observational bias that occurs when people only search for something where it is easiest to look.It is also called a drunkard's search, after the joke about a drunkard who is searching for something he has lost:

A policeman sees a drunk man searching for something under a streetlight and asks what the drunk has lost. He says he lost his keys and they both look under the streetlight together. After a few minutes the policeman asks if he is sure he lost them here, and the drunk replies, no, and that he lost them in the park. The policeman asks why he is searching here, and the drunk replies, "this is where the light is".The anecdote goes back at least to the 1920s,

and has been used metaphorically in the social sciences since at least 1964, when Abraham Kaplan referred to it as "the principle of the drunkard's search".

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harrisonr98 1 point · 2 days ago

Yeah I wrote that before you updated the post. Now I see that you're really looking for a simple theory of everything and I understand what you mean. I briefly read your article and I can see you've spent a lot of time and effort into the question you originally asked. Sorry for trying to put words in your mouth□.

You're trying to come up with a theory of how laws of physics evolve. Is this correct?

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kiwi0fruit 1 point · 2 days ago

I hope that something that resemble the laws of physics emerge in the model. But that not the thing I'd like concentrate on. I'm more interested in seeing the emerging populations of individuals that are stable and have enough coherent behavior (like individuals in a pulation quiet alike in comparison with other species). And then seeing that populations change in time and become more and more complex.

As about laws of physics: they may be a properties of a particular individual universe if we are to remember the cosmological natural selection by Lee Smolin. (if we are under mentioned research assumptions of simplicity).

So the task is much more about special case of artificial life and open-ended evolution than about physical laws. But the desired model can still be a good candidate for a theory of everything. But it might (or would) be very hard to test it.

It also may be that there is a way that position invariant laws on physics (that hold across the universe) can emerge from natural selection. It's an interesting way of research but I haven't thought of it much...

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Meguli 2 points · 2 days ago

Chaitin might have material that can inspire you.

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kiwi0fruit 1 point · 2 days ago · *edited 2 days ago*

Thanks. Looks like a big area to search through...

Random thought: I hope that the desired model of the natural selection would not resemble Chaitin's constant: as we can reason about it to some extent and have constraints that allow it. But we cannot have it's digits...

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Meguli 1 point · 2 days ago

I am not well-versed in this area but a model that strong may not be within the boundaries of halting problem. As I said, I am not that experienced and have no clue whether you can escape limitations of Chaitin's constant. Still, I think that's a good starting point for theoretical analysis.

In a lecture, I saw Chaitin's dislike for dynamical models approach to this problem and he was criticizing Turing for dabbling in PDEs for such problems. But that kind of numeric optimization might be your only bet.

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quiteamess 2 points · 2 days ago

https://link.springer.com/chapter/10.1007/978-3-642-28111-2_12

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zergling_Lester 2 points · 2 days ago

1. Much cleverer people tried that before, what makes you think that you can do better? Ignorance.
2. Go pirate and read https://en.wikipedia.org/wiki/Gödel,_Escher,_Bach, this will get you up to speed with the 1970s state of the art of that stuff and make you realize how much you don't know in the process. Also, it's so damn enjoyable, to be honest with you fam. Anyways, it'd provide a perfect starting point into more serious inquiries.

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WikiTextBot 1 point · 2 days ago

Gödel, Escher, Bach

Gödel, Escher, Bach: An Eternal Golden Braid, also known as GEB, is a 1979 book by Douglas Hofstadter.

By exploring common themes in the lives and works of logician Kurt Gödel, artist M. C. Escher, and composer Johann Sebastian Bach, the book expounds concepts fundamental to mathematics, symmetry, and intelligence. Through illustration and analysis, the book discusses how self-reference and formal rules allow systems to acquire meaning despite being made of "meaningless" elements. It also discusses what it means to communicate, how knowledge can be represented and stored, the methods and limitations of symbolic representation, and even the fundamental notion of "meaning" itself.

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kiwi0fruit 1 point · 2 days ago

1) Smartness is drastically not enough to find that answer. You need to be lucky to pick the right direction. Another necessary components are metaphysical considerations and desire for mathematical presicion.

I'm aware that from this on the task seems to tough for me...

And luck is that main factor. Do you know someone who tried to solve this task using metaphysical considerations attempted to bring some math and bet on natural selection as a mechanism that gives novelty?

If yes then I would be very glad to read what they wrote. If no then your first point is rather useless.

2) As about Hofstadter I tried to dig into his idea of strange loop. I felt like this crazy thing may be useful in that crazy task. But I wasn't able to think about it non-contradictory. May be I really should read the book :) Even if it would be just for fun in the end.

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sagaciux 1 point · 1 day ago

I would suggest that smartness is more important than luck, because there are too many possibilities to stumble upon one by accident. One of Godel, Escher, Bach's arguments is how a self-referencing "strange loop" can be constructed from Godel's incompleteness theorem. What's interesting to me is how specific this construction is, and how long it takes. It's not an argument you could stumble upon, rather, it's something that was carefully thought out and constructed, piece by piece.

The fact that nobody has previously answered your question should be a sign that it is a very hard

question. You may not know of anyone who has tried to bring math and natural selection into solving this problem, but if there are thousands of smart people who have thought about it, what are the chances nobody has tried this combination? I mean, I've thought about it in the past as well, which is why I'm interested in engaging you. As for metaphysical ideas, without knowing a solution, how do you know your metaphysical intuitions are leading in the right direction?

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kiwi0fruit 1 point · 20 hours ago

That's definitely a hard problem. But I hope it has a non-complex non-obvious solution (see the **UPD** to he main post). All I did actually for solving the problem is that I came up with some intuitions in what direction the solution can be obtained. These intuitions might lead in the wrong direction. I'm aware of it. But taking into account metaphysical considerations about simplicity and justified complexity (that root to the "the world was created this morning with me unshaven"-like considerations) I can image only two solutions to the problem:

1. Minimal open-ended model with natural selection that has the beginning of time
2. Model with general artificial intelligence at the beginning of time (aka The God)

As we all know the natural selection is capable of producing sentient beings so it's simpler from Occam's razor to go with the first option not the second.

P.S.

The beginning of time metaphysically justified by anti-"intinite elephants"-like considerations.

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criticalcontext 1 point · 3 days ago

So you want to make a theory of everything. Good luck...

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SnowceanJay 1 point · 3 days ago

This is a really interesting problem!

Regarding the compsci side of this project, the most obvious things to look into are, imho: evolutionary algorithms (of course), multi-agent systems, emergence and self-organization.

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