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Posted by u/kiwi0fruit 1 month ago

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

The simplest artificial life model with open-ended evolution as a possible model of the universe, Natural selection of the laws of nature, Universal Darwinism, Occam's razor

Introduction contents:

Intro pt.1

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 (an important bit),
- the theory of evolution (a lot),
- metaphysics (a lot),
- foundations of mathematics and theory of computation (should be a lot).

The problem I'm trying to solve can be described as **to create the simplest artificial life model possible with open-ended evolution** (open-endedness means that the evolution doesn't stop on some level of complexity but **can** progress further to the intelligent agents after some **great** time). There are analogues to laws of nature in this dynamic model: 1) postulates of natural selection + some unknown ontological basis, 2) pool of phenotypes of evolving populations that are relatively stable on some time periods so they can be considered "laws". This approach implies indeterminism

and postulates random and spontaneous nature of some events. It is also assumed that the universe had the first moment of existence with relatively simple structure.

Intro pt.2: Key ideas

The key idea of this research program is to create an artificial universe in which we can answer any questions like "why is the present is this way not another?", "because of what?" (it's a better formulated ancient question "Why is there something rather than nothing?"). So any existing structures can be explained: as much entities as possible should have a history how they appeared/emerged - instead of postulating them directly. Moreover the model itself needs to have some justification (to be a candidate for model of the our real universe).

There are two main intuitions-constraints for this universe: 1) the start from the simple enough state (the beginning of time), 2) the complexity capable of producing sentient beings (after enormous simulation time of course) comes from natural selection which postulates are provided by universe model rules. The two 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** (they are obvious, but until Darwin formulated them it was really hard to assume them). So there is a hope that **it's feasible task**.

The model to build is a model of complexity generation. At later steps the complexity should be capable of intelligence and self-knowledge. 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"

Intro pt.3: Justification and best tools

Those two intuitions come from the following:

The best tool I know that can historically explain why the particular structures exist is Darwin's evolution with natural selection. And the best tools to justify the model of reality are [falsifiability](#) and [Occam's razor](#). First states that the theory should work and be capable of predictions. The second states that among models similar in respect to falsifiability the simplest one should be chosen.

If we are to go with natural selection as novelty generating mechanism then we should think that Lee Smolin's [Cosmological natural selection](#) (CNS) hypothesis is likely to be true. And that means that our observable universe could have had a very large number of universes-ancestors. This means that it would be really hard to apply falsifiability to the model to build. In the best case when built (sic!) it could provide the basis for General relativity + Quantum mechanics unification theory (or could not...). In the worst case we only get the restriction that our universe is possible in the model. I.e the populations of individuals that **resemble** our laws of physics should be **probable** to appear and our **particular** laws of physics are definitely **possible** to appear (either it's a group dynamic or a single individual universe like in CNS).

Luckily we also have an artificial life open-ended evolution (a-life OEE) restriction and Occam's razor. OEE means that at least in itself the model must show specific dynamics. And we already can assume that the model should be as simple as possible (and if the assumed simplicity is not enough then we should make it more complex). Though simplicity by itself cannot be a justification I have a hope that selecting the simplest workings from many **working** a-life OEE models could be a justification (proof of the theorem that the selected workings should be in every a-life OEE would be even better). And I mean a justification for basic rules that govern the dynamic of the model. By the way, this way we can justify a model obtained via any other research program. So if some "Theory of everything" appears we don't need to ask "why this particular theory?". Instead we should check for

other (simpler?) models that do their work as good and then reason of necessary and sufficient criteria.

More about justification: [Are Universal Darwinism and Occam's razor enough to answer all Why? (Because of what?) questions?](#)

Intro pt.4: The model

The research program uses the artificial life model with natural selection as a basis. This means taking inspiration in natural selection of biological life (**NS**). Also adding Occam's razor (**OR**) to the picture. In order to continue we need to precisely define what are individuals in the model (and environment if needed) and how the process of their replication and death takes place. There are some properties of the model we can assume and go with:

- The are **individuals and environment** (NS). *Either*: the individuals are the environment for other individuals - there is nothing except individuals (OR). At the beginning of the Universe there were only one or two individuals (OR). *Or*: there's environment of which individuals are built (and environment may not be governed by NS postulates).

- **Time is discrete and countable infinite**, there was the **first moment of existence of the Universe**, **space is discrete and finite** (OR). We can start thinking about it with a graph-like structure with individuals of NS as nodes - graph is the simplest space possible (OR, NS).

- **Reproduction**: individual has a potential to reproduce itself (NS). Individuals can **double** (OR).

- **Heredity**: properties of the individuals are inherited in reproduction (NS).

- **Variation**: when the individual reproduces itself, the reproduction does not occur precisely but with changes that are partly **random/spontaneous** (NS).

- **Natural selection**: the individuals that are more adapted to the environment survive more often (NS). It actually Captain Obvious says that "**survive those who survive**" (OR). If we use analogue with biological life then we can assume something like living in the stream of energy using the difference in entropy (so **stream-like behavior** can be put to the model). If there's nothing except individuals (no environment) then maybe node-like individuals can not only come to existence but also die and disappear.

- Natural selection and evolution are **open-ended**: they do not stop on a fixed level of complexity but instead progresses further. And they are capable of producing sentient individuals.

- The **Turing-completeness** is desired for the model: in theory there can emerge (be?) complex emergent individuals performing algorithms. Presumably **complex algorithms require a lot of space and time** so they are made up from many basic individuals.

- ...

- More **complex laws are emergent** from algorithms formed by surviving stable individuals that **change other individuals** (or environment if there's any).

Continue reading:

- GitHub repository of the article: [github.com/kiwi0fruit/ultimate-question](#)

- [Discussion on GitHub](#)
- Subreddit to follow up: [r/DigitalPhilosophy](#) (I would also post to other subreddits but the posts can be deleted or downvoted as follow up is not that interesting as oroginal post)

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🔺 [sagaciux](#) 11 points · 1 month 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 · 1 month 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 4 points · 1 month 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 · 1 month 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 2 points · 1 month 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 · 1 month 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 · 1 month 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.

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".

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🔺 **sagaciux** 2 points · 1 month 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 · 1 month ago · *edited 1 month 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 2 points · 1 month ago · *edited 1 month 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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⬆ **kiwi0fruit** 🎤 1 point · 1 month ago
⬇ As I always say the great role in my assumptions play intuitions of simplicity resembling Occam's razor.

And I also try to apply it to the question "What should the individual be?". And in case we try to define individuals in some particular way the question "Why individuals are this way not the other?". Answering these questions is important for justifying creation of a toy-model of universe (so that it's a universe that has The Beginning of Time not just a model that has a it's cause of existence in the form of people).

And the answer to this question should be satisfactory (that's what I called 'self-justifying' later).

For example if we build a model and define the individuals the first question is "how many individuals should we set?". From simplicity assumptions it should be one or two. Others would appear via reproduction mechanism. One is preferable but the final choice depends on dynamics we can get from one or two that depends on other properties of the model (that are yet to be defined). And if start from single individual then the next time step presumably should have two individuals. And that may give some hints about the **rules** to define.

Another possible way of justifying the individuals design is "gauging away" as Lee Smolin called it. It's like specifying equivalence class on a set (so the "real" structure is the structure of the equivalence class not the particular implementation) or like Electric potential that is defined up to a constant (so the class of solutions that differ on a constant is effectively the same tool). Random thought about the model to build: different ways of defining algorithms (that are like DNA for the individuals) may be the particular implementations and the real thing is the model after "gauging away".

But I feel like going the way of "gauging away" is too tough for me... I'm not good at creating complex things aver and over again. If go this way there should be created many flawed models that would lead to my disappointment and eventually decrease motivation to zero :) So would like to leverage metaphysical considerations as much as possible.

I hope that the justification via simplicity considerations not only the extra burden to keep in mind but also a help. Because if metaphysical simplicity considerations are right hypothesis about the beginning of time then we should build a model using these considerations. But it they are wrong then I give up to build a model that may be of any complexity (and Universe itself then should be unknowable or unexplainable - with this I also give up).

> I mean, I've thought about it in the past as well, which is why I'm interested in engaging you.

By the way, did you use some philosophical or common-sense considerations when you thought about? If yes then what considerations it were?

> You need to actually define a way to measure the fitness of an individual.

But why? Fitness criteria as it's in bioliogy is a tool for studying the process of natural selection. It's not an objective thing that exist.

Or you simply mean the answer to the question "what death means in the model?" (and how it works). That's a good question. At the moment I cannot choose from simplicity considerations if there should be explicit death criteria in the model or it should be emerging property (like if the "genotype" is absent in the simulation at particular time then the genotype is extinct).

> **algorithm(s)** and **properties**

From simplicity considerations it is desirable the algorithms actually also be the properties. That is, the properties of individuals is how they affect and change other individuals (that is should be encoded in the algorithm). But that's a hard idea to think of. When thinking about it sometimes strange loop come to mind. Sometimes that the atoms of the universe should be something more simple than individuals and the individuals emerge from these atoms...

> In fact, even the universe we live in might have a finite limit on complexity!

I think that our universe is capable of containing general intelligence (artificial or not). I think the ability to reach this is good constraint, but a vague one :)

> As for building a universe that ends up like ours

As stated by other commenters:

> the laws of nature are not living organisms that seek to produce offspring. They are not subject to natural selection, they are just a

> fixed variable of the environment.

And we observe them this way. For this I assume that the fixed laws of nature can be the properties of the universe that may be one of the individuals-universes from Lee Smolin's [Cosmological natural selection](#).

It's unknown why laws of nature are this way not the other. I cannot come with idea better than the proposed research task described in the main post.

> but of what relevance to our universe?

My only hope for relevance to our universe is that we can judge about possible properties of the possible universes and even about their probabilities.

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▲ sagaciux 2 points · 1 month ago
▼

I don't think you can avoid philosophical or common-sense ideas if you are trying to design a universe from nothing. In my outline of "Game of Life" there are already assumptions about the existence of individuals, a grid that defines neighbors, the existence of time stepping forward... every assumption is some kind of philosophical or common-sense idea humans have about the universe. What's the point of arguing about the right assumptions, when the proof is in the model? As an analogy, you don't show that humans can fly by having a philosophical debate, you show it by building an airplane. Besides, assumptions can be wrong. Common sense says the sun goes around the Earth, but astronomy shows it makes more sense for the Earth to go around the sun.

When you are designing a model universe, things like fitness criteria and the laws of nature no longer have any intrinsic meaning, except as you define them. For example: in the real universe, death is a name we have for some chemical reactions stopping and others starting. But in a model you can explicitly define death - give it a numerical property and specific conditions which cause it. Or you can choose to leave it out. You keep talking about removing things and getting to the simplest or most minimal model - but even the smallest model has to define *something*. So the choice of what to define is the problem.

I'm not sure what else I can say to help you. I've described the way I would build a model and explore what is possible. Either you can start building models to verify your ideas, or you can keep speculating forever.

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▲ kiwi0fruit 🎤 1 point · 1 month ago
▼

Thank you for thoughtful and useful conversation! Yep, both speculations and model are stuck at the moment. So the better

option is to start again doing not waiting for a miracle or a savior.

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▲ **kiwi0fruit** 🔦 1 point · 1 day ago · *edited 16 hours ago*
▼ By the way: I've dropped self-justification and permanent talking about minimal things for good. What was left is only a necessary and sufficient "kernel" of open-ended natural selection. More details **here**.

So now all I can do is at last start creating open-ended natural selection model. That's a hard task and I no longer have any excuses :)

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▲ **WeirdEidolon** 5 points · 1 month 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 · 1 month 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 · 1 month 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 · 1 month 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 · 1 month ago · *edited 1 month 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 · 1 month 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 · 1 month ago · *edited 1 month 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 · 1 month ago
⬇ Sounds like you should talk with /u/userdna46 -- see if you two can come to consensus.

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⬆ **kiwi0fruit** 🔧 · 1 point · 11 hours ago
⬇ I tried to comprehend what he is writing... but I haven't found where he elaborates on dynamics of adding new axioms. So it seems rather useless for me (may be not just for me...).

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⬆ **UnderTruth** · 1 point · 5 hours ago
⬇ But have you *talked* with him?

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⬆ **kiwi0fruit** 🔧 · 1 point · 3 hours ago
⬇ Nope. Do you think it may be of help?

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⬆ **UnderTruth** · 1 point · 2 hours ago
⬇ Yes! I have spoken with him personally in the past.

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↑ noam_compsci 2 points · 1 month ago
↓ Page not found on the kiwi link

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↑ **kiwi0fruit** 🔬 2 points · 1 month ago
↓ thanks! fixed.

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↑ noam_compsci 1 point · 1 month ago
↓ Thanks! Looking forward to reading.

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Comment deleted   1 month ago

Comment deleted   1 month ago

↑ daermonn 5 points · 1 month 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 · 1 month 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 · 1 month 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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⬆ **GayMakeAndModel** 2 points · 1 month ago · *edited 1 month 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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⬆ WikiTextBot 1 point · 1 month 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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⬆ Meguli 2 points · 1 month ago
⬇ Chaitin might have material that can inspire you.

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⬆ kiwi0fruit 🎤 1 point · 1 month ago · *edited 1 month 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 · 1 month 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   ·   1 month ago

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

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zergling_Lester   2 points   ·   1 month 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   ·   1 month 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   ·   1 month 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.

sagaciux 2 points · 1 month 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?

kiwi0fruit 🖈 1 point · 1 month 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.

criticalcontext 1 point · 1 month ago

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

kiwi0fruit 🖈 1 point · 1 month ago · *edited 1 month ago*

Comments from other sources:

kiwi0fruit 🖈 1 point · 1 month ago · *edited 11 hours ago*

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)

([Bort](#))

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⬆ **kiwi0fruit** 🔑 1 point · 10 days ago
⬇ Yes, you got the main difference right. Apart from that, effective theories describe a smaller part of the reality than the unified theories. So there is no surprise that they are simpler. The assumption of the simpler state in the past and evolution that creates complexity is the attempt to answer the "Why these laws question". I cannot forsee any other ways of answering it.

And also this question fits well with Lee Smolin assumption of cosmological natural selection.

Thank you for the comment. It's a good question about the viability of the research problem.

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⬆ **kiwi0fruit** 🔑 1 point · 1 month ago · *edited 11 hours ago*
⬇ If I recall correctly, you can construct any logical outcome from a NOR and an AND operation. It then depends if you think that "it" comes from "bit". If so, there you go; if not, then you need a substrate for your logical tools to operate upon. Loop quantum gravity's spin networks, maybe.

([u/OliverSparrow](#))

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⬆ **kiwi0fruit** 🔑 1 point · 1 month ago · *edited 11 hours ago*
⬇ So... I'm going to be blunt in expressing my opinion; you're being *way* too ambitious by trying to map this all out at such a high level before starting any actual work. You need to break this up into much smaller components, "solve" them, learn from your solutions, and try to figure out a way to combine those components into something larger.

If you just want to be philosophical and wax poetic about reality and write about your ideas, then that's one thing and keep doing what you enjoy. But if you want results, you need to scale back most of your expectations dramatically.

([u/WildZontar](#))

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⬆ **kiwi0fruit** 🔑 1 point · 1 month ago
⬇ 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...

But you've got the point that breaking into smaller components can be useful - it would provide intuitions and habits of how to deal with that small parts. With these intuitions and habits the task would be easier. But this aside: I do not see how this can be slit up. Not a single idea. As I said **here** the hardest part is to formulate what are the individuals in the model and how they work (they are weakly constrained by expectations of open-endedness and some occam's-razor-like metaphysics). How to split that?

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⬆ **kiwi0fruit** 🔑 1 point · 1 month ago · edited 11 hours ago
⬇
I don't comprehend where you're going with this. I just want to comment that your unit of natural selection should probably be more on the replicator level, not individual level.

Good luck!

(u/SirPolymorph)

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⬆ **kiwi0fruit** 🔑 1 point · 1 month ago · edited 11 hours ago
⬇
Provocative but the laws of nature are not living organisms that seek to produce offspring. They are not subject to natural selection, they are just a fixed variable of the environment.

(u/Vanna_man)

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⬆ **kiwi0fruit** 🔑 1 point · 1 month ago
⬇ For this I assume that the fixed laws of nature can be the properties of the universe that may be one of the individuals-universes from Lee Smolin's Cosmological natural selection.

It's unknown why laws of nature are this way not the other. I cannot come with idea better than the proposed research task described in the main post.

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⬆ **kiwi0fruit** 🔑 1 point · 10 days ago · edited 11 hours ago
⬇
It is very possible that the structure that create what we call laws of nature have gone through some selection. If we observe something it is probably stable. Unstable structure collapse in stable one, this is also a description of biological evolution. 'Bird can fly' can be interpreted as law of nature, emerging from the structure of a bird (or its genetic code), which is collapsed from a less stable from and it's collapsing in more stable ones. The same way chemical law emerge from the structure of atoms which is stable form of matter. You can go down the abstraction all as deep as you want. The idea of evolution of law is for me well grounded. But computational model of it trivial, in the sense that is no different from simulating biological evolution. In computation evolution and selection is reduced to it's logical form that is the same no matter the context. You can use genetic algorithm to solve puzzle, play super mario or simulate cellular evolution but the model isn't changing a lot. All you change is the fitness function and the description of the replicator.

In conclusion, i think evolution of nature law is an interesting ontological idea but uneventful computation model wise.

(u/TheTorla)

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kiwi0fruit · 1 point · 1 month ago · *edited 11 hours ago*

About Section 4.1:

Your constraint 4 sounds very strange, if the purpose is to mimic natural selection. As I understand your Q, the complexity of the graph is a representation of the complexity of the "organism" (am I mistaken?). At the same time, you define 'reproduction' as the duplication of vertices, which to me sounds like an bipedal organism growing a third leg, if the graph is supposed to model the "complexity" of the "organism". How is the population size represented in the proposed model?

(fileunderwater)

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kiwi0fruit · 1 point · 1 month ago

Presumably, there are many "layers" on which populations exist. The vertices themself are the atomic individuals that are characterised by their edges. All the vertices are the basic population. But the goal of the model is to get the individuals at higher levels: as patterns in the graph (there may be even cycles of patterns changing to each other, like wave). The interesting individuals are patterns (subgraphs that persist in the changing graph during time). And there expected layers on layers.

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kiwi0fruit · 1 point · 1 month ago · *edited 11 hours ago*

To me, it is still unclear how individuals, individual traits and the population is represented in your model. It would probably be useful if you clearly defined how 'individual', 'individual properties' (which represent individual "complexity") and 'population' are represented in the model directly in your question, e.g. vertex = xxx, graph =yyy, edge = zzz.

(fileunderwater)

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kiwi0fruit · 1 point · 1 month ago

Current assumption: vertexes=individuals, edges=individual traits and the graph=population. But this is only at the "basic level". Patterns are also individuals but on the "next level".

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kiwi0fruit · 1 point · 10 days ago · *edited 11 hours ago*

Why do you think evolution can explain anything that preceded life? I feel that claim needs proper justification.

(u/sanalphatau)

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kiwi0fruit · 1 point · 10 days ago

Strictly speaking it's a a bit justified hope that natural selection can explain... everything :) It is connected to the idea of self-justifying models of universe (see more details in section 7.1).

Though as the pool of ideas I came with is still not self-justifying enough but my intuition suggests that the closest to self-justifying I can imagine are set of postulates from section 7.2 (they are in Update 2 in this Reddit post).

I don't know better candidates for explaining open-ended universe that have a balance of random and predetermined. So I bet on natural selection as it's a description of a such balanced process. **Actually the whole section 7 is my attemt to justify the claim together with noting it's obvious problems**.

To that I can add that I'm sure that any explanation of novelty generation in the universe would require either absolute random (like in independent random events in postulates of probability theory) or infinite past/actual infinity as a carpet to sweep under (to sweep the moment when novel information/event came to existence - like the result of the die toss in probability theory). But what framework to use together with random? I guess there are some theories of "emergence" out there but natural selection is a more obvious choice.

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▲ **kiwi0fruit** 🔗 1 point · 4 days ago · *edited 11 hours ago*
▼

> So. How would inheritance of laws work between universes? I don't really get what mechanisms you're thinking of here.
>
> Just because something seems right doesn't make it so. If anything studying biology should tell you is that things are often just contingency and chance.
>
> Theories are nice in a vacuum but trying to justify something like this a priori needs clear idea of what mechanisms you are imagining. How why are laws transferring across universes?
>
> Why do you think that we are in a good universe? We could be in a very suboptimal universe for law inheritence?

(u/sanalphatau)

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▲ **kiwi0fruit** 🔗 1 point · 4 days ago · *edited 4 days ago*
▼ To answer these questions I need to have a model of the universe first. That's what the physicists do. If my idea is successful can only be a help for this task - to narrow ontology of the model (and may be use probability for possible universes).

What I first and foremost want to create is a framework within which every "why?" ("because of what?") question has an answer stating how historically (via natural selection) it came to existence.

But no matter how I think about I cannot image any justification for ontology postulates except "to make it simpler" or "as much entities as possible should have a history how they appeared (instead of postulating them)". This seems interesting but it's not what I expected - I wanted a better justification.

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kiwi0fruit 🔧 1 point · 10 days ago · *edited 11 hours ago*

> Do you want to evolve the actual laws of nature, like quantum mechanics?

> If not, you can invent a near-trivial system which evolves into an arbitrary state that you can call a "law of nature".

(u/sorrge)

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kiwi0fruit 🔧 1 point · 10 days ago

Not a this stage of the research definitely. Any stable laws (or better call them stable phenotype?) would be OK. But the model should be open-ended - that doesn't stop on fixed level of complexity and is capable to evolve to sentient artificial life (I doubt that all path to intelligence is within reach of our computational abilities but don't stopping and continuing should be possible).

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kiwi0fruit 🔧 1 point · 9 days ago · *edited 11 hours ago*

> Your problem is right here - nobody has any good definition of open-endedness, and there is no convincing demonstration of any open-ended systems. So you set out solve a major open problem, that so far wasn't even clearly defined. No wonder you will find it difficult and will get no substantial help from the others.

> The "capable to evolve to sentient artificial life" property cannot even be approached now, there is not a single clue about the necessary requirements for that.

> Also, you seem to contradict yourself. Either there is a stable phenotype, or the endless increase of complexity. One excludes the other.

(u/sorrge)

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kiwi0fruit 🔧 1 point · 9 days ago

There's no contradiction: relatively stable on one time period may be chainging on another.

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kiwi0fruit 🔧 1 point · 9 days ago

And I'm fully aware that the problem is hard and help would be a rare accasion... C'est la vie.

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kiwi0fruit 🔧 1 point · 9 days ago · *edited 11 hours ago*

> Bon courage!

> I also tried to make such systems. I don't see in your text mentioning of key obstacles to OEE as I understand them. In the chapter "minimum model for OEE" you mix the description of the model and the requirements for it, the latter poorly defined. Concretely,

> * "there should be the evolution of such patterns" - the evolution and patterns are not formally defined

* "that lead to their complication" - complexity is not defined

* "incorporation the information about the graph structure or about other patterns" - information about ... and how it should be incorporated is not defined

* "evolution is led by competition for "staying alive" of such patterns with each other" - life, death is not described

So your description is, on one hand, too specific without justification, e.g. it is never said why is the concept of life and death required, or what does it even mean. On the other hand, it is too vague, in critical parts about complexity and evolution, all non-trivial concepts. As for OEE itself, it's all lumped up into the last point, "it should be the case of OEE". Any artificial system observed so far either stops at a fixed level of complexity, or generates "empty" complexity (random noise). How to define the useful/substantial/interesting complexity should be the real subject of chapter 4. Then you can start working on a model that will show the generation of such complexity.

Moreover, there is a question of how to demonstrate that the complexity grows indefinitely. There is always a doubt of whether the complexity growth will stop if you simulate the model longer. I think nobody even mentioned this in the research articles so far, even though this is a major and obvious problem with the whole field.

(u/sorrge)

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⬆ **kiwi0fruit** 🔑 1 point · 9 days ago
⬇
> your description is, on one hand, too specific without justification

All the justification I have is based on intuitive philosophical concept (lol) of self-justification that is discussed in chapter 7. It's not yet properly defined and understood (as said in ch.7.3).

All the specifics are in the model constraints to satisfy self-justification as I see it (but there are still not enough constraints to have a well defined model). There too many possible ways to build open-ended model so these extra constraints narrow an area of possible modela. So:

- self-justification uses open-ended natural selection as a solution to "where novelty in simple models comes from?" question,

- open ended artificial life (OEAL) uses self-justification to narrow space of possible models,

- it may be expected that extra constraints would make it harder to build an OEAL but I have a hunch that two task would help each other instead (if not then the whole idea of using natural selection in chapter 7.1 is wrong and then all the research direction is wrong, and then I have neither ideas how nor hope to solve that major philosophical problem).

  > How to define the useful/substantial/interesting complexity should be the real subject of chapter 4

Yep, this is another problem that would inevitable rise. But because of the sel-justification requirements (and problems with it too) I didn't get to the problem of "what is complexity?" yet.

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▲ **kiwi0fruit** 🔑 1 point · 8 days ago · *edited 11 hours ago*
▼
Your self-justification argument is flawed. As I understood it, you say that natural selection created sentient life, therefore we can replace god/AGI with NS in the theory of everything. Then you propose a particular model containing NS as the basis of theory of everything.

The problem is that NS alone is insufficient to create sentient life. Take any existing alife system with NS and see for yourself: there is no chance of sentient life to appear there. It is very likely that your proposed system will not solve the problem either. But then it cannot be self-justifying.

([u/sorrge](#))

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▲ **kiwi0fruit** 🔑 1 point · 8 days ago
▼
I didn't get how your arguments are connected to self-justifying... But NS postulates are not enough to build an open-ended evolution model.

To be correct: I do not propose a particular model. There's no well defined model at the moment. What I propose is that such a model if built would be a good candidate for a theory of everything that doesn't rise question "why this particular theory not the other?"

But to build such model something should be added to NS postulates. Something can be guessed (as in Update 2 part) but it's not enough... And how can something unknown and unobvious be self-justifying?

And are list in Update 2 (ch.7.2) self-justifying? So the worst problem is notion of self-justifying: unless I formalise it somehow I would be stuck...

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▲ **kiwi0fruit** 🔑 1 point · 6 days ago · *edited 11 hours ago*
▼
> how can something unknown and unobvious be self-justifying?

That's the essence of the argument I was trying to convey in the previous message.

([u/sorrge](#))

That sounds like a problem but I think it isn't. Until Drawing formulated postulates of NS they were unobvious and

unknown. But when he did formulated them they become obvious. So I hope the same would be for lacking part of the model.

But when thinking about it I understood that even if something is known and obvious it's still unclear that it's self-justifying :(I have some intuitive grasp of it (simplicity, Occam's razor) but formal definition is still needed to move further.

I also fear that this whole idea of self-justifying is wrong (but at least the idea about the beginning of time is OK). So I should come with another idea (like searching for equivalence classes in all open-ended natural selection models to find the simplest model).

By the way: I've dropped self-justification for good. What was left is only a necessary and sufficient "kernel" of open-ended natural selection. More details **here**.

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⬆ **kiwi0fruit** 🔑 1 point · 8 days ago
⬇ Unfortunately there are too many parts of the model to build that are still "to be formalized". And at least notion of self-justification should be formalized. Or the whole idea of research direction would be questionable.

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⬆ **kiw 0fruit** 🔑 1 point   9 days ago · edited 11 hours ago
⬇ Your research interest sounds interesting. I am somewhat familiar with artificial life, artificial intelligence and computer science but I had trouble understanding you. This may be because your post lacks proper structure and definitions. I could not distinguish between hypothesis and things which are based on other peoples research. Also, I advice you to not expect not everyone is familiar with every concept (e.g. I have never heard of Peirce's concept of Tychism before). That's why there are usually "related works" chapters in scientific works.

(u/Cbeed)

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⬆ **kiwi0fruit** 🔑 1 point · 9 days ago
⬇ The first problem resolves quickly: this whole research is a hypothesis. So the possibility of distinguishing is not meant at all.

There is no need for cites for tychism as it's not really important to the picture. But if someone is qurious (s)he can google it (but I still need to fix this bug). As for other terms that matter and may be unfamiliar: I thoght there were either cites or hyperlinks...

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kiwi0fruit 🎤 1 point · 6 days ago · *edited 11 hours ago*

> Sure, there may be a "thread" of commonality between all things... There may be a hint of objecti-ness and verbi-ness in all things. But in an effort to categorize the universe, a formalization like universal darwinism, IMO, runs the risk of conflating terms that otherwise have *utility* in differentiating seemingly different phenomena. Specifically, the phenomena of teleological activity is a characterization of animate-ness, versus otherwise non-teleological (inanimate) phenomena. By trying to push teleological characterizations down into what we would usually characterize as inanimate matter, we risk washing out the meaning of the word. Instead, I think we should identify the mechanical point of transition between animate and inanimate matter and constrain our teleological terms to those affairs *following* the transition. Or maybe I didn't read enough about your ideas.

(u/j3alive)

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⬆ **kiwi0fruit** 🎤 1 point · 6 days ago
⬇ I guess you forget to mention non-teleologic animate case of non-sentient life. It doesn't actually havs goals, only reasons why + random (But I guess this is disputable the same way as in one of your reddit posts: UI / assembler analogue).

Anyway I seek explanation and answering "why?" questions (see ch.7 for details) so I go simplicity and monism (I guess) way so the first try is to reduce inanimate to animate. Why do you think it's worse than reducing animate to inanimate (taking into account ch.7 considerations)?

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⬆ **kiwi0fruit** 🎤 1 point · 1 day ago · *edited 11 hours ago*
⬇
> Propositional Logic needs to be added to your model.

(u/kma628)

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⬆ **kiwi0fruit** 🎤 1 point · 13 hours ago
⬇ https://en.wikipedia.org/wiki/Regress_argument is on topic.

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⬆ **kiwi0fruit** 🎤 1 point · 13 hours ago · *edited 11 hours ago*
⬇
> If you could answer all why questions, then you could also answer why it is actually possible to answer all why question, and so on. Do you believe it is possible to answer why it is possible to answer why ... why it is possible to answer all why questions?

(u/Jew-el)

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⬆ **kiwi0fruit** 🎤 1 point · 13 hours ago
⬇ This whole post is about answering why questions via NS *and* at some point stopping asking them via simplicity / Occam's razor considerations. So the whole post about whether it's possible to stop answering *and* still be justified.

So in your case it's simply possible to answer all questions - it's a postulate which was set even before creating a model.

I guess there are some unanswerable questions like in which pocket there was a phone before he guy jumped into complete desintegrator. But I feel like we would have conjectures about it. Only one of which *might* be true.

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kiwi0fruit 🖋 1 point · 13 hours ago · *edited 11 hours ago*

I'm not sure what you're trying to accomplish?

So your goal - as per the main article - is that you want to create a simulation, right? So the idea isn't to make a scientific model, but a computer simulation? That's an important distinction.

Is there something you want to learn from it?

What it sounds like you aren't interested in is a simulation of the entire universe (which is good! I wouldn't want you to need a small nuclear powerplant to power your server system there).

One thought here - models are great because they allow us to abstract (isolate, or whatever other model ontology you subscribe to) from the real world. There's no need to accurately capture everything in the universe, as long as you capture the mechanisms you're itnerested in reasonably well. So I think you are overthinking it by quite a lot.

Edit: You might want to read up on the philosophy of models a bit.

([u/as-well](#))

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kiwi0fruit 🖋 1 point · 13 hours ago

> So the idea isn't to make a scientific model, but a computer simulation?

I want a mathematical model **and** computer simulation. I wouldn't call it a scientific model as it would (if created) drastically differ from a common scientific model - very hard to obtain testable results (only open-endedness is a criteria - but it still lacks formalization). It would be more like mathematical metaphysical model.

> Is there something you want to learn from it?

> There's no need to accurately capture everything in the universe, as long as you capture the mechanisms you're itnerested in reasonably well.

That's the juicy part: I want to capture everything in the first moments of existence of the universe. I assume that there's no chances that the simulation can reach our observable universe time - presumably the model would exponentially accumulate information and complexity (both junk complexity and - I hope - artificial life complexity).

> You might want to read up on the philosophy of models a bit.

Can you suggest where to start?

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kiwi0fruit 🖋 1 point · 12 hours ago · *edited 11 hours ago*

I'm sorry, I think you need to back up there a bit. What is it you want to simulate? What's the variables you want to observe? Do you have the mathematical formulas ready?

I'm asking because it sounds like you're in way over your head unless you have thought long and deep about parametrization and which variables you're interested in. I'm also not sure what your goal is - do you want to do a model for the experience? Then maybe start with some simpler evolutionary models ignoring physical models. Also, simulating the chance of life developing sounds like a non-trivial thing, where you need to make a lot of assumpions.

Look, if you want to simulate the entire universe, you'll probably need a supercomputer and a handful of physics departments at your hand.

Obviously, that's out of the question. So start with what you're interested in - simulating/modeling evolutionary development of complex features.

(u/as-well)

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⬆ **kiwi0fruit** 🎤 1 point · 12 hours ago
⬇ Oh, I actually make lots of assumptions about beginning of the universe - so that all why questions can be answered. That leads to the model and simulation of evolutionary development: the simplest artificial life model. So I don't need a supercomputer... I need a definition of the rules that govern discrete time model changes and that provide natural selection. It's a hard task and I'm aware of it.

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⬆ **kiwi0fruit** 🎤 1 point · 12 hours ago · *edited 11 hours ago*
⬇

We have the scientific method already. Its the best thing we have, in wich the Occam's razor is implemented. But often in science, especially physics and cosmology, it is hard to know wich explanation is the simplest. One example would be the disagreement between very prominet scientists about the interpretation of quantum mechanics. We can answer all "why" questions, but that does not mean those are good answers. We will never be able to explain everything, there's always gonna be something (maybe multiple things) that we'll have to accept as a "brute fact", without having an explanation for it.

(u/RemarkableBuyer)

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⬆ **kiwi0fruit** 🎤 1 point · 12 hours ago
⬇ I guess there are some unanswerable questions like in which pocket there was a phone before the guy jumped into complete desintegrator. But I feel like we would have conjectures about it. Only one of which *might* be true.

So it feels like answers are possible (in theory not in practice). We just may never test if it's true. So this whole post was about how search for answers to as much "why" questions as possible even if we lack experimental data.

There is no established practice guideline how to do it. So I ask on philosophy subreddit.

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⬆ **kiwi0fruit** 🎤 1 point · 12 hours ago
⬇

i am not sure exactly what kind of model you are talking about, or what would categorize as a "why" question. there is no way to create one model or algorithm to answer all "why" questions with the optimal answer, given an arbitrary amount of data.

Exist many categories of questions (science, engineering, history, economics, psychology, etc). the only "model" that is ubiquitus when approaching all of those is rationality, in a broad sense.

> I guess there are some unanswerable questions like in which pocket there was a phone before the guy jumped into complete desintegrator. But I feel like we would have conjectures about it.

There plenty questions similar to this one that are impossible or extremely impractical to solve, but an answer exists in principle. And, importantly, we have an accurate conceptual model to describe the answer to those kind of questions if it was given to us. exemples would be: "How many atoms are composing your body right now?" "What are the last thoughts of the person who died precisely when you started reading this sentence?" etc... there are plenty of those. And we have the conceptual framework, we know exactly how the answer look like, even if we can't have the answer.

That's not what i meant by questions we can't know the answer. i was referring to questions like "why there is something rather than nothing" "what happened before the big bang". Our lexicon don't possess the appropriate concepts to describe a possible answer to those. Even the very questions are incorrectly formulated, probably.
(u/RemarkableBuyer)

🗨 Reply Share Report Save

⬆ **kiwi0fruit** 🔧 1 point · 11 hours ago
⬇ The last two questions are perfectly fine to me :-) "what happened before the big bang" is a normal interesting question. And "why there is something rather than nothing" is easily answered via antropic principle (there is a better version of it and I adress it in the original post).

But to make it clear: when I talked about "why?" questions I sometimes mixed questions that appear inside desired model during simulation and questions of why the desired model is created this way. My bad :(

First questions are answered inside the desired model (and even questions like "desintegrator" can be answered withing the desired model). The second question is more like "why there is something rather than nothing". And I'm curious if it can be answered via formal necessary and sufficient proof (and I talk about it in the OP and original article).

But if the desired model is built and if it's really the model of our universe then it's explanation power can be joined with justification of "why the desired model is created this way". So all "why" questions would be answerable in principle... But in practice it would not be so good: it's hard to get answers from indeterministic simulation that should internally simulate many billions of years.

So the model would be locally applicable explanational framework or ontology framework. But it still seems like the existense of such a model (if built) would

render all why questions about existing reality to answerable in principle -- like "desintegrator" question.

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▲
▼ kiw 0fruit 🔑 1 point · 10 days ago · *edited 11 hours ago*

[The Origins of Order: Self-Organization and Selection in Evolution](#).

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.

(u/[deleted])

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▲
▼ kiw 0fruit 🔑 1 point · 10 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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▲
▼ kiw 0fruit 🔑 1 point · 10 days ago · *edited 11 hours 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.
>
> :)

(u/[Deleted])

WikiTextBot 1 point · 10 days ago

Streetlight effect

The streetlight effect, or the drunkard's search principle, is a type of observational bias that occurs when people only search for something where it is easiest to look. Both names refer to a well-known joke:

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.

[^PM | Exclude ^me | Exclude from ^subreddit | FAQ / ^Information | ^Source] Downvote to remove | v0.28

kiwi0fruit 🖋 1 point · 10 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 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.

kiwi0fruit 🖋 1 point · 10 days ago · *edited 11 hours 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?

(u/[Deleted])

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kiwi0fruit 🎤 1 point · 10 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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kiwi0fruit 🎤 1 point · 4 days ago · *edited 3 days ago*

(Update 3)

I started to think that this my idea of self-justification can be split into (1) something incomprehensible OR like provability (that seem useless untill analyzing the complete model). So it's better to throw it out and go with fallibilism and falsificationism. (2) something about not using global laws but instead having algorithms inside individuals that change environment. It's not really clear too but... This second part is only a hypothesis under (1) govern: the main point if the model works open-ended. Then if our universe is possible in the model, etc... (3) Using simplicity and Occam's razor a lot.

What I first and foremost want to create is a framework within which every "why?" ("because of what?") question has an answer stating how historically (via natural selection) it came to existence.

But no matter how I think about it I cannot image any justification for ontology postulates except "to make it simpler" or "as much entities as possible should have a history how they appeared - instead of postulating them directly". This seems interesting but it's not what I expected - I wanted a better justification.

Man, this article needs a concise rewrite...

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TotesMessenger 1 point · 1 day ago

I'm a bot, *bleep*, *bloop*. Someone has linked to this thread from another place on reddit:

- [/r/digitalphilosophy] Introduction complete rewrite: The simplest artificial life model with open-ended evolution as a possible model of the universe

If you follow any of the above links, please respect the rules of reddit and don't vote in the other threads. (Info /

^Contact)

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⬆
⬇   SnowceanJay 1 point · 1 month 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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