

ActInf GuestStream 034 ~ Avel Guénin-Carlut ~ “Physics of Creation”

Discussion with Avel Guénin-Carlut of his 2022 paper “Physics of creation: Symmetry breaking, (en)active inference, and unfolding statespaces”

<https://avelguenin.github.io/>

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<https://www.youtube.com/watch?v=9IPx38SHGqw>

SESSION SPEAKERS

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TRANSCRIPT

00:01 Alexis Rozanski:
Good luck!

00:07 Daniel Friedman:
Hello.

00:07 Avel Guénin-Carlut:
I'm ready.

00:08 Daniel:
Yes, we are in. It is January 23, 2023. We're here in active active inference Gueststream number 34.1 with Avel Guénin-Carlut.
We're going to have a 1 hour presentation physics of Creation. Can the free energy principle ground the construction of physical states bases followed by about an hour discussion. So if you're watching live, please feel free to add questions in the live chat and we'll also have some guests. So thank you Avel for joining and off to you for the presentation.

00:46 Avel:
Hello.
So this is a complete presentation. I will first introduce myself and the work I am I have employment physics. I'm working creative science under version of And Clark. This work is instantly speaking the product of Kyros research which is laboratory which myself, Alex Rozanski, who is present here today and other people are funded to investigate issues of relevance to political political evolution and community science. And the the topic will be on the physics of creation.
So creation is an Attial term, let us say it will be contextualized in the presentation. But let us first define that it corresponds to the construction of physical possibilities, physical test basis to talk in a more technical language. And the original question that motivated this research is whether or not the federal principle a piece of math that's emergence cognitive evidence which we will get to very sooner is capable of representing this process of creation.

02:01 So first, I have tried the first run of this without getting into the technicals, it did not work. So I will address the technicals.

First we will see some concepts in physics, what they do, how they work, how they relate to what people typically do in physics. And first I'd like to take a look at how physics explain. So, physics explain with laws. They think that in nature you have laws and those laws are basically formal statements that constrain the possible states of a system. And typically those are entailing laws that from which you can derive logically what the system will do.

An example of natural entertaining law is Maxwell's equation of electromagnetics. It is a different Maxwell than the one that is here. So what you see is four bits of vectorial calculus that will tell you

how two Fields that are collectively the electromagnetic field evolve with regard to another.

03:16 So this is a formal constraint on what ENB can do, like the quality express constraint by definition. And those can be used to derive basically fully E and B given boundary conditions, which is how you do things in electromagnetism.

But what is of relevance here is that any of the slope presupposes basically that I can define E as a virtual field. So it presupposes what is called set space, which is mathematical space that represents a set of possible states. Before I state ΔE and ΔB is equal to this and this I have to state that E exists and e can take such and such states. In that case, it is a vectorial space in three dimensions and this space basically it does by construction to capture any difference that make a difference about the system that is targeted for any change in e.

04:25 To be basically computable by my theory, it has to be represented in the set space.

So by construction I want the space to categorify every variable of interests in my system. Given the scope and measurement capabilities of my theory, you have underlying notion that is basically implicitly underlying the notion of flows and space, that is the notion of symmetry. I cannot get into the Brea detail here, but I will try to be as complete as possible. We typically understand physical theories outside specifically relativity theory and some weird quantum stuff to Deneve from symmetries. Symmetries are, I will say it out loud algebraic Ronen of transformation of other space that do not affect the system's dynamics as blunted as it's laplacene.

05:29 You don't have to understand what I just said. What you have to understand is that there are ways in which I can transform the system which does not change what it is. An example in symmetries the sailing of the Jorge force arm of skin is field you see that you have physically the same pattern that is repeated again and again and again readily. So if I make a small rotation in either direction, it will not change a thing and if I repeat it and repeat it and repeat it and repeat it and repeat it and repeat it, I will still change my system. Like formally I will apply consummation but it does not change basically what observable properties the system have.

And this is what a symmetry is. It is a set of transformation that is generated by a subset of smaller transformation and that does not change what the system observably is. And because of this asymmetry of a system that basically constrain what difference can make a difference about the system.

06:35 So implication, when I formulate law or state space I make a statement about the underlying symmetries. I make the statement that basically everything that is not in the system that is not represented as part of the system is something that is symmetric, that the system is symmetric with regard to that on which any transformation will not affect the system trajectory.

At least not in a way that is relevant to my theory.

It works for physics because it looks like in physics we have few symmetries that are everywhere verified that are fundamental in some sense it doesn't work so well in life and mind because we don't have that. To be specific, living system have a structure, I do not think it should be controversial and they have considered asymmetry they have changes that will not affect them.

07:38 If I switch all of the carbon atoms by body, I scramble them between each other while keeping the relation to rest. It did not change a thing. So it is very trivial in sense of symmetry.

But basically every structure that is me entails symmetries entails information that are possible that do not affect the structure and other tools affect it. And the structure it is not a given like symmetries are considered to be in physics. It is active reconstructed by the activity of me. If I cut myself, if I fall, if

my bone break, I will regrow. Basically, we'll have circumficial tissue that will occur and that will make it okay again and it will change what software is my body.

Most importantly, I was not born that way. Like big and with a bird and with 80 kilo of meat. I grew and I grew from one single cell. And this single cell just created an atomia structure apparently ex nelo from basically a genetic code in the context.

08:46 And not only that, but life in and of itself evolves in a way that builds structures that build asymmetry.

And all of this means that you can't set a stack space that is the set space of life in general of any living system. The symmetries that in the life system they change to time and they change by the own activity of this system. So any living system construct set spaces and to account for it we need a theory of set space construction. This is the motivation of the physics of creation line of work. And this is basically I did not permit as a question.

It is the question that we need to keep in mind in this discussion. So Daniel, do we have any question yet?

Anyone? Okay, no technical issue that I should know about?

09:49 Okay, so what we'll do is first look at basically what we say of creation in life in mind, at a conceptual level, what is the history of the concept and what I ant to do then we'll look into the formal specifics of how we try to represent physical recognition as coherence and what limits these attempts have. And finally, we will take the reflection further and see whether we can and how far we can represent physical creation. The construction of physical reality with the tentative formalism we have framed here. So let us look at creation in life in mind. Historically, the term of creation, it refers to autopoieces.

That means literally self creation. And that is attempt by an activist what became an activist so mainly matureana and varietal to ground the study of cognition, the study of biology and the way, well, the living system work.

11:00 They framed Autophagic theory as basically the idea that cognition is grounded in a way that link system constructs itself, like their metabolism, allow them to reconstruct the structure. And the structure does not have to be conserved by metabolism. So you have self creation. And this is basically the concept that try to articulate to ground cognitive science and later Variety and colleagues tried to basically concretize this by working on how the cognition was enacted, which is it is implemented in the body and in the concrete. Activity of living systems.

And this basically was very determined to the cognitive evidence and it framed the four E approach. So the attention of cognition beyond the brain let us say very tentatively, the idea that they frame is that you can see the diagram that is taken from the Paulo's work.

12:07 And I tried to explain the correlation between self constitution. So let us say it is a weaker, lighter, more specified notion of the paraesis and agency. The idea is that you have self constitution. That is the fact that the system build themselves and it is basically afforded by the way during system couple with environments. An agency is later higher order of regulation of this. Disability to define basically the terms of field coupling with the environment. And the idea generates is that living systems there are systems that have structural identity that they actively generate and sustain under precarious circumstances. There is no benevolent universe that helps life, that help life be life.

Life has basically to generate environment where it is life and in doing so, it generates and it sustains

what it is, its identity.

13:12 And all of this is necessary for sense making so let us say cognition to be something to occur and this is, in my opinion and to some extent in dePolo's own opinion somewhat wordy it is a lot of concepts, a lot of Greek words and people have tried to frame this in a way that is more mathematical and formal. And the question it generates is how to formalize this selfcreative property of biological colonialization and cognition and in a way that is basically grounded in material informational flow, in things that are concrete physical structure. We have a pretty good answer to that, actually. We have pretty good work that made a point that you had related this somewhat high level concept to basic physical processes.

14:19 This work is the work of Moreno Monsieur and Monteville mainly, who work in forgot the name but institute of and study in the Paybasque in Spain. And the idea is that living systems axel Costa by a closure of constraints. So the constraint is physical thing that shape how other physical thing work? Very simple. If I have air in a box that is closed, the air can't live a box.

It is a constraint. Okay. And the property that integrates living things is the fact that they are constituted by a set of constraints that can lie metabolism in a way that reconstructs the same way, the same system of constraints. And so from there you have selfconstitution. You have also structural, let us say, notion of biology that does not depend on the matter it is made of, but on the way it is sustained.

15:24 That is, I think, pretty good if you ant to have a physicalist notion of life. And we have a very basic ontology in which constraints may shape metabolism and shape information flow as in the way Livingston react to things and that grounds the autonomy of living things, the fact that they can recreate themselves basically. But nothing gives a clear link between this and cognitive meaning or anything we could recognize as cognition. So this is what we will try to articulate next. So how driving systems as we just defined can create meaning.

The notion I would like to import is the notion of active in France which I will not get into the mathematical detail here. But the idea is that the way the dynamics flow literally that is entailed by an agent and its environment it individuals states that are meaningful basically an agent will predict in a relatively formal sense sensations that it will not perceive perceive but undergo and actions that we'll undertake.

16:45 And these predictions are basically what's underlying meaningful the agent it underlies what states will just so happen to shape its own action and be meaningful to them. This can be framed by in a pretty simple poetic move by saying that biological generative systems they do not simply infer what is they bring about their own reality by actively inferring what is meaningful to them, by actively looking for states that they think are really don't fault their own structure. And then you start to have a stronger relation between what a physical system of constraint is and how it individuates states that are meaningful.

But you still don't have a formal theory of basically how this metabolic flow builds learning or creation like builds a new state of possible, a new space sorry of possible states that is not the one it began with.

17:57 I have a description of a structure that is the set of constraints and this produces basically an activity of the system, a flow of a destructure. And this flow, it somehow constrains or shape the structure. The system takes a time t plus one which itself produce new function, a new flow, et cetera, et cetera, et cetera. So it is this dynamic of I don't know what to call that self differentiate, unfolding, whatever the way a system of constraint produce a flow that triple the system of constraint that we want

to formalize. And the question we could reframe as such we could reframe as how does cognition, the ability to understand, integrates information about the world it enacts within biological organization? Because cognition is basically the flow of biological organization. At least you can tell by it.

18:58 Everything that I see is something that I want to say, bring about, that I look at because of the biological constraints I am. And therefore the question of creation can be reframed as how the meaning of projections to the world is brought back to shape my own structure. And this is what we will try to frame mathematically in the framework active Inference Lab Daniel, any questions.

So the attempt that we make here is to see if we can how basically we can represent creation as a process of inference, which is likely the most minimal, highly recognizable way I could frame cognition as something that is distinct from simply.

20:03 Let us look at a piece of math that is called the Fano principle and that is the formal motivation or grounding for active inference.

It will be the hard part for people who do not do math or people who are not already familiar with principle I will work with slowly it is a piece of math that frames statistical coherence from the mechanical system theory. Chemical system theory is basically the idea that you have states and they move as a function of each other. And what the FEP does is to prove that. If I have something that is called Markov blanket so boundary that any information must travel through for two subsystem to communicate radically then you have a synchronization that emerged between states that are outside this boundary and states that are inside this boundary.

21:04 And not only this, but if I measure basically every state that is on the inside of the boundary entails belief, entails equal distribution over the external states and the flow of internal states is such that it minimizes the informational distance between the actual external states.

Well, what I can observe and what I believe to be the case where I of course is the external states so that was abstract. The basic and formal meaning of this is that if I have a chemical system and I have a boundary that acts to mediate information exchange between two subparts then both subparts can basically represent each other and hold belief in each other in a way that is constructed by the systematic synchronization across the boundary.

22:11 It is quite abstract and quite minimal. But it is a formal proof that we can have representation, we can have cognitive meaning from a very very minimal set of hypothesis, which is basically a consistent causal structure. And it is a pretty good case that basic technical system, for example constraints, constraint will be motoring robots this kind of very basic noncommittee things can entail cognitive niche has been argued that it does underly agency and creativity and similar concepts that would entail, in my opinion, creation as a prerequisite.

So we'll try to see whether the FEP actually can represent creation as the ability for agent to individuate states that are spinning to them.

23:15 The thing is that the existence of Mark of Blankete is monitoring for any complex stochastic chemical system so chemical system that are random and this transmission realized as basically something that moves in function of itself plus random noise it is a very generative formulation arguably anything that exists can be framed as such. So we should be optimistic for the ability of this to represent the cognitive introduction of cognitive meaning by basic biological system and therefore creation it is not the case because when I frame something as x of the equal something when I have to preface x we have to define space of states that is x .

24:18 And I have defined creation as the ability to construct basically physical possibilities. So by construction if you frame something within the Microsoft theory you have to interview states a priority. What you have written down is not creation.

It can be a part of creation. It can be interesting in the study of creation. It is not creation, it is not the construction of physical spaces and it is likely not the construction of cognitive meaning at least in the sense that an activist and autopoietic theory people mean it. It just underwrites what become measurable for a given subsystem within the stochastic chemical system which is a lot but is not again creation. Let us think about how we should go.

We should think of creation.

There will be more math here, I'm afraid.

25:18 But if a system is to observe another system it will have to lose information about its broader environment. It is pretty easy. It is something can derive from first principle because basically if you frame it as a quantum system observation will entail entanglement by definition I observe a system and it becomes something that has in the states because I become entangled with it. So its states become physically synchronized with my state.

But I cannot synchronize with everything all the time. So if I act so as to have more knowledge about the object, I act so as to have less knowledge about my environment. So there is no basically Costa less observation. It is something that can be derived in the quantum setting that can be reframed in other way in classical settings.

26:22 Because of the way observation will either induce heating information loss or cause myself to forget information.

You can pretty much derive it in a variety of case. It is likely true in all cases. And it means that observation as it is constrained by my own flow and the way I culture with the environment it does not simply entail the observation of preexisting well integrated physical states. It brings about well defined observables for me to observe the way how to say given this it is hard maybe not possible to frame a theory of conversation from a mathematical theory that entails a very well and ejected physical states.

27:23 If I frame such a theory of observation or measurement of cognitive meaning it will not be general.

And I pretty much have to work creation on the very fundamental scales at which my theory operates. And this is something that is arguably done by reframing of the engineer principle for generic quantum systems by mainly crease Fields. The idea is to use category theoretic equivalence between lots of things. I will definitely not get into that. To will frame the synchronization dynamic that's in view that builds cognitive meaning.

According to the French principle as a series of binary measurements are equivalently asymmetry brain operators. So the way a chemical system synchronized with its environment under the FEP is reframed here as basically a series of binary questions that I ask my environment and that enforce my interaction with it in such a way that the answers to my questions become physical facts which you can derive from water, general quantum information theory background.

28:57 But that gives basically no structure whatsoever to the measurement. Nothing in this theory says what kind of system can ask what kind of questions. And this means that okay, this drives correlation, maybe drives individuation of physical possibilities, physical observables.

But it does not constrain at all what this creation is. So it does not explain much and doesn't help much

to understand how living system recreates itself. So we still have somehow to recruit the cognitive and immigrant formulation of the FEP that I discussed very tentatively earlier. So let us take things from there. I have turned during this formal discussion from the notion that we have to represent creation in the living and cognitive world to the notion that somehow it is necessary present creation of physical reality like the underlying states of physics.

30:10 This third part with this third part will serve mainly to discuss this claim and what it means and what we should do with it. Basically. First, I want to show basically that the claim that there is no a priority physical validity is a pretty basic claim. It should not be treated as exceptional. It is necessary property of a coherent physics.

It is necessary property actually of the formulation or description of a world that is beyond what we call metaphysics. Let us be more specific in the argumentation. I call this argument that agent from ontological consistency an ontology that is naturalistic, that serves to present nature, if it is consistent, cannot call on to external objects that will not be natural to explain the properties of its own objects.

31:13 For example, if I tell you this thing is black because it reflects the light in such and such way and I can also explain the properties of light, it is self consistent. If I tell you this thing is black because God will need and I cannot explain you what God is physically, it is not self consistent.

There is no property that is framed by Alexey Rozanski who is present here as the property of self function. Consistency that is that dentology should basically include itself. The discourse we have on physics is unless we have very radical position about the correlation between human and the other world, it is something that exists in nature and that is something that we need to account as an element of nature. This entails two things. One thing actually it entails that scientific presentations, the models and theory we have and the property those models and theory have, they must be accounted for as natural entities in their own rights and they must be, at least in principle, explanators by the tools of physics and science.

32:35 And this entails in turn that I cannot have such a thing as a law asymmetry or a set space that preexist physics. Any statement I make about physics must itself be explained by physical processes. I will elaborate on what it means. The view of physicist is typically that we are theories and those theories are representation of the world that just so happen to account for fundamental structure of the world. For example, we have the Maxwell law of electromagnetics electromagnetism and those laws are representations of a force that exists and that is generative by su one I think by asymmetry in the Hamiltonian, sorry, asymmetry in the quantum property of systems.

33:37 But this symmetry preexists basically any attempt to represent any physical process. It is a fundamental property. What I say is that you cannot have fundamental property, you cannot have something that predates physics and that cannot ultimately be explained. And if you admit such a thing, your ontology is not consistent because you have to admit some things that are beyond that predate nature to exploration things in nature which is the opposite of what selfconsistency is. So if I want to frame a world where you do not have explanation that Conor on two things that are beyond physics, you have to have lots of entries in spaces that are constructed by physical processes.

And it is not a problematic view to have at least epistemologically, it is necessary. Let us discuss what it means concretely.

34:42 We have cognitive systems, not coincidence systems they perceive. And this perception brings about cognitively relevant states which the cognitive agent experience as real. We have physical

observers. These physical observers bring about what we call pointer states that are well-investigated states that are measurable. And those states constitute physical reality at least as any given observer can experience it.

What I say here is that this is not epistemic notions. The pointing states and the cognitively relevant states that perception, the cognitive relevant state under perception by agents. They are Riols and they are investigated as Riols by their observation. And if we frame it properly, the Qfep at least what we could do with the Qfep.

35:43 It represents how protomines, at least particles, agents that have properties that we classically understand as mindful, they individual physical observable, which means that they create a space, which means that this is a theory of creation, not simply a theory of how access reality, but a theory of how we get reality in the first place.

And to do anything like grounding properly this claim, it will take a lot more details and I will try to work by showing what such a theory would do because obviously I do not have such a theory that is framed formally from start to finish as of now. And if I did, I would not present it. Now let us look at the way constraint basically creates the relative experience this is Lagrange of how, as humans on the world, the social world, basically, we understand things like constraints over what we do and can do and what entails.

36:59 I understand that if I talk to you in proper English, you will understand if I talk to you in French Australia, you will not understand. Understand that if I address, it will be inappropriate.

And if I hold myself in a certain way. It will lead you to believe me more or less understand that if I start speaking very loud, it will disturb people and they will act for me to stop talking very loud. I understand very basic facts about how this world works and I understand how this constrained the action I can take and the consequences of that action. What experience is basically a sociocultural escape which exists independently from me and that I act within. And what I claim is that this sociocultural landscape evolves in a way that is creative, that is basically abuse.

New norms exist that did not exist ten years ago. And that is even more true for 1 million ago or before humans were a thing.

38:04 And the way I can represent how Agents tried to understand this social landscape and possibly fail our errors, norms and the landscape in such way it is equivalent representation of the landscape itself and the constraints that constitute this landscape and the way the flow of the landscape reconfigures the landscape. So what I did here is to basically frame a theory of creative evolution. These of sets of constraints well of a structural landscape on the way individual agents act and understand and act.

Within this landscape, I have sensed in which Costa observation and cognition about physical. Here a social reality, but still physical in the sense that it exists in the physical world.

39:04 How this landscape can be created by something that is cognitive and this basic ontology, if I am correct, here is something we can mathematize I hope so. And that we can frame as a basic theory of the individual, of new physical possibilities, creation ie. Note to this graph is given to in a brilliant and what is of importance here is the duality between two representation, two perspective the perspective of agents that basically enact social culture constraints that they experience as a physical fact as a reality they cannot go beyond or escape or maybe affect in brute force.

That's a possibility, but not escape. And the perspective of a set of constraints that endlessly unfolds in a way that is creative and that is a formal intuition I plan to build on.

40:12 And I can say something a bit more specific about how it works by analogy to the boundary principle and the autographic principle.

Basically creation operator, in my opinion, I could argue for that. I will not do this in detail. Right now is something that goes for space of it's not actually a space. Of physical possibilities. It's a space of potentialities.

It does not have possible states and impossible states. It is just the statement that something is possible. It's very close to what Greeks called chaos. So you have such a space of unintivitted possibilities and from this space unfolds a pair of an individual observable which is called e for environment and an agent that is capable to observe this observable.

41:13 And the agent is also capable to maintain boundary between itself and the observable.

Or basically it's observable to stay existing as observable to be observed.

And from this, I think that some mathematical operator that has this basic flow is capable to describe the construction of physical spaces as the unfolding strictly strictly no metaphorically a physical structure as basically the emergence, the coconstruction, the integration, as you will, of well integrated observable states. An observer that is capable to see the state and Bijan in active states maintaining whatever worked as and integrated space of possibilities before as well integrated boundary between itself and the system.

42:14 Let us think, for example, of a piece of paper. I, an agent, can basically write things on it. And by writing things on it I create new physical observable which is the content of what I've written.

And the fact I write on it and I read it makes the piece of paper not a piece of paper but a boundary between myself and a semiotic space where the writing occurs. This is the basic dynamic that must be framed for us to understand cognitive meaning and that if we framed in such way could work to describe the construction of the spaces x nilo because literally you do not need physical possibilities to be a thing for B to exist. It is the point of this presentation. You don't need a space of possibilities to preexist the function of the agent and the government. This is why it is relevant and this is why it is hard to formulate.

43:16 And given an operator with this property we can pretty much work it back at the function of physics and see what happens. So how about physics of creation? Let us tie the threads of this presentation. I will formulate three take on messages. First, we have something that is called the FEP that is not framed, that is mainly framed as barriers and mechanics as informational enrichment of demeacosystem theory but that can also be framed as something in quantum information theory.

It says that agents actively infer states of bidding through their engagement with the environment in a way that maintains their structure. This gives us a formal background.

The quantum frame it of the sorry, quantum framing of it gives us very, very generative and hard to say.

44:24 I would not say ill specified, but very few specified doesn't have a lot of detail. So it gives us a very not detailed round for a study of how committee meaning underwrites the construction of physical set spaces. But because it is very abstract and not very specified. We have related in a much stronger way to the classical formulation of the FEP where the internal flow of the agent and the synchronization manifolds that emerge from the interaction have a very specific topology, have a very specific geometry and can be equipped with meaning about the underlying physical structure.

Second, we have to admit that passport realism is a thing. We have to admit that there is something

wrong in how we view science.

45:24 Let us quote Einstein if without in any way determining system we can predict with certainty the value of a physical quantity, then there exists and the amount of reality corresponding to that quantity. By this account, nothing is real, which is a very big problem, a very bad position to hold. And we have in some sense to account for the role of observation in creating, well integrating physical states not only for quantum physics, not only for cognitive science, but for everything in between, which is in some sense entailed by quantum physics, in some sense entailed by cognitive science.

So I don't think it is a very big deal to say that, but I think it will be taken as such. And the statement I want to make is that not only doing away with this brand of realism is compatible with naturalistic Dean with science, but it's also necessary because for naturalistic science to be a thing, I have to represent myself representing as there is something metaphysical that comes to play either as taking myself as a detached, nonphysical describer of the world or by postulating some kind of godlike preexisting structure that I just swapped to stumble upon.

46:53 You will have something that is in physics in some sense if you don't do away with this brand of evidence. Peopleism and it has been said to me that it is not a new view. No, it is not.

It has been framed as a criticism of the notion of fat man thinking itself by early Buddhist philosopher about 3 million years ago. And the fact it is not new is not really a problem in my opinion. We should go with things that seem true, whether or not they are exciting and novel and the fact that we can have a cosmology without practicing nature and other people do not find any problem with it should be a sign that maybe our insistence that no, there are things in themselves is not well motivated.

And finally, what I propose here, beyond physical considerations and dimension of what some piece of math does is very very very basic.

48:06 Not draft, but drawing of physical creation that holds in two movements. The first is abstractly the inclination of something from nothing, of order and chaos given a space of undefined possibilities by you are the inclination of an observable that is well defined and of an agent whose observation of the individual's boundary. So we have this kind of framing that could work as a handle on how to write suspense construction. It does have a very strong category 30 called Filler from the way basically the content of B is not what's at stake.

This diagram is pretty much agnostic concerning what B is and is not.

49:07 And it must be because it underwrites the becoming of B and there is a lot of work if I want the physics of function to be a thing in framing properly. What kind of mathematical operator basically follows the flow of this diagram and what those mathematical operators do and the kind of physics they commit to life. But for this I have concerning case I have the case of how humans collaborate to build and recreate social norms because it is a case of creation. Like it is pretty much the single case of creation I could convince anyone is a thing there is money because we believe there is money and it works as we believe it works because we believe it works this way.

It is very true statement to say that norms constrain us because we believe in norms and the duality it affords between representation of single agent trying to understand and act within a social world and the flow, the interesting flow that is created by social constraints and that recreates social constraints it is pretty specific.

50:20 It is much more specific than the vague operator and on the left and I know this operator must represent that. So it gives basically some level of grip and distant level on how the physics operation

would work. And they would work by describing the unfolding of physical structure as the construction within physics of meaning and or constraints over what is observable by viva Nigeria observers. And pretty much we have to work from there, because I do not think there is no Axel Costa in the sense I introduced earlier.

There is no self consistent therapeutics if we don't do that, so let's do that.

This work, again, is to some extent my work is to some extent the collective work of Keros, which is basically a battery that works towards an active sense and active naturalism, a sense that is naturalist in the sense that it plays the observer within the world and works within well defined causal ontology rather than less well defined laws and abstract principles.

51:46 And it tries to do so in a way that examples people, as in humans, to understand their reality to basically use this knowledge about how the world works to constrain their own behavior and navigate the world. Especially given the recommendation of constraints that we expect and be explained in the coming decades. So I strongly suggest you take a look to our website and our general line of work and consider if you want to talk to us or join us. The QR code is, I believe a link to our website.

So thanks to Maxwell, thanks to Daniel, thanks to Blei thanks to Yona, thanks to pretty much everyone who helped me write this and think it through. It was big work. So I will run through the slide if someone wants to read them in the video. And now we can go toward the discussion.

52:48 Excellent.

52:49 Daniel:

Thank you. Thank you, Alexis and Maxwell. Welcome back. If you want to join and please, either of you provide a first statement or any set of questions, however you want to continue, just go for it.

53:08 Avel:

You know what, give me five minutes. I will try to destroy my head. So chaos, but don't expect me to.

53:22 Daniel:

Okay, well, do you want to share your perspective on the project? Things that Avel would be familiar with, while you're here?

53:31 Alexis:

Yeah, I can begin, I guess.

So I worked on the metaphysical or ontological ants. And yeah, to me, Avel gave it a good presentation. Yeah, it was really nice to see it framed into the whole way of talking about everything, like linking it to FEP and then to other stuff.

If I can share a bit more about the metaphysics of the ontology.

The idea was to create an ontology that is naturalist. And as FEP seems to be really naturalist, then I wanted to make it work together. At first it was only in my own field that I developed this

54:34 ontology. And then Avel said to me that it was really linked together. So that's what we tried to do here.

54:46 Daniel:

What does that look like? How are you evolution what a metaphysic is or how you know when you found the right one or an incompatible one.

54:55 Alexis:

Yeah, so the basic question was about the question of what exists more generally. So that was my anger of if it's a thing in English.

There are many discussions about what there is in philosophy, mainly in the 20th century due to choir. I think it is popular in general in the culture of science. So I followed these debates on what there is and pretty much there are a lot of views about what there is and what there is not. So I was a bit hard to say that disturbed by the fact that there are things that are not. And I wanted to give it a try to talk about what seems not to be and to make it exist in some way.

55:59 Generally, what doesn't exist is linked to consistent like Pegasus or let's say, stupid sentences such as the round square copy of the college or something else, such as, I don't know, some weird, non really mathematical entities. And I was like, okay, so I admit that they do not work, but at least we are talking about them, so can't we just say they exist in some way? And then I went into social ontology and I found that we can call them social artifacts. And then I was a bit relieved with this view. So I tried to make it work with also phenomenality or cognitive or personal experience, human experience, because being a social artifact doesn't make it all.

57:04 Then I just tried to make it work between ontology, social ontology and cognitive ontology. And also something else. Aval talked about the self referential inconsistency. So it's a debate I found.

57:28 Avel:

By.

57:28 Alexis:

Working on ontology and I was really into it the fact that the theory is inconsistent if it doesn't applies to itself. And I found some articles about it which were against naturalism, but one kind of naturalism only, so it was mostly naturalism. And I saw that the people who were working on that, they didn't know about a lot of naturalism. And as I worked with Cairo and in my study, I found that there are many kinds of meteorologies.

So I saw that the argument doesn't work with other kinds of materialisms such as the one that is developed here. I hope it's clear.

58:22 Daniel:

Yes. I'll ask one question on this topic from the Chat and then feel free to take it in any direction or Maxwell. So Adam Rostowski in the chat asked,

Thanks. Avil question. Maybe for Blei. What if state space is considered theoretical biology rather than causal ontology? Its presupposition would then not be a threat to biological consistency.

So what if state space is considered theoretical ideology rather than causal ontology? Maybe just unpack the question and then give it a thought.

59:02 Alexis:

Yeah, I will write it now in order to reflect on it.

59:12 Daniel:

Perhaps Abel just goal directed question. What are the state spaces that you're concerned with? How would you characterize what they are.

59:24 Avel:

By construction state spaces? There are spaces of postulated physical possibilities. You have a pretty clear I do not understand what the notion of ideology, how it works here, it's pretty trivial that what we call ideology will define what a person or political system or inclination is capable interested in seeing. It is the topic of Scott Singh states computational, let's say, work of federal case and biology that looks at basically how whenever states try to do things overtly, usually for the population, their main concern in effect is to build the capability of control. And usually they do so by cutting through complexity aggressively.

1:00:26 Very basic instance of that is scientific forestry. That is, I can say it is indeed forestry. The idea was that Russia needed Warboats, loads of them.

They also needed to be able to predict how many Warboats they would build on a given time frame. So they need to know how many warbot compatible trees they had. But you don't have warboat compatible trees and not warbot compatible trees. You have trees from sites, from ages, different aspects. So if you just counted trees, even with well defined measure, you would not really know how many trees you have.

So they just raised forest and planted homogeneous patch of a given species ant a given time with a given soil. So they knew that when they knew they had 64.

1:01:30 I don't know what trees there are. I actually know what trees they are. I don't know it's totally in English.

So it's not oak, but they will say oak to say something when they knew they had 64 30 years oak. Well, that's 64, 30 years oak. And that's it. They can cut the trees and they know exactly what they can do with it. So this is a way in which something we could account as ideology.

So the notion that we should be able to control blah blah, blah blah, it basically constructs physical reality in very concrete sense because they cut free that plant other trees that fit their expectation. It is a form of niche construction. It is a form of how do you call that cognitive attention, in the sense that the loads they would need to account for our Atreides are they just offloaded onto the environment by making trees actually the same?

1:02:40 And it is a form of meaning projection. They are the stamp mining, which is that they need to count trees that are barboats compatible and they project it onto like how actual forests are organized. Those are physical possibilities as Dutch by the state. Those are set spaces. We have a set space that was very complex with a lot of possible trees, possible species, possible size. That is brought down to how many trees I have. And could you repeat the question word for word, please?

Because it was not clear to me how national biology intervened.

1:03:32 Daniel:

What if state space is considered theoretical ideology rather than causal ontology its presupposition

would then not be a threat to biological consistency.

1:03:48 Avel:

Yes. Okay. Because of ontology precedes a set space, it is the ontology of creation constraints that they have waived. And somewhat impressively at the moment, set space, I think I will be able to demonstrate it, but I can't at the moment. They express the point of view of an agent.

So I imagine that this is what is meant to be produced by biological theory, theoretical ideology. And I do not think Ramstead space are a threat to ontology. I think ontologies that consider Ramstead spaces as fundamental are flow ontology is fine.

1:04:39 Daniel:

Thank you, AVO Blei, feel free to chime in and then Maxwell, if you want to add anything.

1:04:45 Alexis:

Yeah, so I think I will join the commentary. Also, I would like to say that if we take clients definition of ideology, I will not explain this now that well. Yes. So the idea, I think, is that the concepts are tool and not fundamental stuff.

That's what I think it is implied by ideology here. So what I say is that.

1:05:19 Avel:

You.

1:05:19 Alexis:

Give the value of being an ideology or consolentology, depending on your goal and.

1:05:27 Avel:

Your.

1:05:30 Alexis:

But at least minimally, the stuff you're talking about, that's the fundamental stuff that I would say. So even though it is ideological, even though it is instrumental, let's say minimally, it is something and it has consequences on the world. And that's what I think Avil said with the niche construction of social time. It didn't really say that in these words. But even though your IDs are, let's say, stupid or absurd and people appear to hear you, then your IDs, they are in the world and they do something.

So I hope I answered well. If not, then I can take questions.

1:06:21 Daniel:

Thank you.

Maxwell, do you want to add something?

1:06:27 Maxwell Ramstead:

I don't currently have anything burning to say. Avalo, I think this is the end iteration of our discussions

around this. As always, I think you did a great job presenting what I think is a genuine issue. And I've just been rehearsing the same appeals to multi scalarity.

I find it interesting that you would speak an answer to these issues in Quantum FEP precisely because of its scale free nature. So you can't appeal to a spacetime background when speaking in the Quantum FEP formulation. So I think in my mind that makes things potentially more difficult. I see why you would want to do that. Because of the focus on the definition of an observation as a physical interaction.

1:07:32 I guess my kind of overarching question is whether the multi scalarity of classical FEP helps at all in the sense that we've described before. So you have a set of observables, some of them change too fast to really disclose or allow us to track, reliably some phenomenon behind the blanket, others do. In the latter case we talk about states, in the former we talk about random fluctuations. So I suspect that the kind of definitional discussions by which I mean definitions of states like these kind of foundational issues that arise in classical FEP might be helpful hereabouts. I also suspect that you'll disagree with me, so I'm looking forward to hearing your thoughts.

1:08:34 Avel:

Basically the distinction is clear between us at least as your friendly problem. You seem to be a realist about the physical possibilities about state spaces which are not. I have an agreement for non realism, which is self control ontological consistency and determinants of self consistency and self consistency. That brings us to say that you can have preemptive set spaces in which to frame, in which to classify, have physical observables that somehow preexist physics, nature, the process that are within it. So that is one physical argument.

The question is then can I demonstrate conclusively that you do not have physical observables before observation, but state spaces do in fact reduce the perspective and observer. And basically, if I can demonstrate it, the debate is over.

1:09:37 Until then, you can hold structural values, but you have to account of how thing exists if they are not fundamental. I think multi scale FTP can do that. So it's not a critical problem for you. Everything holds on the formal demonstration that we do not in fact have sex basis as prompted physical affect.

1:10:09 Maxwell:

Well, I would push a little bit back against your realism versus antirealism distinction here.

I'm really just talking about like at the level of the formalism. You start with some observables, which seems to be what you are also saying, and then you can talk about the way that those observables are related to some other things which may be latent. All of that is a formal statement as far as I'm concerned. And it is useful whether or not it maps in some kind of fundamental realist ontology sense. I guess if there is a kind of transcendental overtone to what I'm saying in the sense that we've argued in print, on the map territory, fallacy fallacy paper, that the FEP theoretic maths and the related cluster of principles, unitarian, maximum entropy and so forth provide ultimate constraints on any model building exercise, just full stop.

1:11:17 So again, that doesn't presuppose any realism about what maps map onto. It's really just a statement about the construction and maybe the process of constructing.

1:11:31 Avel:

You're correct. It says I was attributing, I don't know to say English, it was not accurate to frame you as a realist about its basis. It was correct, however, to frame you as an instrumentalist, which I refuse to be because of naturalism, basically I consider it necessary to frame causal ontologies that map, onto reality properly, as fine grandly as we can. And to do that we have to include basically the translation relation. And this is when everything becomes complicated because you can't say if there are such physical possibilities, then this occurs.

You can't use that language because by doing that you frame physical possibilities as something that is abstracted from the underlying physical reality. You decouple the formal from the actual. And I think whatever ontology we use must be what reality is, must correspond structurally to what drives reality.

1:12:37 So it is the contrary. It is who is the realist.

But the constraint I was going to.

1:12:45 Maxwell:

Suggest maybe actually.

1:12:55 Avel:

I go for ontology that is consistent in the sense I friend and the constraint of that are much stronger than the constraint of our instrumentalist anthology that just we say interesting things, which is not actually easy, it's just much more easy.

1:13:13 Maxwell:

But suppose we started from the assumption that we don't have to have a strong position on the reality of state spaces. Does that affect your agreement at all? If I were to say I just as a practitioner of science start from my observables, you can be a radical phenomenologist from this point of view if you want. You're just starting from your observables and then working out like what resists your manipulations or interactions.

Does that, in your view, kind of allow us to move around asking the questions about.

1:13:56 Avel:

You can move around with oh, about the fix upgradion? No. Move around. Yes.

Understand some things with cognitive meaning. Yes. You have FEP grounds cognitive meaning in Demiko sampiri. It's huge. Did what it does not is afford the ontological consistent theory of physics and the difference between us is not what we hold the FEP to do.

I think we're both instrumentalists from you as a realist but the difference is that I see an affordance to build a much stronger self consistent physical theory that draws element and a general philosophy from the FEP, the philosophy of activity in France. Basically I push in this direction because I think the goal is variable.

1:14:59 It is ultimately an ethical call. If you do not agree that the goal is variable you should not agree that it is useful to push it. I do not have ultimately any show of that.

1:15:13 Maxwell:

Maybe there is a kind of Connor intake here because I think at least in the history of philosophy this split between realism and antirealism or instrumentalism I think it's perhaps overly simplistic as a description of the potential options. There is a whole continuum line of thinking that talks about something intermediate in some sense.

I don't know, just a thought.

1:15:53 Avel:

Is a dam in the room? If you're in the room, use the chat. But in a sense I agree that.

1:16:04 Daniel:

Not in the room. But I can read another question whenever you're done.

I'll read another question from the Chat.

1:16:10 Avel:

Yes, but I was going to say something which is that I agree that basically is a distinction between instrumentalism and annualism must be dissolved because none of them are ecologically consistent. Both suppose representation relation that is outside the world and the question is whether the words as a formal construct correspond to the reality as a structural thing. It's not a constant question to ask the all of the things are in the world. We have to have a theory of our things are true or not.

That affords for the statements we have about the world to be in the world because they are.

And so from the moment once you free that biological consistency is something to have a lot of the distinction we have in western philosophy will be dissolved. Which makes communication complicated.

1:17:12 Of course.

1:17:16 Daniel:

Maxwell, you want a closing thought on that or I'll ask the next question?

1:17:22 Maxwell:

You can ask the next question. I think that brings us nicely to.

1:17:29 Daniel:

This is from Alex Kiefer. So Alex wrote I love the positive story in this paper insofar as I understand it, which I'm still working on and the idea of treating even such things as state spaces and scientific reps as amenable to physical descriptions. But to bounce off what Maxwell is saying I am not sure I see the deep critique of thing in itself realism here probably depends what one means by that.

I tend to think of the strictly incoherent concept idea of something unknowable behind phenomena. So why is treating statespace correlation as part of phenomena at odds with that? And it's also Ramstead in the chat.

1:18:17 Maxwell:

Just to pick up on that, I think you don't need to be a strong realist. You can just believe that you are more or less getting it right.

And the semantics that we've proposed that uses active coherence and the free free energy principle, the kind of formal basis precisely uses the fact that you have a certain perspective, you have certain beliefs, and your beliefs are going to be more or less wrong and that the prediction error or the free energy is precisely the kind of minimal ingredient that you need to hook you into a situation enough to be doing something pragmatic that you might call truth telling.

That's really all you need from a formal point of view is just the ability to be wrong and to change your mind in light of new evidence.

1:19:16 Avel:

So my claim is not that everything in physics is false and formal statements about postulated possibilities of no epistemic value or trivial epistemic value. My claim is that those representation, as any representation are rational. They relate to objects and the true value or value in a sense that we have to give the meaning we have to give to that if we are to give anything at all must be grounded in the study of physical dynamics that's underlying our emergence. If we are to have again an ontologic consistent theory.

We could just say that evidence is discourse that is not entirely false and say things that are not entirely false. We could do that.

Again, the notion that physical discourse must be legally consistent is ultimately ethical like it is a statement on what you should and should not do.

1:20:25 I can say that it is better because XYZ you can say that XYZ are not meaningful targets to have and that whatever we do is okay essentially, or maybe it's better than X-Y-Z. But the notion that I do not critique the spaces but at least it's Ronen point, I have to frame it as a critique for it to resonate. But the point is that the spaces are rational property and that to study this rationality, it reframes the entirety of physics, it's epistemology it's ontology, it's cosmology. And if you look ant the flow of this theory, it's not least action, it analyzes social evolution.

Revolution is agent producing meaning as norms and then the norms when they think it is something that is very basic for us to understand how solar system evolves.

1:21:29 And yet there is no such theory, there is no theory of such revolution that do not presupposes variation and obstruct away any form of structure and metabolism. It simply does not exist. So the nonexistence of a materialistic theory of revolution is maybe a pretty big problem for a purely predictive pragmatic value standpoint. From a more abstract standpoint, we don't have a Korean cosmology, we don't have an explanation for why there are things and why the things that are look like what they are physically.

We just have to postulate that space time is such and such for physics to make sense. Which is a problem. We can't have a physical theory that stands only on the fact that its statement does not give rise to obvious problems. We have to have something beyond the statement.

1:22:31 We have to have some way to account for how this statement became true.

And it is a pretty basic point to make in psychology, biology, sociology. We can't just say things are such and such. We have to say how they become such and such and why they become such and such. It is nothing in evolution, nothing biology makes like nothing in biology makes sense except in light

evolution. And it is because those are systems that are I don't like Telegy call, let's say teleonomical. Those are things that are organized, that are coherent, that work in a specific way. And so we have to cannot just say they do x, we have to say how and why they do x. And this epistemology has not permeated physics basically because of the belief of physicist in Platonic truth of symmetries or formalism or symmetry.

1:23:34 Maxwell:

I have a question for you. So I'm thinking about this in terms of the direction of travel, of our research on the free energy principle which I mean, there are two main components too that we could discuss that are relevant here.

The first is the move from state based to path based or path integral formulations where what's at stake is precisely probability density function is not over individual but over trajectories, entire trajectories of a system where what your generative model Lagrangian is describing is the probability of some specific history. So this kind of intrinsically historical formalization and on the other hand, as a kind of second main direction of travel really formalizing these kind of three nested scales of inference where you have inference over state factors and individual states like color and red, green, Bleu and so on coherence over the parameters of the model.

1:24:49 The characterized the relations between states and configurations of states and finally the structure of the model which is really like the actual relations and functionality of what is connected to what. So one of the things that we're working on is getting to the mathematical foundations of these basically mutually constraining scales of inference. So suppose you had access to a path based description of the free energy formalism supplemented by a clear formulation of inference nested within parameter optimization, nested within structure optimization.

In other words, assuming that we solve structure learning, which is a big assuming, but if you granted those two things, would there be still much of a problem?

1:25:55 You think, from a formal point of view, if you could just move in the space of all possible model structures and paths through such spaces, would you not basically address what you have in mind here?

1:26:15 Avel:

Three things. First, bath integral. It solves the issue of preset meaning for vertical assistance and the issue of that already. But it is not something I called on here so it would not help with the issue I've discussed. Secondly is structured learning.

The question is how basically living things project structure. If we have that we would progress in a big way for a theory of cognitive meaning and agency. But you will still operate within a given space of possibilities. You will have attraction conversation of the state of possibles by virtue of what the FEP is it builds manifold. So the manifold the thing will evolve on the manifold where it will evolve.

So some of active states space would become trivial, some of the dimension will become trivial and some things that do not really appear per se in the set space will become relevant.

1:27:27 So they will become part of this data space as experienced by the agent. But the hard part is to account for how this test space as experienced by the agent becomes this test space per C. How you have matrix of six or six that serves as a boundary, let us say. And how agents will basically

collaboratively build *tissemoso* meaning where they have alphabet and can communicate long sentences using this grid.

And this is not in and of itself a question of structure learning. Although solving structure learning wasn't able to have a lot of computational experiments that would help greatly with looking at the fine brain structure. The question is how you use mathematics in a way well, in a way that describes creation.

1:28:29 That the concept of the spaces. That's what I'm suggesting within the space.

1:28:35 Maxwell:

That's what I'm suggesting when so the what I'm talking about is if you could figure out when to add a new node or edge to your generative model like precisely when is it appropriate to add a new parameter? When is it appropriate to say oh, these two parameters are connected to that state in these proportions. If you have that worked out I could see a kind of straightforward resolution to what we're just talking about. The system just unfolds dynamically and occasionally it learns new structure or parameters which basically means like new degrees of freedom are added to the system.

1:29:24 Avel:

You are again talking at the epistemic level.

You can describe a lot of things by basically looking at the dynamics and being smart about it. You don't even need advanced mathematics to do that. The statement we make is different. Let us say that you have people that agree that shells are an appropriate means of exchange for x, y and z. Then money becomes a thing.

It is a thing that exists individually because it has structural properties and these properties drive observables through dynamics and equally inevitably did not exist Ronen before. The question we ask is how we account for an evolution within a space that builds another space and we cannot just look at the space and declare how it has changed. It is not the problem we are posing. Problem is how it's present mathematically something that occurs within space, that proves another space that is the same but not the same, that is structurally similar, that inherits from what existed before, but is different in quality of aspects because this one thing became.

1:30:43 So what we have to have is a theory of becoming, basically.

And we can be very smart about modeling things without having a theory of becoming. We can be very precise nimco interference and very efficient at seeing regime changes. That does not mean we have a self consistent theory of becoming. Creation, test based construction, connectivity like those are two different problems, although 1 may help the other. regretly, both may help the other greatly because the thing we are looking at is the same way, looking at two very different aspect of the thing.

1:31:32 Daniel:

Maxwell, want to add something or Alexa on that?

1:31:34 Maxwell:

No, I'm going to think about that.

1:31:37 Alexis:
Thank you.

1:31:38 Maxwell:
Avel awesome.

1:31:40 Daniel:
Yeah.

From the chat on that topic, Tom wrote a similar question. Avel, could you elaborate more on how active could be expanded to accommodate state space creation? Assuming active is normative about free energy minimization, when should an agent expand the state space? And Alex Kiefer also kind of added a note it's appropriate to add a new parameter when the model complexity accuracy trade off says so. More seriously, isn't free energy measurable across models or different state spaces? So it's almost like there's the structure learning metacognition layer and it almost is like can the box be wrapped within the box? Can it be possible to have a state space that within its state space represents itself? And or to what extent do these physical intermediates and their associated physics and metaphysics need to come into play for different systems and at what level of generality?

1:32:45 Avel:
Basically, about this, I subscribe to a variant of consistent history interpretation of quantum physics. But it's not quantum physics. It's just something that has the kind of optical properties quantum physics has.
Well, I did commit to quantum indoctrination theory earlier, so okay, let us say it is in nature quantum, which is a bit trivial because, yes, it has pieces in it, which is what being quantum is. But whatever. This is the most specific mathematically consistent white presented that I found. Do you still see those slides?

1:33:26 Daniel:
Yes, EBA.

1:33:29 Avel:
EBA Bay.

And this is basically category theory because this diagram as a property, which is that following the arrows basically change what spaces b begins as ancestral interface. So a space of possibilities that in principle a fault interaction, but it is not semantically loaded. And the fact that you have the Nigeria of E , the Observables and A , I framed it as an agent, but it would rather be adaptive capabilities or constraints that enabled observation of E . So this does not conserve the property of B because B becomes equipped with semantics. So we have theories that look at spaces without looking at what is in spaces.

1:34:30 Those are category theories. And those are the most abstract field of mathematics as far as I know. And they do not afford semantically loaded things like free energy. Energy is a measure of not only it entails of states, but it also entails measure of states. I think the basic mathematical structure we

need to work on that is much more basic than any other things.

And any energy measure will break down much before we get there. But what we have that is more semantically loaded is this the duality between the experience of struggle to landscape by agents and the entrance flow that is created by the landscape and reconsider the landscape. So the question was what was the question?

1:35:32 Could you repeat it? Word force word Daniel.

1:35:37 Daniel:

It was just about the normativity around model selection and whether modeling states spaces could or would require the artifact.

1:35:56 Avel:

The activity is there it is in this representation of the problem, I have a small agents that represent circuit landscape and act within it. And I can just claim, okay, there is a set space, there is a flung destined space. I can defend energy. These agents minimize strategy.

And then this is where structural learning intervenes, basically, because those agents will try to understand the world. They do not experience the world directly. They will infer the world in a way that is robust and competent, but they can make up new things they can fail to understand. They can cheat, they can erode the structure of the landscape that is collectively enacted in many ways. And this, again is dual to something that is dynamics.

Actually, I do not know what it is. It doesn't have a word. The unfolding of the structure of the landscape under its own flow.

1:37:02 That, again, is not dynamics because it's not what the sensory says.

1:37:07 Maxwell:

We described what you're talking about in terms of niche construction in human systems.

Karl and I had an interesting discussion about this a few weeks ago. And yeah, I think what really distinguishes human systems from non human systems is the degree to which active inference lab loop is mediated by what would otherwise be internal states, but end up having this kind of ambiguous function. Of yeah, they're environmental, but they encoding the material aspects of some normative practice or some store some information about what you're doing, like a blackboard, for instance, or these slides that we're all looking at in some sense, encode the thought or aspects of the thought that you're trying to communicate.

Maybe a lot of the problem here can be finessed by noting that it's not just about agents interacting with each other.

1:38:09 There is a kind of common store of traces, like a kind of material thing that we all have in common.

1:38:21 Alexis:

Yes.

1:38:25 Avel:

You have a common collective action of given structural landscape because humans are such that then they synchronize in a robust and smooth sky loaded way. And that structural landscape, it does not exist. It is not something that pre exists. The fact that agents do that agents infer properties and then enact them. And this makes it an open landscape.

And the normativity of the FEP affords probably a computational experiment design that help us see how such landscape unfolds and look at material theory where the agent is absent, where it is landscape that produce the landscape. And once we have that, we have a theory of creation. It is what the theory of creation is.

1:39:17 Maxwell:

So what you're saying is if we had a theory where the agent was able to expand its state space through structure and parameter learning in particular, then we would have what you're looking for. Am I misunderstanding?

1:39:34 Avel:

Yes. But I'm not sure that we agree that we're relying on the constraints that this segment entails.

1:39:45 Maxwell:

Not sure I see what you do.

1:39:46 Avel:

Because the goal is not to understand how the agent engage with personnel environment, it is to obstruct. If we get to the target, we can obstruct entirely the agent in what they think and just look at constraints and how they informed. I went light on Axel Costa because we do not have it was not the place for that. But we need to look at specifically constraint over what is observable and how they are invigorated and how they produce other constraints, etc, etc.

We have to get back at this.

1:40:32 Maxwell:

Constraints are dual to priors. I mean, you're talking about the same thing.

1:40:38 Avel:

But the formulation that is taken in physics often by belief is DST. It entails primitive space. And this is what needs to be to address the problem I want to address.

This is why to have to be overcome and this is likely possible given constraints and trick ontology. So biology where do not have possibilities, then constraints of other possibilities, but constraints, then possibilities afforded by constraints. And I do know what I'm saying.

1:41:13 Maxwell:

Is that those two stories are the same story. That's what Bayesian Mechanics says.

1:41:22 Avel:

Within DST.

1:41:24 Maxwell:

But they're both from DST. So a free energy principle theoretic model of the belief updating of a particle in a system is in the strong sense of like is dual to you. If I have one, I have the other. Right? Is a maximum entropy dynamical systems model of the whole system, as in the whole system of particles and environment to which it's coupled and all of that sensory Conor. That's the cool thing. The FEP is the canonical optimal dynamical systems model. It's maximum entropy in the sense that it makes the least assumptions given your current state of knowledge about the system.

It's James. As in J-A-Y-N-E-S. It's James.

1:42:24 Optimal in the Parliament. So belton shock mebodyville.

Yes. If you have a constraints model, you also have an FEP model and vice versa. If you work it out from the perspective of the FEP, you can map back onto constraints. But definitionally, if you can frame a.

1:42:45 Avel:

Constraint model with no reference whatsoever to the ecosystem theory or preexisting spaces.

Yes, I agree, you have solved the problem but the paper which we refer to frames it within DST so it has those that we need to get beyond to solve this specific problem. Again, I do not mean to say basically you have framed this equivalence, I think up to details, let us say up to details I would need to think about it actually, but with the potentials that are precisely those that I want to use the equivalents to the Conor. So it is not I guess I'm.

1:43:28 Maxwell:

Just saying that constraints don't get you out of the problem that you were posing originally either like both you have another kind of layer of pre-giving static.

1:43:42 Avel:

Is not we have to characterize constraints, it is that we have to have an ontology of constraints.

So mathematical controls that Axel Costa with no reference to anything else, just constraints. What means? I don't know. But if we have that in the sense while considering the sense that is given by Monsieur Moreno and while leveraging the equivalence between constraints and belief that meaning belief, whatever that is derived we have one, but it is not something that has been done because FEP is friend within vanillafep, vfep is friend within DST, which basically states and Qfeps does not specify what build observable is, just specify that there are observables that we can make obeyed.

But we can't solve this within DST or within pure abstract quantum indoctrination. So it is not afforded by the structure of this series one prospective states, the other prospective observers we have to show how those are becoming integrated and the only way forward that I see is a constraint biology.

1:44:57 Maxwell:

Right, but what I'm saying is mathematically speaking, if you're talking about constraints then there is a in the end it's probably function. I mean, you know, there is a rigorous and systematic mapping from

what you're talking about to what the FEP is already saying.

That's really what the duality is saying maximizing your entropy with respect to some set of constraints is cue to minimizing your free energy with respect to some model. It's the same thing if you have one, you always have the other.

1:45:41 Avel:

How would you frame the notion of a constraint in the sense of control Monteville and Moreno with no reference to either DST or in the United States?

1:45:50 Maxwell:

Well, I mean in these reaction networks that they're mapping, they are implicitly using.

1:45:55 Avel:

Some kind of reaction networks.

It is another line of work.

1:46:01 Maxwell:

Right, but I'm just saying that there is a similar kind of individuation of things that's going on when you map out some kind of constraint schematic. In that sense, the point that you're making sort of like grandfathers both here, which is okay, but how do you write down a state space model at all? And how do you grow them in particular? But I guess I'm just saying, yeah, constraints are just as subject to this as to the extent that the FEP is subject to your criticism.

The constraint stuff is also for the same or dual reasons. If you just inverted all of the arrows in your reasoning, you would also be able to apply this to the constraint stuff equally. That's not an exit to what you're pointing out. But I guess my complimentary point is if you think moving to Axel constant ontology helps us, then that's interesting because any constraint mapping is also cue to an FEP theoretic model.

1:47:17 So maybe the FEP can be used like very directly, just based on the way that you're like if you solve the problem in terms of constraints, you could flip it back.

I don't know. If you're stuck along the way, then you can flip it at that point and think, okay, well, looking at it from this, do I want to look at self organization from the perspective of the cells that are self organizing or from the perspective of organization and the maximization of entropy and all that stuff?

1:47:51 Avel:

I guess so if you're doing that, the FTP treats a naturally different problem. This is not a view. This is a view opposed.

Specifically. I do agree that physics of and by belief derives within the st rigorous relation between basically what are the two sides of this up to details. What I am saying is framing as a goal the fact to leverage that as a way to build a mathematical theory of state space construction. And I also claim that this would be essentially equivalent to build self consistent constraint biology for that, for this diagram. I'm not sure what you are going against, because it is an ambiguous that your research as of now is

framed within DST, which presupposes states, which the constraint biology would not.

1:48:55 And it is ambiguous that is very relevant because it, as you said, entails one duality, at least in one specific case, which is this of DST. That is the key problem to address.

1:49:08 Maxwell:

So I think you may be combining two issues in this worry. There's the worry of like new states arising and there's the worry of using states at all.

Okay, the problem is not really that dynamical systems theory assumes states, it's just the static nest of the predeterminedness or the prespecified nest. Okay, if that's specifically your worries, there is a very fruitful way forward, I think, to address a lot of them.

1:50:01 Avel:

My proposal is a state space construction, not states based negotiationism. To get A, I need B to begin with, I need physical things to be there. Well, to have actually selfconstitute, you would need this to work from ex nilo to get something from nothing.

But it is not the issue at hand here. The issue at hand here is how existing things can unfold create whatever meaning states. So it is not the notion of states that is the problem. The problem is the fact that we do not have a theory of how states are created and we cannot frame it exclusively from mathematical theory that by construction presupposes a space of possibilities. We can, however, from this theory to generalize it to the space construction, which is what I'm proposing.

1:51:00 Maxwell:

But what about the renormalization group? So if you start really from the idea that you just have observations and they have a scale of noise associated with them, there are principled physics kind of ways of bootstrapping. Something kind of saying, well, some stuff changes. So fast relative to my reference scale that it basically averages out and just contributes kind of random fluctuations to what.

1:51:35 Avel:

I'm observing, whereas possibilities and you look at basically a way to analyze it, to look brain evolution scales.

But maybe it would be afforded to other pastoralism, but it does not intend, it does not model past realism. It is a model of how complex things, complex, dynamic, unfold.

So it is relevant. It is not what I'm pointing at.

1:52:07 Maxwell:

Right.

1:52:10 Daniel:

As we come near the end. For each of us, maybe you can spend the most time avil, but for each of us, what are our next steps? What cognitive counterfactuals and physical embodiments are going to be shaped by this work and discussion? Maybe we can have nonaval go first and then you can have the last word.

Sound good?

1:52:37 Avel:

Okay.

1:52:38 Daniel:

Well, personally, I'm very excited to work on the category theory this year, learning about the recent dissertation of Toby Smith. Also, I think it's interesting to bring in that niche modification active infrast variational ecology. A lot of the work that, as Maxwell brought up earlier, had been framed within a multiscale setting, bringing some of these new developments over the last one or two years, like the path based formalization renormalization group, environmental process, generative, process, generative, model, Symmetries, Weak, Markov, Blanket.

There's just many new concepts and toolkits on the table today in 2023 than I think there were one or two or three years ago. So it's been a super interesting discussion and it brings a lot of topics to our attention that I expect will be able to reduce our uncertainty about a lot in the coming year.

1:53:47 I'll pass to Blei, then Maxwell, and.

1:53:49 Avel:

Then Apple, the opposite. It would be more consistent because Blei and I goal directed together in controls.

1:53:55 Daniel:

Okay, maxwell?

1:54:01 Maxwell:

Well, I mean, Daniel, I would echo your overall assessment. I share your enthusiasm for where everything is at right now. I think we're poised for some very exciting work and a lot of very interesting stuff has happened over the short term in terms of what Aval presented. I think in addition to what you were describing, one of the things I want to work out this year is really the loss of the free free energy principle Bayesian mechanics. I think up until recently, what most everyone has been doing, myself included, was just coming at this thing from whatever disciplinary background we had access to and trying to just make sense of it.

But I think that has made us kind of blind to some of the and everyone has kind of their blind spots.

1:55:05 All of these so called interpretations of the FEP signal to me that there's philosophical work to be done to kind of understand. Jules had just put it nicely on Twitter. I think he said that he'd become convinced of two things. First, the FEP is true in the sense that it's quote unquote, the right way to do it. And second, that it's a lot more like boring than all the hype suggest in the sense that it just follows from the way that a bunch of physics hooks up. It's very fundamental and important. But yeah, it's part of the kind of core package now and there are new exciting horizons of unknown. But more to the point is there's like a kind of core philosophy to the Sat that d Maisto be developed? So for example, the duality between the principle of maximum entropy which implements a form of like Occam's Razor in some sense and the free energy principle I think is kind of deep.

1:56:14 But we've only started to think about the implication that have and Chris Fields group has been suggesting that there's a similar duality between the FEP and unitarity or the conservation of classical information in quantum information theory. So that's very exciting. Sorry for talking so long.

1:56:37 Daniel:

Awesome exciting times indeed. All right, Alexey, and avoid with the final words.

1:56:46 Alexis:

Yes, I will be short. So I'm really excited about how these debates will move the lines in theoretical but also practical philosophy and on goal directed perception of stuff in life in general to be a bit broad. Also, I hope that all of this will make the difference in metaphysics and ontology in philosophy and meta biology and naturalism, of course, as it seems to do in active insurance lab and chaos.

1:57:36 Avel:

We need to do to set all the dust on the agreement I generated there. The first is to formalize much better segmental. Biological consistency and phosphorialism both need to be very clear in their reach and entailments. This is something we'll do with Alexey Menlee and possibly autograph members. Something that we need to do too is to put a lot of work in working out what these Bay things mean. I do not know. I can tell you that it is essentially correct. I'm pretty confident that essentially correct, but I have no idea whatsoever what it means, but which is pretty big problem as far as I'm concerned. So there will be a lot of work for me and other members, namely Yanabrinak and Maxine Chimole to work out the specifics of this mathematical thing that allows order to unfold from chaos.

1:58:47 And most pressingly in my opinion at least, it's what I'm supposed to focus on in terms of flow. It is to work out what this means, how social constraints are enacted and how they evolve, because ultimately the rest is abstraction. This is what has content. This is what allows us to say, okay, these are what exists. These are the constraints that shape things, and this is what is their flow.

It is critical from centric perspective because it is what gives me to listen to our accounts. It is critical from pragmatic perspective because it is what tells us what world we are in and what is its flow, which is the goal of Cairos, something we'll do with mainly my own job and Venus Gonzalez. And so, basically, we will work around the specific of this.

1:59:47 And if someone starts to collaborate, please write us. We will be very interested because there is a lot of all of these problems are big problems, all hidden states, a lot of firepower.

So, basically, anyone who wants to, who's interested in working all the specifics with us is very much invited to reach out.

2:00:10 Daniel:

Excellent. Thank you, Alexis, Avel, and Maxwell, for joining. Thanks, everybody, for watching. Till the 034.2!