Why we know a lot of the past but little from the future

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Abstract

'Because the past has past and the future has yet to come' would be the simple answer. In this essay I try to go the round path with Carl Friedrich von Weizäcker that takes the structure of time - past, present, future - as necessary precondition for scientific experience to be possible and so for physics. Only from that precondition the growth of entropy can be shown. Given the physics (entropy grow) von Weizsäcker then shows, that the time structure we experience is realized in nature can be derived from the second law of thermodynamic. I want to show, that an additional element is needed: there must exist a mechanism of information grow, that makes the future unknown from the present. This is possible without contradicting the second law of thermodynamic. I further ask whether scientific experience can be derived from apriori knowledge and whether there is a being beyond physics.

1 Introduction

The real question is: How s physics possible? Physics is the most general theory describing all there is in an (almost) unified way. Most physicists are realists and answer the question by saying, that it is nature that behaves with mathematical precision. Here we take a Kantian approach and say: physics is the most general language that describes the precondition of scientific experience. That's why in all our experience we are able to find a physical theory describing that experience. And by experience we mean events we can predict. These events by its predictability and controllability appear as hard facts.
With Karl Friedrich von Weizsäcker we set the structure of time at the beginning of our experience. We learn from the past to predict the future. The past is factual, has already happened. The future is open and has yet to come. This time structure can be used to derive irreversibility from reversible microscopic laws. It can then be shown that the irreversibility is the cause that documents tell us more about the past than the future. This is not circular von Weizsäcker emphasizes but makes the whole argument semantical consistent. In addition to get the full time structure I will argue that there must be a mechanism that creates information in order for the future to be unpredictable. Otherwise we would know already the future and we might with that have a memory of the future.

Further we go to ask whether it s possible to reconstruct not only the abstract form of physics but also the concrete structure of our physical theories.

Finally we ask whether there is a being beyond physics and try to argue, that we find that in the uniqueness of each human being and in the uniqueness of human history and maybe in

the uniqueness of the history of the cosmos. There I will argue that the language of physics is not enough to describe the world as it is. Art, psychology or theology might use a language that is more appropriate to describe the human condition.

2 The structure of time

2.1 The order of time

Let us discuss the Ehrenfest urn model. We have 2 urns A and B with A having N white balls and B N black balls. After each step a random ball is chosen in A and one in B and put in the other urn. It is clear that with time passing the balls will mix and ending in a state where around $N/2$ white balls are in A and the others in B. The model describes a reversible stochastic process. The model is very useful to discuss the issues with the growing entropy because it introduces the randomness in the exchange process, so that one has not to bother with how randomness comes into the system.
The problem of the reversibility of the process can be seen that when one finds the system in a state out of equilibrium, where the number of white balls is $n < N/2$. If we then ask, how many white balls m where there before, from reversibility the answer is that with hight probability it was k with $n < k < N/2$. Before the entropy was bigger and it decreased. How comes we never make that conclusion? Because we take the past as present that has past, where in the future the entropy would grow.

2.2 Documents

Now that the we have shown, that entropy is growing with the time von Weizsäckers tries to show how it comes that we know much about the past but little about the future. He shows that a good document has a low entropy. Given that document it bears little information about the future but a lot of information about the past, since the knowing of the document increases the probability of the events happening previously, that before knowing the document have had very little probability because the have been in a state with low entropy. But for the future since equilibrium will be achieved with almost certitude the existence of the document does not increase our knowledge.
Here I do not agree completely with von Weizsäcker. A broken vase gives us a lot of information of how the vase was before it was broken. But we know also exactly its future. It will stay broken, become dust if we wait long enough. If we would only have entropy grow and otherwise deterministic dynamics, we would know exactly the future. I would say, we would have memories of the the future. There must a other process that make, that we know little about the future. There must be a information growing process.

2.3 The grow of information

Evolution could be described as a process that creates information. Also human beings create information constantly. How is this possible? Does this contradict thermodynamics? Prgogine showed that away from equilibrium such processes are possible. There we have bifurcation, where the system can develop in different unpredictable ways.
Von Weizsäckers also advocates a view where the growing of forms (information) also can be possible within the growing entropy. This is the case in crystal grow at low temperatures. He shows this in a simplified model.

Maybe this can be visualized also in Ehrenfest model at the beginning of the section. Imagine that when a black and white ball meet they can build a group together. It is in the state of maximal entropy, where the most combinations are possible. I had now time to develop this further.
It is a phenomenon that in evolution we cannot know how mankind will evolve but we can retrodict how the species must have been. The same for human behaviour: we don't know how someone will act, but after he has done it, it is easy to find an explanation of why he must have done it. The past was the state of low entropy wth only little potential information to be actualized.

3 Physics from precondition of experience

Is it possible to derive the structure of physics from the precondition of scientific experience? While a very general structure of physical theories seems to be possible to derive, it seems very hard to derive the 5th axiom (referring to Lucien Hardys: Quantum theory from 5 reasonable axioms) that discriminates quantum probability from classical probability theory from apriori arguments. In fact we had classical physics working very well until the beginning of the last century. What kind of argument could make it necessary to introduce quantum probability? I would guess, that it is the analysis of the measurement process that would lead to quantum mechanics. Classical physics might not be able to describe a complete consistent theory including the description of the measurement process. In fact in the Solway congresses it was always the unknown disturbance of the measurement apparatus that had shown that quantum mechanics is consistent. Of course the picture of the disturbance itself is a classical one. The disturbed observables had to be removed in Heisenbergs formalism so that only observable quantities remain.
Can we derive the concrete structure of physics from apriori arguments? Kant failed where he tried to derive some synthetic knowledge. Von Weizsäcker tried exactly this. From the smallest informational unit - the qbit (he called it 'ure') he tried to derive the existing physical structure. However he did not derive the interaction between the particles. I want to make a try to do exactly that. The argument is a transcendental one: I ask that there must exist an interaction that makes quantum measurement of the first kind possible. This is of course the von Neumann measurement. Having a system initially in the state $|i> |0>$ with $|i>$ the state of the ure with $i = \pm 1/2$ and $|0>$ the initial state of the measurement apparatus. After the measurement the state has to be in some state $|i> |i>$. We are going to ask that the unitary evolution has the symmetry of the ure $SU(2)$. So this seems not possible in a finite Hilbert space. If we suppose continuous time a simple Hamiltonian that is $SU(2)$ symmetric is $\sum \sigma^i p_i$. This leads to a Hamilton equation with the symmetry of special relativity:

$$i\partial_t \psi = \sum_i \sigma^i p_i \psi \tag{1}$$

where σ^i are the Pauli matrices and p_i the momentum operator. For a initial state with $p_1, p_2 = 0$ we have the von Neumann measurement in the 3rd direction. The ure is inseparably linked to space and time through the measurement interaction.
So the relativistic space and time structure seems to follow directly from the measurability of the ure. Now we have to go further: how we measure space?
Also how is measurability connected to gauge invariance? Since local gauge is the standard method to derive the interaction.

4 Is there a being beyond physics?

We use to use words only for things that are relatively stable. Not for the space between the things. Physics describes structures that have elements that persist in time. Structures we can control, make measurements. Repeat measurements. This seems not to be possible with human beings that are unique. Also humanity is unique. We cannot recreate the state of humanity to do experiments. The basic precondition of being able to apply physics seems to be missing. In fact the most boring description we can give of a human being are his predictable attributes. So for describing humans, humanity we have to use an other language, that is more appropriate. Art, literature etc. is doing a good job.
Given the uniqueness of each human being and of humanity also moral categories come into play. Something completely out of the scope of physics. We have to take responsibility for our future. How to steer the future of humanity? Use science in the best way possible but know its limitation in describing what is really out there.

References

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