

The Beginning in Science and Humanity

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The problem of the relationship between science and humanity has resurfaced recently. What could be the reason? One reason could be the interest of researchers in the role of creative processes in the emergence, or beginning, of scientific knowledge. Looking at the beginning of science, you may observe the shifting of the object of study from the results to the process of how the results are obtained.

Revolution and Evolution in the History of Science

Steve Fuller expresses interest in Lee Smolin's book *Time Reborn: From the Crisis in Physics to the Future of the Universe*, in part, to address the problem of time. Fuller addresses time in his own work often in connection with Darwinism, with evolutionary theory and natural selection. Evolution and revolution — the main problem of historians, philosophers and sociologists since the middle of the 20th century! You may recall that for Alexandre Koyré the history of science was quite different than for Pierre Duhem. For Koyré, revolution was the main feature the history of science. For Duhem, evolution was much more important for understanding the history of science. Hence, we see different interpretations of the scientific revolution of the 17th century. Koyré considered it as the beginning of a quite new science. Duhem tried to find in the past something close to any novelty received in the course of revolution and to demonstrate the impossibility of obtaining a result that would not be available already in one form or another in science of the previous period. The beginning of science was the main point of the discussion between these explorers of science history. Koyré saw it in this concrete place and time, in the revolution of the 17th century. Duhem removed the beginning to the past, as far as it was possible. His logic permitted him to do this on to infinity.

If we agree with the idea that every fundamentally new result in science must have its own roots, then we have to make a corresponding conclusion. Of course, Duhem did not deny the existence of scientific revolution in the 17th century. His aim was to understand it. For this it was necessary, to his mind, "to dissolve" the revolution in evolution. Koyré attempted, on the contrary, to study evolution by considering it as having its basis in revolution. The study of its basis is a necessary condition to comprehend the laws of evolution. The problem of this discussion is not "the idea that our ordinary experience of time's flow, which gives us a sense that reality is moving from the past through the present to the future, is not merely a feature of human psychology but is fundamental to the nature of physical reality" (Fuller 2013, 12). Nobody denies the possibility of such understanding of time and its correspondence to reality. But if we are guided by this conception of time, how can we comprehend the appearance of novelty in science? Is there any place for it in evolutionary science development?

The Emergence of New Knowledge in Science

Fuller agrees on this question with Smolin who is sure that obtaining new knowledge is possible only when time is understood as an arrow. He writes: "If ... the future is not yet

real, if novelty is possible, then the future is at least partly open and amenable to our efforts to construct it" (<http://brickmag.com/culture-science-divided-against-itself>). At the same time one of the participants of the discussion in Smolin's paper, his opponent, states: "With enough information the future is completely determined and predictable" (<http://brickmag.com/culture-science-divided-against-itself>). This idea is correct, to my mind, if we consider time as flowing from the past through the present to the future. All possible scientific knowledge is deduced from the past. And today's knowledge can be reduced to its predecessors (remember Duhem). The development of science is cumulative and progressive. The process of new knowledge emerging from the head of scientist is removed from the logic of scientific knowledge to psychology, sociology and history.

In addition, new knowledge can be obtained only if there is an outcome from science to the surrounding world. Recently, the notion of "context" is used to explain the appearance of scientific novelty. Context is not a science, but creates it. On each occasion context is different and science is formed on its new basis. The problem of the beginning is solved in another way. The beginning belonged to science, and to the outside world at the same time; in other case we have a logical circle. David Hume understood. (About the paradoxical nature of this situation with the beginning see also V.S. Bibler *From the Science Studies to the Logic of Culture*, 1991; Gilles Deleuze *Logique du sens*, 1969.) The very act of the birth of new knowledge "drops out" from the flow of time (see Merab Mamardashvili, *Arrow of Cognition*, 1996).

I cannot judge Smolin's idea of black holes from a cosmological point of view. But for the philosophy, it is interesting. This idea is something like points of bifurcation, or mutational points, or stem cells. Fuller sees "the crux of Smolin's cosmology — that black holes might serve as the seed bed for multiple evolving universes" (12). He writes about "Smolin's proposed revolution in physics" (12): "The universe ... is subject to periodic 'bounces', as it collapses into a black hole, only to be reborn with somewhat altered parameters that change the laws of nature so as to enable still greater complexity to flourish" (13). If this explanation of Smolin's theory is adequate, and I don't doubt it, then the comprehension of time must not be as an arrow. We have after every collapse, every "bounce", another law of nature. You can say that there is a new beginning of science and for a scientist it is necessary to understand it.

In the 20th century a special interest regarding the beginning, as an important moment in the research activity, was observed in many sciences not only in cosmology and physics. In biology, Darwin's theory of evolution and natural selection was much discussed. Natural selection needed to be reconceived in the frame of genetics — before selecting you need to have objects, among which you can make your choice. But from where do they appear? Where is their beginning? In order to comprehend evolution, it is necessary to answer this question, the question of the beginning, of the emergence of novelty.

Natural Science Acquires Features of Art

My point is that this trend in science revived an interest to the relationship of natural science and humanity. I do not think there is any sense in discussing whether scientists read Dickens or Heidegger and if this can influence, in some way, the relationship of scientists and humanists. Smolin does not take into consideration in this case that philosophers cannot teach scientists to work and vice versa. Scientists are not, as a rule, professionals in philosophy and for them it is difficult to comprehend philosophical topics.

In the arts, and in the literary world, the creative process was always in the foreground. It is difficult to imagine that Picasso became the great artist because he was continuing the work of his predecessors, that his ideas were already present in the pictorial art of the past. Pushkin created his original literary masterpieces from the beginning and Shakespeare worked in the same way. And you may not say that Pushkin's works are better, more perfect than the works of Shakespeare as they were created later. An idea of progress does not work here. The same is in the science of the 20th century. At least the tendency in science studies to explore individuality becomes more and more significant. You cannot say that Newton's theory was less perfect than Einstein's vision of the world. They are different, but the place of their appearance at the arrow of time does not play any role in this case. Each of these scientists' theories has its own foundation and explains the world as a whole — that does not mean that the history of science is put in some timeless space.

Fuller is right when attributes great importance to the notion of time. But time is understood in philosophy by different ways; this is not the place to discuss it, but it is so. Duhem's understanding of the history of science is not false. It is true for early modern science and can give good results in some cases today. But another understanding of the development of science, where the flow of time ceases to be continuous and uninterrupted, advances.

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