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In the Wake of the Pandemic: Scientific Researches must be Controlled with the Participation of "People from the Street"

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Abstract: ***It is already a common knowledge that the humanity was caught off guard by COVID-19. To understand why it has happened, the author is analyzing peculiarities of scientists' thinking. According to the principle of fallibilism, any scientific theory, including the most fundamental and commonly accepted, tomorrow may prove to be (or not prove to be) false. Today this principle is adopted almost by all philosophers of science, while scientists in mass keep on denying it, trusting too much their estimation, concepts and theories. The scientific community dramatically lacks self-criticism while scientists' inventions have more and more global aftermath with time. This combination is extremely dangerous for the biosphere and the humanity, as was emphasized by the COVID-19 pandemic. Imagine a drunk elephant in a china shop. The suggested solution is to ensure control over the science with the participation of "people from the street" just like jurors participate in a jury trial. Suspicious scientific researches should be forbidden (or allow) by "people from the street" having common sense and being free from their own scientific and clannish scientific interests. It would not be smart at all for the humanity to die from inability to limit dangerously overpriced ambitions of scientists.***

Keywords: virologists' main failure, principle of fallibilism, scientists' sins, freedom of scientific work, "jury trial" for scientific researches

1. Introduction

Whomsoever much is given, of him shall be much required. They say that the intellectual crème de la crème of the humanity is in science, and more and more funding is allocated towards scientific researches. However, the science did not predict COVID-19 pandemic and it also failed to provide us in advance with the means to fight it. Moreover, it seems as if exactly the science is to blame for this pandemic.

2. Virologists' main failure

Let's dismiss the conspiratorial myth that virologists on request of some dark forces transformed the bat coronavirus, which is not dangerous for a human, into pathogenic virus SARS-CoV-2 and maliciously released it.

The version stated, in particular, in the article by Yaroslav Ashikhmin [1], advisor to the CEO of International Medical Cluster Fund (Moscow), seems most realistic to me. It says that virologists were duly driven by the best intentions in an effort to learn how to predict pandemic threats and approach them with the pre-developed vaccines. Such was, for example, the case with PREDICT, International Research Program of 2009–2019, financed by grants of the US governmental agency USAID within the framework of the Emerging Pandemic Threats program. However, specific actions taken by virologists, mildly speaking, were strange on a hard look. They were trying in their laboratories to test by experience whether a virus that is not dangerous for a human may become life-threatening as a result of mutation.

Actually, for more than two decades, virologists have been trying to transform a common virus into a dangerous one in their laboratories, so that in case of success they could develop a vaccine against it. If such pathogenic virus suddenly occurred naturally, the virologists would already have a vaccine against it. At the same time, they implicitly assumed that virologic laboratories would be top-security jails for viruses.

Researches aimed at genetic modification of various viruses were conducted in several countries, and not only at the Wuhan Institute of Virology, where they were funded precisely within the framework of the PREDICT program and aimed specifically at modification of the bat coronavirus. And exactly this modified bat coronavirus broke free nowhere else but in Wuhan. Coincidence? I don't think so. In support of this let me quote YaroslavAshikhmin:

"Properties... of the [SARS-CoV-2] virus are perfectly suitable for escaping from the laboratory without any bad intention. It is easily transmitted from person to person, survives well on various surfaces and has a long incubation period. Infection may be almost symptom-free, but a patient will be contagious... coronavirus does not belong to the most dangerous... group of pathogens, and scientists, due to negligence, might have failed to observe precautions to the maximum" [1].

Another quotation from this article: "Yes, consideration of scenario of occasional leakage of virus from the laboratory partially discredits modern virology. However, the science must serve the interests of the society. Such experiments may be conducted only after the most detailed examination of each experimental record by the International Ethics Committee. The committee must include not only virologists, but also philosophers, doctors, specialists in bioethics, and junior laboratory personnel who is better aware of actual compliance with all safety principles".

As it turned out, despite the virologists' assumptions, it is very hard to make a 100% secure jail for viruses out of an ordinary virologic laboratory. So the virologists have failed

in estimating this hazard, leaving the entire humanity to pay the price. I totally agree with YaroslavAshikhmin, that virologists must be controlled by non-virologists in their work, which is potentially dangerous for the humanity. At the same time, I believe that such control is necessary for the ***entire science***, as all scientists tend to make mistakes ("whole science is woven of mistakes") and some of their mistakes may be globally dangerous for biosphere and humanity.

3. Sin of indefensible generalization

This is about the principle of fallibilism, according to which any scientific theory, including the most fundamental and commonly accepted, tomorrow may prove to be (or not prove to be) false. Above all, thanks to Karl Popper, this principle he fundamentally developed in the latter half of the XX century has been adopted by almost the entire community of philosophers of science (but by no means all of the scientists, refer to Section 8).

Now there is no mystery in the principle of fallibilism. Statements of scientists may be single (singular) and universal. The first category includes statements about single facts like "the heat engine*A*has a cold reservoir", "the heat engine *B*hasa cold reservoir" etc. Statement "all heat engines have a cold reservoir" is a universal statement. Scientists get scientific theories intended for interpretation of emperical facts by generalizing the end number of single facts and by making a universal meaning of their findings.

The problem is that any generalization is a roulette. By generalizing, a scientist can always make a mistake. A single instance where a universal statement is false is enough to confute it. Let's say, we cannot 100% reliably prove fairness of the law of energy conservation as we cannot test all possible cases of conversion of one form of energy into other forms. If we discover at least one instance where this law is false we will consider it no more a common law of nature.
It is important that scientists are not only enforced by a nature of scientific knowledge to make non-100% valid generalizations, but they tend to them by themselves: they try to be ahead of other scientists, to be the first to declare a finding (struggle for the priority is a driver of the scientific work). Moreover, the scientists are not just prone to make premature generalizations, but they are prone to makeas broad generalizations as possible. This is the point of so-called pioneer phenomenon (term of L.B. Bazhenov) consisting in overstatement by pioneer scientists of novelty, scale and significance of their novation and its extension to all and everything.

4. Examples of indefensible generalization

The first example is classical mechanics (Newton's laws of motion). Today, its scope of application has significantly narrowed in comparison to the XVIII–XIX centuries, because, as it turned out, this mechanics is not valid in the fields of the microwold, high velocities and large masses, where it was replaced by quantum mechanics, special and general theory of relativity respectively. Scope of applicability of Newton equations (as well as Liouville, Maxwell, Schrödinger, general theory of relativity) has most narrowed by their time symmetry which leads to their inapplicability for irreversible processes, while reversible phenomena in the observed world are extremely rare [2].

The extreme rarity of reversible phenomena is confirmed, among other things, by the fact that the observed world (with the radius of approximately 13, 8 billion light-years — see the third example), as we know today largely thanks to Benoît Mandelbrot, is mainly fractal, whereas(this is my statement) all equations that generate fractals are asymmetrical in time [3. P. 138–141, 167–173].

The second example— formulation of the Second Law of thermodynamics by Sadi Carnot [4]. According to Carnot, any heat engine has a cold reservoir, where to a portion of heat received from a hot reservoir is thrown. In other words, Carnot claimed that heat engines without cold reservoir (now they are called the perpetual motion engines of the second kind) cannot exist.

Carnot had derived his thesis from the thesis about the indestructibility of caloric (weightless fluid supposedly causing thermal phenomena) generally accepted in his times. In modern terms: Carnot thought that the caloric consumption is similar to the energy consumption. Really, we do not destroy energy by consuming it, we just convert it to another forms. The caloric consumption, Carnot said, does not mean its destruction; it means it transition from the warmer body to the less warm one. In Carnot's opinion, a cold reservoir was this less warm body required for any heat engine.

By the middle of the XIX century the molecular kinetic theory of heat had won, and it became clear that, converting into other forms of energy, the heat stops existing as heat. In the context of Carnot's logic, one could say that the caloric consumption meant exactly its destruction, whence it follows that, again according to Carnot's logic, there is no necessity in a cold reservoir.

However, with rejection of the caloric theoryphysicists did not reject Carnot's statement. The reason is clear: because, those days, all known heat engines have cold reservoir really. One and a half centuries have passed, and today I can say why it was so: firstly, all heat engines were ***cyclic*** those days, and secondly, they all used ***a one-phase*** working substance (gas or liquid). Non-cyclic thermal engines and cyclic thermal engines with two-phase working substance (gas-liquid) may operate without a cold reservoir. It is detailed in my works [5, 6], and herein I am going to touch upon only solar thermal power stations. Mirrors direct sun rays to the water tank, the water boils converting into steam, and the steam drives the turbine that generates electricity. There is no cold reservoir: ideally, solar heat is fully converted into electric power; maximum theoretical efficiency of the station is 1, not Carnot's efficiency.

It may go without the Sun. All we need is a heater, a tank with boiling water and a turbine that generates electric power. There is no cold reservoir in this option as well. Maybe such primitive heat engines without a cold reservoir are used somewhere, but they are simply not marked as the perpetual motion engines of the second kind.

The third example— overestimation of the cosmic expan-

sion phenomenon discovered in the late 1920s and early 1930s. This expansion was interpreted by cosmologists as the ***Universe*** expansion, while there is no proof that the ***entire*** Universe is expanding. And this is actually true, because we can observe only the internal volume of sphere with a radius of approximately 13, 8 billion light-years due to the Big Bang that took place about 13, 8 billion years ago. Moreover, if the Universe is fractal, then it may not globally(the whole Universe as a whole) expand or contractbecause the fractal infinite Universe has zero global density. So the observed cosmic expansion relates only to our Metagalaxy (to the observed world). All this requires drastic revision of the modern cosmologic world picture [7].

It's essential thatafter discovery of the giant cosmic structures whose sizes (about 4, 5, 10 billion light-years) are fairly comparable to a radius of the observed world (about 13, 8 billion light-years) within the last 10–15 years, the fractal Universe hypothesis seems to become more and more plausible than a competing hypothesis of (macro) homogeneity of the Universe [Ibid.].

5. Accusation: Scientists are clinging on to out-of-date generalizations

In my opinion, the communities of philosophers of science mostly remain too tolerant towards scientists when it comes to the principle of fallibilism. It is assumed that scientists do their best to eliminate their mistakes. In Popper's interpretation this myth sounds as follows:

“I do not know any creative scientist, who wouldn’t make mistakes — I mean the greatest of them: Galileo, Kepler, Newton, Einstein, Darwin, Mendel, Pasteur, Koch, Crick and even Hilbert and Gödel... Of course, we all understand that we should not be mistaken, and we are doing our best ... At the same time, we are nevertheless sinful animals — sinful mortals, as the early Greek philosophers would say: only gods can know; we mortals can only express opinions and speculations” [8. P. 31].

This image that Popper gives us has in fact little to do with reality. Scientists tend to eliminate only intraparadigmal mistakes: fails in logic, calculation mistakes, incorrect experiments. But, on the whole, they are reluctant to eliminate paradigmal mistakes resulting from incorrect generalization of a group of single facts. On the contrary, with all their might they cling on to generalizations, which start cracking under the weight of new facts.

Let's try to substantiate this accusation.

6. Sin of coding with using recipes of advertisement

We use the term "coding" here in approximately the same sense in whichmedics say, for example, about coding against alcoholism.

The number of scientists is growing around the world, and it's more and more difficult to be heard on the market of scientific ideas and theories. The situation is complicated by the fact that carriers of different paradigms usually do not listen to each other. That's why authors of scientific findings often go beyond the academic discourse and try to affect directly the subconscious of their colleagues. For this purpose, scientists use the same ploy as we see in advertisement, where the promoted product is shown in conjunction with something that would certainly trigger positive emotions. For example, they show adorable children and animals. As a result of multiple reception of advertisement, a positive perception of the advertised product is producedat the subconscious level.

Following this recipe, authors of the scientific novations use terms that are keyfor them, in conjunction with terms that initially have positive or negative connotation. “Average” scientists are also subject to a sin of coding: these are the general laws of thought, not only the scientific one. All of us seek to speak our thoughts in the most convincing manner, unconsciously using the coding tricks. Coding each other we are most susceptible to coding by our great predecessors: genius scientists use this method ingeniously, getting amazing results.

7. Examples of the use of coding technique by the Scientists

The first examples are the heat engines without cold reservoir. By calling them perpetual motion engines (of the second kind) in 1888, Wilhelm Ostwald used the magic of words “the perpetual motion engine is impossible”, which extremely complicated argumentation against their prohibition. It was a shrewd move, but mildly speaking, scientifically incorrect. **Firstly**, a human being cannot create anything perpetual, so an epithet “perpetual” is intended to nip any discussion of a possibility of creating such engines in the bud. **Secondly**, the case with the perpetual motion engines of the second kind is completely different from that with the perpetual motion engine of the first kind. This double move succeeded, and physicists ended up coded for absolute rejection of an idea of a heat engine without cold reservoir.

The second example is the theory of natural selection. This theory like nothing else promoted a development of the evolution ideas. However, the specific mechanism of origin of evolution novations—***mechanism of natural selection*** suggested by Charles Darwin is mildly speaking questionable. Nevertheless, Darwin's theory displaced the competing evolution concepts for a long time. First of all, the autogenesis theory that supposes that evolution takes place as a result of self-development of the matter under the pressure of interactions (the theory of self-organization). But Darwin's theory won. And I suppose, it was mainly due to the “successful” choice of the name for the theory. In fact, the term “natural” does not contain any information about the specificity of the mechanism of organic evolution suggested by Darwin, but it makes a reader believe that this is about something normal, ordinary, established, usual, accustomed, run-of-the-nill, routine (I wrote down several synonyms of the word “natural” from a dictionary). This choice, though scientifically incorrect, turned out to be very efficient in terms of coding, providing like nothing else an instinctive positive attitude of the scientific and near-scientific communities toward the

theory of natural selection.

The third example is the "negative coding" case. Jean-Baptiste Lamarck [9] dwelled on the evolution of organic world affected by ***self-development of the nature***. Means used by nature to create more complex organic forms are ***interactions***, among various forms of which Lamarck gave priority to heat and electricity. Nothing mystical. Unfortunately, using the scientific language of the XVIII century Lamarck called the interactions driving the organic evolution ***invisible fluids*** that were perceived by scientists in the XIX century like something mystical, leaving his more than reasonable autogenetic concept behind the evolutionism scene almost for two centuries.

8. Sin of excessive respect for the great predecessors

There are three main factors giving rise to this sin. **Firstly,** —coding of scientists and near-scientific public widely used by authorsof scientific findings.

Secondly, the imprinting phenomenon occurring in the animal world and the human realm, including science, discovered by Konrad Lorenz (1903–1989), the founder of ethology, i.e. science of genetic component of the animal behavior. If the newly hatched ducklings or chickens are provided with a moving balloon or a cardboard box, they would take it for their mother, following it anywhere, being incapable of "critical revision" of their attitude toward it. The same happens to young scientists: all of us tend to treat scientific ideas we were taught as gospel truth and it is extremely hard to revise them.

Thirdly, the ongoing rejection of the fallibilism principle by the scientific community, as specified in Section 3. Belief insustainability of truths obtained by scientists, which is still prevailing in the modern science, lays the base for the concept of classical science that dominated the science and the philosophy in the XVII–XIX centuries and included a concept of ***cumulative development (via accumulation of truths) of the scientific knowledge***. The victory of the principle of fallibilism in the philosophy of science in the latter half of the XX century had to ruin the concept of cumulative development of the scientific knowledge as well.

Cumulatism collapsed under the pressure of facts stating there are ***gaps*** in development of scientific knowledge, that are intrinsic to the entire universal evolution, including evolution of non-organic, organic and social worlds. In the organic evolution, such gaps are called saltations, and in the social evolution — upon reaching specific scale — social revolutions. In the context of scientific knowledge, evolution gaps — again, upon reaching corresponding scope — are called ***scientific revolutions***on the initiativeof Alexandre Koyré and Thomas Kuhn. However, the collapse of cumulatism and the victory of the principle of fallibilism took place only in the community of philosophers of science, while the concept of cumulative development of scientific knowledge is still prevailing in the scientific community.

It is understood, that if you think that scientific knowledge is composed of 100% reliably established truths and its development is a process of accumulation of such truths, March from one truth to another, then ideas of our great predecessors are gospel truth for you. This is precisely the position of the modern scientific community with few exceptions.

In theory, one of the three factors named above would be enough to make scientists truly believe in validity of scientific ideas and theories developed by the great predecessors. But there are three of them! Their combination works perfectly. It becomes clear why the modern scientific community perceives the great scientists of the past as prophets of the absolute truth.

Let's highlight once again that excessive trust in the great predecessors coupled with rejection of the principle of fallibilism are intrinsic exactly to the scientific community but not to the community of philosophers of science, which hold to diametrically opposed views. Scientists' position is quite understandable: they, and not philosophers, are responsible for "pureness" of scientific knowledge. They say, it is impossible to work if you keep on doubting everything you do.
Of course, mere worship of the great scientists of the past is not bad. However, it is bad when this worship is excessive. But it becomes excessive, when, having revealed weak points in such scientific theory we inherited, we start to defend it "at any cost" manipulating facts and logic, genuinely believing that it is true. I, myself, am guilty of that, and I understand that probably all scientists are capable of unconscious adjustment of facts and logic so that they fit the specified concept (paradigm). It looks pretty decent: scientists just try their best to understand and justify universal statements passed down to them.

9. Sin of suggestion of new theoretical justifications for collapsing generalizations

A talented scientist, and of course a genius one, will have no issues with finding and suggesting a new theoretical justification for the universal statement (generalization) which passed down to him, which he considers it to be fair, and previous theoretical justification of which has been refuted.
This is precisely the course of events that we observe, for example, in the story of Sadi Carnot and Rudolf Clausius. When the justification of the thesis "all heat engines have a cold reservoir" proposed by the former became invalid by the middle of the XIX century due to the collapse of the theory of the caloric (refer to Section 4), the latter suggested its new justification, without even doubting Carnot's thesis [10]. This justification is based on the value increase law introduced by Clausius ad hoc, and this valueis now called the Clausius entropy. This new justification is also invalid because of invalidity of the Clausius entropy increase law (there are well-known cases of full conversion of heat into other forms of energy, i.e. Clausius entropy decrease), as detailed in my book [6]. And I will add here that, as we can see in Section 4, heat engines without cold reservoir exist really (for example, solar thermal power stations), so any theoretical justification of the thesis saying that heat engines without cold reservoir are impossible, including Clausius's justification or any other, is invalid.

10. Community of scientists is ever more dangerous for the humanity

We come to the conclusion that the scientific community trusts utterly its estimates, concepts and theories, while it has no real grounds for that. It dramatically lacks self-criticism, while scientists' inventions become more and more large-scale with time. This combination is extremely dangerous for the Earth's biosphere and for the humanity. Imagine a drunk elephant in a china shop.

Danger related to the insufficient self-criticism of virologists was covered in Section 2. This case is obvious. However, even those mistakes that seem absolutely harmless, even abstract mistakes may be extremely hazardous.

For example, let's take the same Carnot's prohibition against the heat engines without cold reservoir. The problem is that, as stated in Section 4, consuming energy, we do not destroy it, which is forbidden by the law of energy conservation, but we just convert different forms of energy into one another. In the long run, almost all energy produced by us on the Earth sooner or later is dissipated as heat, heating the biosphere. Wherein, the energy consumption grows exponentially, doubling approximately every 30 years. If and when the humanity produces annually as much energy as the solar radiation that reaches the Earth's surface, and dissipates it as heat, advanced life forms would die. The biosphere will definitely not handle the doubled heat flow.

It is clear that in fact the situation described above is unattainable, because by that time, if no preventive measures are taken, there would be no humanity on the Earth, so there would be nobody to produce so much energy. Catastrophic symptoms of thermal pollution of the Earth would occur earlier. Some experts suppose that the energy consumption must not exceed 0.1% of the solar flux capacity, others speak about 1%. Comparison with the energy consumption growth rates and with the fact that in 2003 the solar flux exceeded the energy consumption about by 5 thousand times, shows that, if no measures on essential reorganization of the power engineering are taken, then catastrophic symptoms of thermal pollution of the biosphere will begin in 50–150 years.

Any considerable slowdown in energy consumption growth will not work, as it would contravene the laws of universal evolution, which vector, as we know, is oriented towards intensification of interactions [11]. On the other hand, no resources of the planet will be enough for the long-term exponential growth of the energy consumption. Therefore, the humanity must follow the example of the organic world that has been demonstrating successful combination of evolution aimed at intensification of interactions with ecological balance with the environment for billions of years. For this purpose, natural systems use ***circulation*** of the substance and energy. As for the human activity**,** ***energy circulation may be implemented as heat circulation***. We have yet to learn how to collect the heat which is today irrevocably dissipated in the environment, to return its energy to the energy cycle again and again. It is the transition to such —thermocyclic— power engineering that would address a problem of thermal pollution of the environment menacing with a world-wide disaster.

It's worth saying, that the humanity has already been moving one step at a time to creation of the thermocyclic power engineering. The most demonstrative of that are ***thermal pumps***, that are more and more widely used now all over the world for heating of buildings and that take energy from the environment, the Earth's surface layers or atmosphere. At the same time, the main problem is that heat distribution in the environment is basically featured by low temperature gradients. Therefore, thermal pumps and other classical heat engines taking heat from the environment have very low Carnot efficiency. That is why it is very hard to establish the thermocyclic power engineering using classical heat engines, those i.e. having a cold reservoir. So, exactly the "harmless" Carnot's prohibition of heat engines without cold reservoir with potentially high efficiency, that are not restricted by Carnot efficiency, stands in a way of actual establishment of such power engineering (for any details refer to [12. P. 121–151]).

It's clear, that there are more than a few cases when the humanity had to pay dearly for inadequacy of the scientific community, and with increase in the role of science this danger will only grow.

11. Conclusion

I hope that I have persuaded the reader that science needs external control like the one suggested by Yaroslav Ashikhmin for virology, as quoted above. The question is how we can arrange such control so that, on the one hand, it would not restrict freedom of scientific work, and on the other hand, it would not allow scientists to generate disasters.

It would seem obvious that non-professionals cannot and must not control professionals. However, despite its obviousness, this argument is invalid. The humanity had already solved a problem of control of non-professionals over professionals, and this solution turned out to be successful. I mean ***a jury trial*** where "people from the street" control professional lawyers. Turning a deaf ear to legal complications, the jury considers only one issue: whether the accused person is guilty or not. I suppose that something similar may be developed for the control over scientists. Specialists (scientists, medics, lawyers, etc.) can (and should) detect and discuss suspicious scientific researches, but only the "people from the street", having common sense and being free from their own scientific and clannish scientific interests, should allow or prohibit these researches. "People from the street" shall have to be limited to giving their verdict on potential hazard or safety of a specific research, and shallhave to be keep out of any other issues of scientific life, in order to minimize loss of freedom of scientific work.

I myself don't like the idea of control over scientific researches. In 2016, I retired from the academic institute due to the "senseless and merciless" control by the Russian officials over academic researches, established as a part of the so-called reform of Russian Academy of Science [13]. But, what's to be done? It would not be smart at all for the humanity to die because of inability to limitdangerouslyoverpriced ambitions of scientists.

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