Human dimension of Open Science and the challenges of AI technologies

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Abstract. Open Science as a major enterprise to enable a citizen science and AI technologies that can provide for the vast amounts of information to be digested by each human persons are argued to be connected to each other by revealing the possibility of the personalization of knowledge and the human dimension of science. The development of the IT sphere is shown to be the history of its personalization, which presents the challenges for handling the present-day AI technologies so that they would augment human labourers, and not replace them.

1 Introduction

The current social state of science, despite the rapid present-day development of science-based technologies, especially those of the IT sphere, can be best described as a state of crisis. Sociologists note that in most countries of the world it is becoming more and more difficult to pursue an academic career, and that the success in science depends not so on abilities, but rather on belonging to the privileged strata of society [1]. What is more, academic science no longer possesses a privileged social status it had enjoyed during the 19th and the 20th centuries, as general public demonstrates rather disappointment in academic science, leading to the formation of "alternative" forms of knowledge starting from *folk science* and ending with outright pseudoscience. As noted by Christian Fuchs, in the era of "post-truth politics" and "fake news" spreading around the world through social media, people no longer trust facts and experts – they "do not rationally examine what is real and what is fiction, but assume something is true if it suits their state of mind and ideology" [2, p.283].

The problems, in our opinion, is not just that people do not trust "facts and experts", but that it is difficult to establish the reliability of facts and the competence of experts. As Estonian scientist Jüri Eintalu argues: "Because of various reasons, it may turn out that the scientific institutions are not producing science, while the "non-scientists" are doing real science. In the extreme case, the official science system is entirely corrupt, consisting of

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fraudsters" [3, p.116]. The researcher even calls such a situation "institutional degeneration of science": for example, elite universities tend to consider any research activity carried out outside their walls as non-scientific, and this leads not only to a loss of trust in scientists by the public, but also to corruption within science itself, to the growth of depression and suicide rates among graduate students and to the overproduction of professional researchers with academic degrees [3, p.117]. "Professional science" also faces crises – like "replication crisis" that took place in the 2010s, when the international psychological community faced the problem of reproducing experiments. In particular, in 2015, after analyzing the data of psychological experiments published in leading journals, it was found that only 36% of such experiments could be reproduced – and with less effectiveness for the vast majority of them [4, p.140].

As a reply to the challenges of such a crisis, international academic community has adopted the concept of "Open Science". An "umbrella term", Open Science appears today mostly as a way and as a set of principles aimed at ensuring the objectivity of the research activity by providing open access to both data, methods and publications [5]. However, Open Science is in fact not limited by open access, but has other broader aims that could indeed help to overcome the social crisis and change the status of science in today's society. Particularly, according to the Amsterdam Call for Action on Open Science, that concept is to address the societal challenges of our times and to establish a kind of "citizen science" [6, p.2]. The same idea is also visible in the UNESCO Recommendation on Open Science, which emphasizes that science in general is to benefit people and the planet, particularly by allowing new social actors to be engaged in scientific processes, contributing to the development of citizen and participatory science and to democratization of knowledge [7, p.4].

Open Science is thus a project for re-institutionalization of science, which reflects the noted ideas of sociologists on the inadequacy of the traditional institutes to solve the current problems of science with its "institutional degeneration". With the idea of "citizen science" in consideration, Open Science as a trend aimed at democratization of knowledge could be argued to reveal the human dimension of science, its personalization, as opposed to the institutional paradigm of managing the research activity and defining its values, goals and methods.

It is interesting to note that this trend of the recent years coincides with another important and urgent topic of the agenda of the social discourse – the one related to the development of artificial intelligence (AI) and its growing usage in many spheres, including not only industry, but both scientific research and education. That raises a number of problems related not only to the field of information technologies (IT), but to humanities and philosophy as well. According to the results of the survey conducted among experts in AI technologies in August 2022, in 20 years artificial intelligence could replace 60% of truck drivers, 20% of surgeons and 50% of retail salespersons, while in 50 years those figures would rise up to correspondingly 90%, 50% and 80%; moreover, about 5% of the experts that took part in the survey believes that a more advanced AI could cause either human extinction or some kind of severe disempowerment to the humankind, while about 10% of the responses acknowledge the possibility of such extinction or disempowerment caused not so by the AI itself, but by human inability to control advanced AI systems [8].

The need to investigate the new intersubjective reality caused by the impact of AI and the new dimension on our understanding of the responsibility of science in dealing with the new technologies has already been the subject of research [9, 10]. However, the profound social and the humanist perspective of both the AI development and the current social crisis of science remains an open question, and the close connection between the two urgent issues related to the social and human aspects of science has not been discussed yet. Thus, the aim of this paper is to consider the human dimension of both contemporary science (particularly in the form of the concept of Open Science) and the challenges society faces because of the

development of AI technologies, using the methodology of philosophical consideration and analyzing both the current tendencies and their possible consequences.

2 Open Science and human freedom

As we have already noted, the major aim of Open Science is not just to promote open access as a way to solve the crises of replication peculiar rather to the closed circle of professional institutionalized science, but to revision the very idea of science's institutionalization, to virtually "open" serious science to society as a whole, so it would not need to find consolation in creating and following dubious forms of *folk science*. Open Science is an enterprise of democratizing science and creating a citizen science.

However, we would argue that both openness and democratization here relate not only to the field of knowledge, but to the society as a whole: in its openness and in its core values, science serves as force of social transformation as well. For example, as stated in 1990s by the then US President Bill Clinton in his address to university graduates, "science is something more than material wealth or the acquisition of knowledge. In fact, it is about our dreams... Together with President Thomas Jefferson, we have always believed that freedom is the firstborn daughter of science" [11]. Indeed, from a philosophical point of view, freedom and democracy as a social and political ideal and practice are closely related to the classical ideal of scientific rationality.

The mentioned statement about freedom as the "firstborn daughter of science" (used by Thomas Jefferson in 1795 in his letter to Swiss politician and writer François d'Ivernois [12]) belongs entirely to the tradition of the European Enlightenment: scientific rationality, academic freedom, the autonomy of the human personality, and democracy are all well grounded in that tradition. After all, these concepts are rooted in the idea of the profound interconnection between the achievement of social and political freedom – and the formation of rational knowledge, which is expressed in Kant's famous words about the courage to use one's own mind, to make use of one's own understanding: *Sapere Aude!* [13].

According to the logic of the Enlightenment, every person without exception should be endowed with such courage by definition, freeing him- or herself in the course of his or her personal development and enlightenment from the power of traditions and authorities and learning to manage oneself, one's own life and the life of one's own society without striving to alienate that natural ability in favour of anyone or anything else. The humanist idea of "complete and harmonious development of all powers" can actually be interpreted in the sense of making scientific activity available to each person – not so as professional research, but as *a culture of rational inquiry*. That's why science produces freedom – by making knowledge and especially free judgement available to everyone regardless of his or her nationality or social position, in total agreement with the ideal of humanism and today's project of Open Science as citizen science.

Of course, every ideal describes aspirations rather than practices. If we take look at the historical process of the development of science, the classical science of the 17th and 18th centuries will appear to us on the first glance as completely "open". Scholars of the day embodied the model of *République des Lettres*, democratic and cosmopolitan by its standards and open in theory to all talented scientists from almost all over the civilized world. However, despite its dedication to the idea of the general Enlightenment, it still remained elitist and European-centred in practice, as only a very small number of people could afford to have sufficient education and time for the research activities and for acquiring the culture of rational inquiry, to say nothing of complete and harmonious development of all human powers. Besides, as shown by David Lux and Harold Cook, the rather narrow circles of the early scholars could be even called "closed" as the practices of early science depended on tightly knit social bonds [14, p.201].

3 Mass science and institutionalization of knowledge

In any case, the situation changes radically already in the 19th century. The classical "open, but elitist" science based on free activity of personalities of more or less prominent and independent cosmopolitan scholars gives way to the mass science subordinated to centralized nation states. In other words, science becomes *institutionalized* – and finally gains egalitarism while losing, at least partially, its academic freedom, its autonomy and its openness. John Dewey used to explain this contradictory process at the beginning of the 20th century, when the mass science was still on the rise, as a decline of democracy, even if a necessary one: «As soon as the first enthusiasm for freedom waned, the weakness of the theory upon the constructive side became obvious. [...] The "complete and harmonious development of all powers," having as its social counterpart an enlightened and progressive humanity, required definite organization for its realization. Private individuals here and there could proclaim the gospel; they could not execute the work. [...] The realization of the new education destined to produce a new society was, after all, dependent upon the activities of existing states. The movement for the democratic idea inevitably became a movement for publicly conducted and administered schools» [15, p.108].

So, if the ideal of the Enlightenment in fact corresponds to the aim of Open Science as citizen science, the present-day situation is quite different. By the end of the 20th c. the shortcomings of the institutionalization of the Modernity become even more evident. As thousands and even millions of people get engaged in scientific activity around the world, both state and private institutions, in order to cope with the management of an ever-increasing number of persons they administer and the ever-growing knowledge those persons create, tend to more formal evaluation criteria, which are not always adequate. These are primarily abstract and quantitative scientometric approaches that are equally applied to various disciplines, including social and humanities, and are based on indicators of the number of publications, including those in such "closed" databases as Scopus and Web of Science. In case of Ukraine and other less developed countries, that also implies the necessity to pay the significant costs for article processing charges, which are in no way on par with the level of salaries Ukrainian scientists get (and are usually not reimbursed). As convincingly demonstrated by Indonesian researcher Sandersan Onie, even in such large countries as China, Brazil or India, the pursuit of formal quantitative indicators of academic activity in accordance with the requirements established by government bodies leads but to a loss of quality, to corruption, to the spread of the activities of "predatory" journals, and all that in turn acts as another factor in increasing the public distrust in scientists [16].

On the other hand, if the masses of scientific workers, including millions of undergraduate and graduate students, are to provide certain amounts of publications regularly, then attempts to fulfil the requirements would ultimately lead rather to violations of academic integrity than to the increase in quality. After all, it is not possible to *force* a person to be creative by administrative methods: the only result would be some distortion, an imitation of creativity – that's what the already quoted Jüri Eintalu calls a "pokazuha-science" [3, p.117]. That means that a certain share of "professional" publications may have quite a distant relation to the real science itself, resulting from the efforts to "fulfil the plan" by any means possible, and that institutional science is a "closed" science serving not so the interests of society, as the interests of its own institutions.

The problem, of course, is not that "professional" science is necessarily corrupt, but that in present-day society it faces challenges it can't overcome by its own, since the institutional criteria of evaluation are found to be if not completely inappropriate, then at least insufficient. Conducting one's own research in many fields of present-day science, especially natural science, requires both expensive equipment and a large amounts of time. As a result of the rapid development of science during the last decades, the amount of knowledge that appears

each year within each discipline has increased comparing to the classical age of universal scholars with their ideal of complete and harmonious development of all powers to such an extent that specialists even in a relatively narrow field must expend an enormous amount of time and efforts just to simply familiarize themselves with at least basic new materials in order to maintain their qualifications at the appropriate level.

On the other hand, such a situation contributes to the described social crisis of science: if even professional scholars faces difficulties, than the volume of scientific information significantly complicates access to it by society as a whole. The challenge of Open Science is thus to not only provide access to the data and publications, but to de-instutionalize and re-instutionalize science: it could be argued that the development goes in a dialectical way from "open and elite" science of the classical age, to "closed and mass" institutional science of the Modernity age, and to "open and mass" human and citizen science of the hopefully near future. The easy availability of the vast amounts of information in the age of IT technologies provides both challenges and opportunities: it is possible that the use of the latest AI tools (such as ChatGPT) for searching and processing information could make science more accessible to society. However, that's a rather questionable issue that only starts to be considered now in academic discourse.

4 AI and the challenges of personalization

Would the AI technologies help humans and make their knowledge more accessible, thus providing for further personalization of science? After all, it is exactly those technologies that could be argued to present an alternative way to promote citizen science – by not only making the vast amounts of information available to the general public (that was already accomplished in previous years by information technologies), but to provide a way to navigate through this ocean of information, which practically impossible to process for a human person just by him- or herself. Or is it, on the contrary, that AI technologies present a threat or at least a set of serious risks for the humankind, as already stated by some of the experts [8]?

In fact, the very idea that technologies can both improve and augment humans in their labours and threat them by unemployment and other harm is certainly an old one that predates the sphere of information technologies. For example, as early as 1832 Charles Babbage, who is considered to be the original inventor of the concept of a digital programmable computer, used to stress: "One great advantage which we may derive from machinery is from the check which it affords against the inattention, the idleness, or the dishonesty of human agents" [17, p.54]. The harshness of these words may come from Babbage's personal misanthropy, but the whole idea is quite sound and well coincides with the contemporary discussions. As the said inattention of humans may be explained by the *inhuman nature* of their occupations that consist of wearisome labour and repetitions of primitive actions. Babbage in fact was an ardent proponent of the division of labour so that a qualified mathematician would not bother spending his or her valuable time doing simple calculations (that could be done by a less skilled person or by a machine after all).

Should not we then greet the perspective of some machinery replacing humans in their non-human labour? The answer to the question is not that obvious. It is worth noting in particular, that Karl Marx who was one of the few 19th century scholars to appreciate Babbage's contributions to the economics of machinery and factory production, came to exactly opposite conclusions regarding this principle of division of labour, seeing it as a source of segregation and social injustice. And even the further development of machinery appeared for him under this perspective as nothing more than a new form of suppressing humans: "In handicrafts and manufacture, the workman makes use of a tool, in the factory, the machine makes use of him. There the movements of the instrument of labour proceed

from him, here it is the movements of the machine that he must follow. In manufacture the workmen are parts of a living mechanism. In the factory we have a lifeless mechanism independent of the workman, who becomes its mere living appendage [...] At the same time that factory work exhausts the nervous system to the uttermost, it does away with the many-sided play of the muscles, and confiscates every atom of freedom, both in bodily and intellectual activity. The lightening of the labour, even, becomes a sort of torture, since the machine does not free the labourer from work, but deprives the work of all interest" [18, p. 461-462].

It is not entirely impossible that the aforementioned grim picture of machine suppressing humans could relate not only to the factories of the 19th century, but to the computers of the 21st century as well. We would argue that "confiscating freedom" here means depriving humans of their ability to think independently, as machinery moves from the sphere of physical labour to that of mental and purely theoretical. Computers are programmed to follow the rules of formal logic – and that logic, just like the classical science in general, is rather based on thinking about general and universal laws, not unique and personalized cases. As an example of how the laws of formal logic contradict the common sense peculiar to the everyday thinking, we can refer to the experiments conducted by then Ukrainian psychologist Alexander Luria in Middle Asia in 1930s. Luria proposed local residents a question representing a simple syllogism: if there are no camels in Germany, and Berlin is the capital of Germany, then are there any camels in Berlin?

It was found that elder people who did not receive any kind of formal education usually answered the question positively – explaining that Berlin is a big city after all, so there should be a bazaar there, and somebody with a camel could well come to that bazaar. At the same time, younger people who have studied in modern schools solved that problem just immediately and without any hesitation: the correct response is negative [19]. This example shows that it is not entirely correct to consider the opposition between the formal logic and the common sense in only one aspect, that of the absolute correctness of the former. As even if the first part of the syllogism is correct about camels not having their natural habitat in Germany, the opinion of the elder people with their common sense could indeed be true: a single camel may be in fact present in Berlin – if not in a bazaar, then at least in a zoo.

Such way of thinking deals with the *singular*, as opposed to dealing with the *general* – it could be tied to the trend of Open Science and decolonization of knowledge [20], as well as to the personalization of science and knowledge aimed at restoring their human dimension. In fact, the very history of the development of the IT sphere is that of *personalization*: since the very genesis of the computer industry and up until now, it is the history of how computers were becoming more smaller and more accessible. There is a famous quote attributed to Thomas J. Watson, the chairman and CEO of IBM from 1915 to 1956, who allegedly said some time in 1940s that there is a world market for maybe five computers in total. There is no evidence he ever actually said that – however, it could be argued that in the 1940s and the 1950s, when computers were huge mainframes costing hundreds of thousands US dollars and occupying large halls in universities, many prominent IT experts used to think in exactly the same way, saying that one or half a dozen of computers is what the industry needs. And as late as 1977, the year when 'the revolution of micro-computers' brought us Apple II, Commodore PET and TRS-80, the president of Digital Equipment Company could still say that "[t]here's no reason people would want computers in their homes" [21, pp. 255–256].

In the same way, nobody in the 20th century – neither in industry nor in science fiction – could predict the appearance of mobile phones and computers and their universal spreading: it turned out that humans needed personal appliances, and not supercomputers or state programs for interplanetary space exploration. The AI technologies of the present day, on the first glance, well coincide with this trend of personalization: AI can serve as a personal guide for each human person, helping to acquire the information needed, including translation from

foreign languages. The problem, on the other hand, is that AI technologies in fact lack a human dimension – they can augment humans, but not replace them. One practical example of that is the concept of AI-driven cars – robotaxis. In 2014, Travis Kalanick who was then the CEO of international taxi company Uber, predicted that the prospect of self-driving cars presented an existential challenge for Uber. He said that human drivers account for two-thirds of the cost of an Uber ride: "The reason Uber could be expensive is you're paying for the other dude in the car... When there is no other dude in the car, the cost of taking an Uber anywhere is cheaper. Even on a road trip" [22].

Kalanick's mistake was that the economy is actually more complex. The same Uber monthly serves almost 100 million people in more than 10,000 cities, and yet Uber does not have a single car of its own. All their drivers are contracted, and Uber only pays them when they carry passengers. For example, if a driver is waiting at the airport, that is not a Uber's problem. All Uber requires is some sophisticated software that allows it to quickly and accurately match the needs of those who want to ride and drivers who are ready to provide them with the service. And it is fundamentally important that no one fines Uber if there are too many or too few drivers ready to take you where you want to go.

Robotaxis lose all these advantages. And the main loss comes either out of wasting money on an excess number of cars or out of losing customers if fewer cars are available than needed. Moreover, AI-based cars do not mean working without human personnel at all: someone has to perform a bunch of functions besides driving, including washing, refuelling, servicing and so on. Replacing just one set of costs (that of a human driver) does not lead to the overall increase in efficiency.

Of course, this does not mean a general failure of self-driving cars. This does not apply to tractors in fields and trucks on equipped roads. But with robotaxis, which is one of the most hyped techno-utopias of the early 21st century, it could well turn out like with the techno-utopia of "flying cars" in the 20th century, according to Peter Thiel's famous expression about Twitter: "We wanted flying cars, but instead we got 140 characters" [23]. The nascent market for self-driving cars has attracted hundreds of companies eager to get involved, but in the next decade self-driving cars will probably only transport large loads or pizzas, and maybe learn to drive themselves up to a client who ordered a car-sharing service. No one yet believes that AI-driven cars will ever replace personal transport.

The same could be said about other AI-based technologies as well. The fear of AI driving human into unemployment is exaggerated – or rather it represents the current wave of overly optimistic attitude towards AI possibilities that is based on wrong understanding the way AI can and will function. Another convincing example is how the large companies have farmed out their customer support to AI: it is almost impossible now to get help from a living person even for paying clients of Google or Amazon. And the efficiency of AI is very far from ideal – like in evaluating and removing contents from YouTube for various reasons. For instance, in April 2023 Adrian Black, a YouTuber dealing with reviewing and fixing old computer devices, had one of his channel deleted for an obscure reason of impersonating himself – i.e. his other channels.

The problem has not been solved until thousands of retweets and quotes followed so that the issue was finally brought up to attention of human staff, which is not at all possible to minor consumers. Who could only note: "Remember, when using Big Tech products, you are not a customer, you are the data" [24]... Still, we would not like to finish with this rather pessimistic note. The overuse of AI-based technologies that consider human customers as just another data can and should give way to more objective evaluation of their possibilities – and to a better understanding of how their usage could augment humans instead of pretending to replace them. And that's the way to personalize knowledge and to realize the goals of Open Science in achieving citizen science, corresponding also to the classical ideals of the Enlightenment.

5 Conclusions

As a result of the proposed brief investigation, we can argue that two urgent topics of today's social discourse, Open Science as a major enterprise to enable a citizen science, and AI technologies that can provide for the vast amounts of information to be digested by each human persons, are in fact connected to each other by revealing the possibility of the personalization of knowledge and the human dimension of science. The classical humanist idea of complete and harmonious development of all human powers can be interpreted in the sense of making scientific activity a culture of rational inquiry available to each person, thus giving birth to social freedom and democracy. When science becomes institutionalized mass, it gains egalitarism it was lacking previously but loses its academic freedom and autonomy by becoming "closed" science subordinated to state agencies.

The challenges of the present-day Open Science is not only to provide open access to the data and publications, but to re-instutionalize science, achieving "open and mass" human and citizen science. The development of first IT and then AI technologies makes that perspective actually possible – by making the vast amounts of information available to the general public and providing a way to navigate through this ocean of information for each human person. At the same time, the present-day situation with AI technologies demonstrates not only hopes, but challenges as well. As the history of the IT sphere could be presented as the history of its personalization, AI that could serve as a personal guide for each person in fact lacks a human dimension – they can augment humans, but not replace them. And while if the fear of AI driving humans into unemployment is exaggerated, we should definitely reconsider the current optimistic attitude towards AI possibilities and to learn how to understand them and how control them – how to makes use of the AI technologies instead of allowing the AI technologies to make use of us humans as just another data.

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