

Is Science Neutral?

By Christos Christodoulou*

Is science neutral? It is a question that has been exhaustively discussed in scientific circles (both in the exact sciences and the humanities), and many interesting and conflicting opinions have been expressed. But why are obliged to discuss such a question, and, even more so, why should we expect an answer to it? What does it matter whether science is neutral or not? In what way does it change our lives and affects the way we use the achievements of science? How does it change our research methodology?

When we are talking about science, though, what exactly do we have in mind? What is its relationship to technology? Are they distinct fields or are they overlapping ones? Is technology autonomous; does it determine social developments or is it determined by them? Could it be checked and to what extent?

Science is concerned with the study and understanding of the natural world, having as its main purpose the explanation of natural phenomena on the basis of observation, experiment and theoretical principles. The scientific research is divided into basic and applied one – two distinct approaches, with different objectives and methodologies. The aim of the basic research is to understand the nature's fundamental principles and laws without necessarily being interested in the practical application of its discoveries. In contrast, the applied research's aim is to apply the accumulated knowledge for solving practical problems and/or developing new technologies and applications. It is important to note that these two approaches are not mutually exclusive. In fact, basic

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research can lead to the creation of new knowledge and principles that can then be used in applied research new technologies and solutions to practical problems. Also, applied research can inspire new work in the field of basic research, with the aim of understanding the underlying principles. Technology is therefore applied scientific knowledge for the development of products and services which, at least in theory, improve the quality of life. As the boundaries between science and technology are becoming increasingly blurred, while science feeds technology and vice versa, we cannot, in our opinion, safely speak of science and technology as two totally distinct areas. In modern society, they often cooperate to promote innovation and growth. However, one could claim –a digressive comment with theological characteristics by a non-specialist in theology– that through technology and science humans often try to reach theosis; yet the latter is not understood in biblical terms, but rather in terms of being upgraded to powerful superhumans possessing certain superpowers. In every invention the original sin is committed on a scale: to become a Godless god-creator, solving problems and curing needs that arose because of the fall, creating new needs as a result, following the same perpetual cycle.

But what does neutral science mean? It means independence from political, social, economic, religious, moral or other sorts of commitments and influences. In this context, scientists must work objectively and transparently, seeking the truth without being influenced by prejudices, ideologies, economic and political pressures and personal beliefs. Respect for the neutrality of science is important for the preservation of scientific integrity and the credibility of scientific research. This allows science to evolve independently and provide objective answers to questions and problems that arise in society.

But is science always neutral? Or, otherwise, could that ever be possible? Although the principle of neutrality is important in the scientific process, there are many factors that can influence scientific research and its results. In any case, science is perhaps the only powerful tool for understanding the material world and further improving living conditions. Despite the discrepancies that might arise in practice, independence, transparency and objectivity constitute a fundamental triptych.

We should note here that science cannot be completely free of influences: scientists are members of the society and do not function out of history. Social, economic and political circumstances can influence the way science deals with certain issues. In their turn, scientific theories influence society as a whole and can be used as a banner (usually in the hands of lay people who do not fully understand the scientific endeavor) to support philosophical, economic and social models. The funding of research from various sources (governments, public organizations, private bodies, companies) can influence research interests, priorities and possibly results, as funding risks creating dependencies, which in their turn can lead to exerting pressures for specific results or avoiding of publication of the findings in order to support specific political agendas. On the top of that, politicians and governments can use scientific reports and findings to make policy decisions which can have long-term social repercussions. Furthermore, personal beliefs and/or biases of scientists or the wider scientific community, as well as political or social priorities, influence the choice of research topics, the ways research is conducted, the data analysis and the extraction of conclusions. Ideological constraints and social compromises that have been made during the past centuries have often prevented science from being developed freely and autonomously; at the same time, scientists, due to personal political or religious beliefs, have adapted scientific concepts on the basis of commonly accepted conventions. Obviously, therefore, external factors have the same decisive influence as internal ones on the evolution of science. If scientists succumb to all kinds of pressures by adapting their results to support specific agendas, this can lead to the misuse of science, as well as to the undermining of its credibility. Of course, the impact of all these factors may not be immediately apparent, but their influence and footprint are particularly strong, even if the scientists themselves are not always fully aware of it.

The neutrality view is based on the assumption that knowledge is autonomous and *de facto* true and provable, free from any influences, autonomous from the social environment and intertemporal, since it interprets already existing objective facts. But the history of science and technology shows that their development is determined by the prevailing

cultural, economic and social patterns prevailing in each era, derived from existing power relations and social priorities. Science and technology cannot be separated from the social environment within which they are developing; thus, scientific theories and technological applications are not unaffected by various kinds extra-scientific references.

Technology, as an applied science, is not about interpreting the physical world, but about designing, developing and building systems that serve human needs. It is therefore obvious that behind every technological achievement there is a purpose as a starting point, i.e. the knowledge of the object precedes its existence. On the contrary, for science, the physical world's reality comes first; the science's ultimate goal is precisely to discover its operating mechanisms. Even in the case of basic research our motivation is to understand nature and/or the transcendental, which depends on the scientists' metaphysical beliefs. The existence of once indisputable axioms, formed in specific historical circumstances have led science and technology in specific directions. Their questioning, influenced by social-philosophical currents or other reasons, have led to new scientific breakthroughs (e.g. Newtonian physics –quantum mechanics– relativity theory).

All scientific and technological revolutions are often presented as isolated processes. The unique character of knowledge is ignored; at the same time, it is also overlooked that all scientific/technological achievements have emerged within specific political, cultural, social, economic conditions, with the effects of the attained knowledge having already left on them their indelible mark. Science and technology do not evolve independently of history, as the whole social, political and economic context strongly influences scientific ideas and practices. Thus, in our opinion, it is self-evident that we cannot talk about the science's absolute neutrality and complete autonomy from the social environment. Questions raised by philosophy and religion, needs imposed by specific historical conditions, and artistic trends are only some of the factors that exert major influence on the development of sciences. After all, no scientist could complete his or her achievements without building on previous ones and on the work of those that had preceded them, while at the same time the way of thinking and the scientific methodology

they are following have been shaped by successive generations within a specific environment. In this context, and despite our wishes, technology cannot be completely neutral, since its nature is determined by our predominant value system. From the moment that scientific research –both basic and applied– are complex social processes, charged with existing theories, neither the experimental data nor the theoretical explanations of phenomena or the conclusions drawn from them are completely neutral, although objectivity is not under question. Moreover, the dialogue between the exact and the theoretical sciences, and the search for truth through different paths, give rise to reflection, open up new directions and ultimately bear their fruits; however, they confirm the science’s non-neutrality.

The establishment of a scientific truth or the prevalence of a technological innovation is shaped by processes lasting decades (or more), with the concept of timelessness being outdated, as theories or practices that were considered solid and indisputable have now been replaced and superseded. The history of science is full of concepts and interpretations of the natural world that have been abandoned, giving way to new theories, through processes of scientific revolutions and paradigm shifts¹. So how certain can we be of the validity of a theory or of the ultimate prevalence of an invention over another one?

These observations demonstrate that science is a dynamic field, a social and political phenomenon, and not just an objective tool, where neutrality is not always strictly defined. This is a reason why discussions about science often include ethical, political and social issues, and why scientific research and community must be sensitive to these potential influences and implications. Recognizing these risks and maintaining high ethical standards are prerequisites for ensuring scientific integrity and good practice in research, with the aim of achieving objectivity and transparency in the scientific process in order to maintain public confidence in science as a tool for understanding the world and taking decisions in society.

1. See Th. S. Kuhn, *Η δομή των επιστημονικών επαναστάσεων*, transl. G. Georgakopoulos and V. Kalfas, Synchrona Themata Publications, Athens 2008.

We should make clear that science and technology, constantly interacting with the unknown and pursuing innovation, simultaneously influenced by social processes and all kinds of competing interests, are by no means a panacea; new unforeseen challenges and unexpected events bring back to the surface issues that were thought to be solved, demonstrating emphatically the finite nature of human capabilities, when science loses contact with current reality, seeking to take full control of the natural world, with sometimes disastrous results, in order to serve non vital and/or unnecessary needs.

The neutrality question is always a timely one, as trivial as this may sound, but also particularly important for scientific/technological progress and development, since scientific and technical knowledge is inherently embedded in already formed cultures and civilizations. The statement that science is not neutral refers to the fact that scientific research, as well as scientific discoveries and applications, are not entirely independent from the social, political and cultural context within which they are developing. This means that science is influenced by the dominant values, beliefs and social conditions of a specific era, and that scientific discoveries can have social and political consequences. Viewing science as non-neutral is a fundamental position to deal with unforeseen negative effects and consequences of the various discoveries or inventions. Accepting the fact that there is no ideal condition, in this case neutral science, protects us from well-meaning but overly optimistic views of reality. When you make a groundbreaking discovery or invention, you cannot guarantee that its use will be limited to a good purpose. Such an attitude should under no circumstances lead to suspicion and conspiracy theories; it is simply useful to consider all aspects of a new discovery or invention. However, the fact that science is not completely neutral does not mean that it is necessarily biased or that it serves sinister purposes and interests. On the contrary, the purpose of the majority of scientists is to understand the natural world and to improve the quality of life through technological advances.

In our opinion, the well-known argument about the use of the knife (you can cut bread or kill with it) suffers due to the fact that the inventor of the knife had something particular in his mind, there was a specific

need that required a solution, in order for him to be inspired, design and make the knife; thus, feasibility (i.e. the treatment of a specific problem in a certain social context) automatically abrogates neutrality. Even if all inventions were made with an exclusively benign purpose, the degeneration regarding their use is inevitable: no one can exclude the use (legal or illegal) of technological achievements for non-beneficial purposes, without knowing in advance which use will ultimately prevail, depending on the priorities that have been set in a given social context.

To conclude: the development of science and technology is one of the greatest achievements of human civilization. Science provides a valid understanding of the world, while technology uses scientific knowledge to develop tools and applications that improve the quality of life. Nevertheless, science and technology are human endeavors, they are developing within a specific historical context, and are inevitably imbued with the values, goals and aspirations of a given society. Science may be objective in terms of methodology, data collection and processing, but it is not neutral; as we have already explained, the influence of social, economic, political and religious parameters is strong. In any case, what we need to do is to be aware of these limitations and remain increasingly vigilant; thus, we could constructively criticize the scientific processes and their outcomes by promptly dealing with any abnormalities, without resorting to Manichaeian simplifications and categorizations.

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