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Humanism and responsibility in experimental research: Ethics, physics, medicine

Abstract

When Stephen Toulmin (1922-2009) expressed the view that medicine saved the life of ethics—and did not allow it to follow philosophy into death—because it transformed it into bioethics, he expressed an eternal truth, since there has never been a time in human history when people have not shown an interest in health and its preservation: proper nutrition, exercise, healthy living conditions, medical care and pharmacy, more than philosophical thought, adhering to the axiom primum vivere deinde philosophare. However, he did not notice the dynamics of bioethics, which, just a few decades after its codification in 1971 by Potter van Rensselaer (1911-2001) and his work Bioethics. Bridge to the Future, not only transcended medicine to become a point of intersection and interaction between different sciences: biology (genetics, biotechnology, Biomedicine), Theology, Philosophy, Law, etc., but also accumulated around it such a large body of literature (from 1975 to 2000, the United States National Library of Medicine catalogued over 50,000 bibliographic references on a wide range of bioethical topics) and databases (with a wealth of collections of government reports, proceedings of ethics and deontology committees around the world, unpublished documents of expert committees, legislative provisions, audiovisual media, books and journals in digital form), which now requires specialisation, continuous methodical and systematic cultivation as an autonomous subject of knowledge.
Keywords: Medical ethics and deontology; environmental ethics; animal ethics; social ethics; survival science

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DOI: https://doi.org/10.12681/aprlp.254.3290

Since the time of the ancient Greeks, the question of whether it is right for doctors to experiment on humans has divided the medical community into two opposing camps. Herophilus[1] (331-280 BC), who considered the experimental method essential for establishing medical knowledge on an empirical basis, did not hesitate to achieve his goal of reviving, as Celsus and Tertullian report, at least 600 living people who were about to die, while, on the contrary, Galen (129-199 AD), who believed that experimentation was worthless unless it was based on sound reasoning, not only did not experiment on living humans, but also on dead animals, and also supported rationalism, i.e. the superiority of theoretical research over experimental research. In ancient Greece, according to the global bibliography (Eftychiadis, 2001), the foundations were laid not only for the separation of medicine from magic and divination, but also for the practice of medicine using scientific methods.

To see clearly how medicine was practised in ancient Greece, we can consider Plato. According to him, in ancient Greece, doctors treated slaves differently from free citizens. While slaves were simply given medicine without being asked or told why they had to take it, free citizens had to be persuaded that the treatment and medication they were being offered was appropriate for their condition. This is confirmed by the testimony of the orator Gorgias, brother of the physician Herodicus (*Gorgias,* 456a-b; Skouteropoulos, 1998): "It has happened to me," says Gorgias, addressing his interlocutors, many times to visit with my brother and other doctors a sick person who did not want to take medicine or let the doctor operate on him or cauterise him – and while the doctor could not persuade him, I managed to persuade him with my rhetorical skills.

With the advent and spread of Christianity, the course of history would change. Belief in the Resurrection of Christ transformed people's perception of death and, with it, their perception of life itself. Christianity reveals the value of individuality by emphasising the value of personal spiritual awakening and responsibility.

[1] Founder of the medical school of Alexandria and pioneer of anatomy.

For the Christian Fathers, man is solely responsible for his actions, freed from the bonds of family and society. In early Christian times, the Romans, writes Rodney Stark in his work *The Spread of Christianity (*Stark, 1996), threw people onto the streets at the first signs of illness because they were afraid of catching it and dying. Christians, however, faithful to Christ, stayed and cared for the sick with practical love. You could only do that at that time if you thought: So what if I die? I will have eternal life.

In this dark age, when, according to Roman law, people were considered objects that could be freely bought and sold in the marketplace, the Apostles proclaimed to the ends of the earth the equality of all people, the abolition of slavery, and compassion for widows, orphans, the elderly, and the sick. Thus, the Gospel changed the way Christian doctors would henceforth deal with various medical and philosophical issues, such as: What is the origin of life? How does the healing power of nature and its laws work? Should abortion and suicide be allowed or not? What is the relationship between the brain and thought and the soul? etc. The Gospel also helped doctors to develop ethical considerations, such as: What rules should biomedical researchers follow in their research? Should medicine be an end in itself for doctors, or is medical research subject to ethical restrictions? What makes an excellent doctor? What skills and qualifications should they have? How should they behave towards patients and their families, colleagues, subordinates in the research laboratory or clinic, nursing staff and pharmacists in order to be worthy of their mission?

In the light of the Gospel, the unwritten rules of the Hippocratic Oath, which since they were written have never ceased to inspire doctors in their noble mission, will acquire their true meaning. Medicine will become ethical and health will become a social and universal good. Medicine as a science, created through scientific methods, and medicine as an art and craft, acquired through practical apprenticeship, will elevate the medical profession to the most distinguished of all.

On a purely scientific level, the efforts of doctors to achieve certain knowledge cannot be distinguished from the efforts of other scientists to achieve success in their own work for two reasons: on the one hand, because the way of thinking is common, whether we think with numbers or with words and images, and on the other hand, because speech is man's power. With their discoveries, temperate scientists "prolonged human life, conquered diseases, and offered humanity unprecedented conveniences and material goods. (They thus managed to push aside) demigods and demons and (discover) a universe more complex and awesome than the human imagination could conceive" (Broad & Glanz, 2003).

However, the fact that people have managed, through the development of science and especially medicine, to build a bulwark against disease, the sufferings of life and death – does not mean that they have become more human, not only because health is one thing and virtue another, and someone may take care of their health, have regular check-ups, exercise and go to the doctor, not to do good but to do evil, as, for example, a cunning and well-trained thief does, but also because the materialistic hedonism that dominates our era has turned everything around us into a commodity, even beauty and health, leading us to blind practicality, the simplistic thinking of people who are dazzled by the external world and neglect the internal (Skalkeas, 2004).

For philosophers, if we want to distinguish genuine science from its counterfeit, i.e. pseudoscience and charlatanism, the only reliable way we have is to test all the knowledge offered to us through experimentation.

The origins of the experimental method can be traced back to Aristotle. In its classical form, however, empiricism was associated with John Locke and David Hume. According to them, the experimental method should be applied to all sciences, whether physics, medicine or ethics (with mental experiments and imagination): on the one hand, because scientific research cannot be reliable unless it stems from the systematic study of empirical reality and, on the other hand, because nothing can exist in our minds without first passing through our senses. In other words, empirical knowledge may not be able to reveal the essence of things to us, but we must not forget that it is also the only valuable kind, as it not only protects us from sterile subjectivism – and the danger of becoming embroiled in a dialogue of the deaf – but also because its conclusions are well documented through empirical evidence and experimentation, which proves that what we know about our world is what our senses allow us to learn about it.

Doctors, like all scientists, if they want to be truly worthy of their name, must not think inductively or productively, but hypothetically, "that is, from the best available information to the best explanation" (Peirce, 1923). To substantiate this view, its supporters proceed in three complementary stages: a. they point out the inseparable link between theory and observation, b. they propose the principle of disconfirmation over the principle of verification, and c. they emphasise the public nature of science.Specifically:

a. As Karl Popper (Popper, 2002) rightly points out, it is wrong to believe that we can have bare observations, raw materials, since our observations are always made in the light of corresponding theories. The starting point of our research is not the experiment or observation, but the theory, which dominates it from beginning to end. In other words, the scientist first conceives of a theory and then attempts to prove it experimentally, since if he has nothing in mind, he will not know what he is looking for (Popper, 1991).

b. Science is not advanced by verification, but by the falsification of scientific theories, and the history of science is nothing more than the transition from one theory to another through the falsification of the old by the new. The insistence, Popper observes, on verification is pure dogmatism, not only because if we knew the truth we would not need to search for it, but also because genuine science does not abhor criticism, but rather seeks it out. The scientist, Popper observes, who is imbued with a genuine scientific spirit is not only open to the new, but is also ready to revise or reject his theory, provided that it is proven that he was wrong in his measurements.

c. The confirmation of certain theories over a long period of time (such as the law of gravity) and their resilience to criticism from the academic community does not mean that they cannot be overturned in the future, since our world has an open structure and no one knows what the future holds, whether things will remain the same as they are today and will not be overturned. "Scientific objectivity," Popper observes, "(the intersubjectivity of science is not a product of the impartiality of a (single) scientist, but a product of the social or public character of the scientific method" (Popper, 1991).

In this sense, an experiment should be defined as the practical testing or application of a theory under specific conditions and methodology, or, according to another version, the methodical production of various phenomena, planned according to a specific research protocol, with the aim of studying them thoroughly, determining their nature, the causes that produce them and the laws that govern them (Dimitrakos, 1969). In other words, the experiment is rightly considered the alpha and omega of scientific objectivity, as it not only refers to a public experience that anyone can repeat, provided that one makes the "effort" to follow the same research protocol to the letter, but also proves that peer review cannot be exercised in isolation from laboratories, scientific journals and conferences, because the data from one experiment can only be overturned by the data from another experiment.

For philosophers, experiments derive their scientific credibility from various factors, such as repeatability, statistical analysis, controlled variables, etc. However, if we approach them from a logical point of view, it is not difficult to see that, despite their diversity, they can be categorised into four main categories for systematic reasons, corresponding to the research principles followed in their design:

1. Agreement. According to this principle, of all the possible causes of an issue under investigation, we must choose one to keep constant and unchanged throughout all phases of the experimental process, while changing all other causes sequentially. If we ultimately succeed in producing the desired result, the condition we chose to remain unchanged during the experiment can legitimately be considered the cause of the phenomenon. To put it as it is stated in the literature: The principle of agreement assures scientists that the hypothesis, variables, procedures, and results of their experiment are connected to each other in a straight line.

2. The principle of difference. According to this principle, in order to diagnose the real cause of a phenomenon, we must move in the opposite direction to what the principle of relevance dictates. Of all the possible causes of a thing, we must choose one in order to exclude it from all stages of the experimental process. If, despite all the combinations of causes we have tried, during the experiment, we ultimately fail to produce the desired phenomenon, then we can reasonably claim that the cause we excluded from the outset is the cause we are looking for.

3. The remaining causes. According to this, in order to consider an experimental result reliable, we must be able to gradually exclude, step by step, all possible causes except one during the experiment. In this way, we can be sure that the observed result is due solely to the cause we have identified and not to those that have been ruled out.

4. Parallel variables. According to this, in cases where we want to experimentally study a phenomenon for which, however, we can only have probabilistic knowledge of its causes, the correct way to study it is to focus our attention on whether (and to what extent) other phenomena occur when it appears, the causes of which we do know. In this way (i.e. by identifying alternative causes and examining them in parallel at different levels or in different groups), we will be able to distinguish between confounding variables, as they are called in the literature, variables, i.e. variables that only superficially affect the issue under study, but are not essentially related to it or are part of the main hypothesis, so that we can ultimately arrive at its main cause. For example, in a pharmaceutical study, we divide the participants into two groups, one receiving the drug under trial and one receiving a placebo. If the other variables remain constant, then we can be sure that the differences we observe in the results of the two groups are due to the cause under investigation (the drug) and not to other factors.[1]

[1] Randomisation in clinical trials does not simply increase the reliability of their results. It also reduces the risk of systematic errors, allowing researchers to make valid generalisations about their findings.

The principles mentioned above can ensure the validity of the experiment's results, but they cannot reveal anything about the ethics of the scientists conducting them or the purpose they serve. Whether they are conducted responsibly or not, whether they benefit democracy and pluralism or not, whether the laws and ethics established by international conventions on human rights and bioethics are observed, etc. Their use is instrumental, like mathematics.

To ensure that humanity that scientific studies conducted across the entire spectrum of science, from computers and artificial intelligence to elementary particle physics, the human genome and medicine, respect the rights, safety and well-being of participants, as well as the integrity of science, Research Ethics Committees were established. These committees were tasked with reviewing, approving and monitoring scientific research in order to ensure democracy and public accountability for all.

All of this has contributed to the fact that, in our time, the relationship between theory and experiment does not function in the same way as in earlier times. Science in Nazi Germany played a decisive role in this, where Philipp Lenard and Johannes Stark (Hentschel, 1996) did not hesitate to invoke scientific progress and the good of humanity in order to completely eliminate theory from science, to consider it an invention of the Jews (as well as Christianity, which they regarded as a Jewish heresy) and instead to propose experimentation as the only reliable, Aryan method.

Fortunately for all of us, however, this is not the case. Theory and practice are equally necessary for science. Only together can they provide a comprehensive approach to understanding and solving the problems we face. No one can monopolise the truth, since each of us has the right while we live to approach and experience the truth in our own unique way, sometimes regretting and changing our minds, sometimes becoming better and sometimes worse.

In physics, writes Max Born, the difference between theory and practice is clearer than in medicine, because in medicine we use experimentation more than mathematics and conceptual analysis.

All physicists, writes Born, "consider the work of our hands and minds to be useful and important," indicative of our genius (Born, 1993). However, theoretical physicists view practical physicists differently, and vice versa. Those who are obsessed with experiments "not only boast about their measurements, but also look down on the paperwork of their theoretical colleagues. Theorists do the same. Not only do they boast about their grandiose expressions and groundbreaking ideas, but they also despise the dirty hands of their colleagues in the laboratories wearing aprons." For Born, neither experiment nor theory should be absolutised.

"Looking back over the history of science," Born writes, "we see a kind of cycle: periods of experimental development alternate with periods of theoretical development. Theories tend to become increasingly abstract and general. They settle on principles that have been [...] proposed by philosophers and eventually assimilated by theory. However, as they become part of a philosophical system, a process of dogmatism and fossilisation begins. This is characteristic of (all) quantitative sciences," including medicine.

Equally true, Born continues elsewhere in his work, is the fact that: "the first doubts (about theories that were considered empirically and experimentally unassailable, such as Euclidean geometry) did not arise from experimental evidence, but from logical starting points. Intuitive insights."[2] "Experiment," writes Feynman, "helps to produce scientific laws in the sense that it gives us the starting point. But what is needed in addition (to move forward to the new) is imagination, (which will allow) [...] from these (first) impulses, (to create) the great generalisations" (Feynman, 2013). "The scientific process," says Born, "produces experts without knowledge when it is self-sufficient and does not question the principles, the method it uses and its reliability" (Feynman, 2013). A dominant role in science is played by the questioning of authorities, trust in common sense, and the intelligence of 's naturalness

[2] Some mathematicians, for example, considered "that it was not logical for a single straight line to pass through a point," and subsequently laboured to "construct non-Euclidean geometric systems" that not only apply to the real world but are also connected to physics and astronomy.

(Feynman, 1969). That is why "Science (should be understood as) belief in the ignorance of experts."

For Bruce Kasanoff, intuition is the highest form of intelligence. That is why the most intelligent people listen to and trust their instincts, even if they sometimes contradict their logic.

"Intuition," writes Kasanoff, "is knowing the right answer automatically and understanding what is important from what is insignificant, instinctively (Gigerenzer, 2008; Kasanoff, 2021). When you investigate deeply, considering countless possibilities and contingencies, you not only sharpen your intuition, but also contribute to the formation of collective intelligence." "Intuition," Kasanoff continues, "is our ability to understand the feelings and reactions of others, so that we can move from a chaotic or primitive conception to a well-organised understanding. Intuition helps each of us distinguish the essential from the trivial, the new that will determine the future, according to our inner voice." Einstein writes, listening to his own inner voice: "The intuitive mind is a sacred gift and the analytical, rational mind is its faithful servant. We have created a society that honours the servant but has forgotten the gift."

Those who make great intellectual leaps and determine the future of humanity harness the power of intuition to use it for the benefit of all. The fact that many scientists, such as mathematicians[3], and philosophers[4], "tend not to worry about whether their theories are in tune with the intuitions of ordinary people" or not, envisioning chimeras and utopias, should not lead us to believe that scientists are entitled, because of their gifts, to use any

[3] Spyridon Stelios, "Experiment and Philosophy: From the Mental Laboratory to Contemporary Practice," Aition 4 (2016): 112-115.

[4] The opposite view is expressed by Antti Kauppinen, "The Epistemic vs. The Practical," in *Oxford Studies in Meta-ethics,* vol. 18, ed. Russ Shafer-Landau, 137-162 (Oxford: Oxford University Press, 2023). A good analysis can be found in Spyridon Stelios, "Experiment and Philosophy: From the Mental Laboratory to Contemporary Practice," Aition 4 (2016): 112–115., 4. According to him, philosophers should not be confused with the common mind: "According to Kaupinen," Stelios observes, "the methods used by experimental philosophers can investigate [...] only superficial intuitions [...] while (traditional philosophers) who use conceptual analyses (engage) with strong intuitions [...] expressed by competent users of language under ideal conditions and without the influence of relevant factors. (According to Kauppinen) intuitions of philosophical interest can only be explored through dialogue and reflection, a participatory process similar to dialectic.

means necessary, adhering to the axiom of science for science's sake (Stelios, 2016; Nadelhoffer & Nahmias, 2007). Nor, of course, should they look down on others. Scientific research and experiments should be conducted within a code of ethics and conduct, because only then can they serve humanity.

With this in mind, four young scientists, Gustafson, Rydén, Tibell, and Wallensteen, drew up the first code of ethics and conduct in 1981 for scientists who want to respect not only their science but also themselves (Gustafson, 1984). According to them, scientific research is an absolutely essential activity of enormous importance to humanity. However, because scientific research can either directly or indirectly exacerbate humanity's problems rather than cure them, scientists must be able to defend their work not only scientifically but also ethically.

It is a fact that scientists cannot completely control the future use of their research results, which, once made public, can be exploited by anyone, even by those with malicious intent, or to have in-depth knowledge of the central planning of the scientific endeavour in which they are involved. Nevertheless, this fact should not prevent individual scientists from making sincere efforts not only to constantly evaluate the consequences of their research, but also to refrain from any research they consider unethical.

For Gustafson, Rydén, Tibell, and Wallensteen, scientists who wish to be worthy of their high calling should take the following seriously into account:

- Their research must be conducted in such a way that its application and other consequences do not cause significant ecological damage. (Animals should not be mistreated. Human suffering, ignorance, or despair should not be exploited.)
- They should not distort the truth for profit, nor conduct research in which the desired outcome has already been predetermined.
- Scientists have a special responsibility to thoroughly assess the consequences of their research and to make these consequences public.
- Scientists who conclude that their research conflicts with this

code must discontinue such research and publicly explain the reasons for their position. Such criticism must take seriously into account the possibility and specific weight of the negative consequences that may arise.

There is an urgent need for the scientific community (and others) to support their colleagues who feel convinced that they must discontinue their research for the reasons set out in the code, but also to denounce decisively all those who, whether for ideological reasons or because of their greed, selfishness and vanity, do not hesitate to sell out their scientific integrity, killing the human being within them.

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