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FALLACIES IN ARGUMENTATION AND DISCOVERIES: METHODOLOGICAL ANALYSIS

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Abstract: This article discusses and suggests solutions to a number of issues related to the problem of main causes of fallacies arising in the history of scientific discoveries like the role of "evident facts", uncritical assumptions, erroneous preconceptions and "crazy ideas". Special attention is given to particular cases of Aristotelian idea of the First Mover, Charles Darwin's non-Darwinian principles advocated in many occasions on pages of Origin of Species, the mechanical explanation of the physical world by the nineteenth century science. The issue of "crazy ideas" is presented in its relation to the notion of "absurdity". Authors of the article invite its readers to a well-known fact of history of science that scientists can suggest incongruous concepts while the scientific community and wide circles of men of learning could accept these absurd concepts as a respectful and true theory for long centuries of whole epochs.

Discussions of the problems and their solutions in this article are undertaken in the light of the concept of meta-argumentation developed by authors of the article.

Keywords: Meta-argumentation, fallacies, discoveries, "evident facts", uncritical assumptions, erroneous preconceptions, "crazy ideas", the First Mover, natural selection, Darwinism, crazy ideas.

Introduction

Fallacies in research are of numerous types and some of them are unavoidable. The biggest danger is presented by the "evident" and yet misleading facts. On the other hand, all problems and even facts we perceive in the light of fundamental scientific theories. There is some probability that scientific paradigms of a given epoch may avert and turn away the research from the true understanding of observational facts. Another source of fallacious conceptions in history of natural philosophy is that of uncritical assumptions and preconceptions. Researchers readily accept even a strange assumption if it is helpful in finding solutions to difficult problems. Scientists always give preference to a concept that provides the possibility to make exact calculations whatever assumptions were led in the foundations of this concept. The history of science proves that scientific concepts never emerge as complete creations. But this same approach may bring to excessive tolerance to one's own erroneous concept. This article discusses also the ways by which some incongruous and obviously absurd viewpoints got the statue of scientific conception.

The first section of this article introduces the concept of meta-argumentation developed by Hasmik Hovhannisyan in cooperation with her co-author Robert Djidjian (See Hovhannisyan, 2014; Hovhannisyan, 2015; Hovhannisyan & Djidjian, 2017).

The second section discusses the misleading power of "evident facts" that is considered the main factor yielding formation of erroneous scientific concepts and theories. The Aristotelian idea of the First Mover is thoroughly analyzed regarding the everyday knowledge of those epoch.

The third section shows that many fallacious concepts in history of natural philosophy were supported by uncritical assumptions. As an instructive case the mechanical explanation of the physical world by the nineteenth century science is presented. Scientists of the 19th century strongly believed they had already succeeded to explain all the unlimited variety of natural phenomena. The mysterious point of their tremendous achievement was that all the completely different fields of natural phenomena were given purely mechanical explanation. In actuality, all complex and divergent natural phenomena had been reduced to primitive mechanical models.

Section 4 deals with fallacies born by erroneous preconceptions. The idea that Charles Darwin himself was not Darwinist is discussed at length. In later life, Darwin claimed that he came to the idea of the evolution through natural selection already in 1838 (Darwin, 1859). But the fact is that up to 1859 (the year of publication of the 1-st edition of Darwin's *Origin of Species*) none of Darwin's published works contained any slight attempt to prove or just to discuss the idea of evolution. Darwin's non-Darwinian principles were not just an occasional misjudgment of an inexperienced investigator. On the contrary, they emerged from Darwin's vast experience in regard of the problem of species and his excessive studies of variation under domestication. Darwin was strongly convinced that under domestication there was more variability and more monstrosities than under nature. This conviction he advocated in many occasions in the *Origin of Species.* Such a hypothetical feature of variability, or "fact" in Darwin's opinion, could be accounted only to the action of change of conditions.

The last section studies the concept of "crazy idea" in its relation to the notion of "absurdity". Authors of the article invite readers to a well known and yet amazing fact of history of science that scientist can suggest incongruous and even absurd concepts. They conclude: crazy ideas are radically new principles designed to solve profound difficulties in a given fundamental theory. Absurd concepts are necessary conclusions from the principles of a given theory signaling a basic crisis in its foundations.

1. Fallacies in Argumentation and Meta-Argumentation

Taking into account the immense variety in which the variations of the term "meta-theory" are used nowadays we find it necessary to explicate the meaning by which Hasmik Hovhannisyan first introduced the notion "meta-argumentation" as the complete general theory of rational argumentation She pointed out the following 3 main interpretations of the term *meta-argumentation* in the works of contemporary researchers:

(1) meta-argumentation as the study of *models* of the general theory of meta-argumentation,
(2) meta-argumentation as a simulation of *arguing about argumentation* in the long-term development of practical algorithms for artificial intelligence,
(3) meta-argumentation as a study of arguments in their applications to significant scientific statements.

It was presumed that each advanced area of scientific knowledge, sooner or later must try to understand the methods for constructing theories in their field of science. Similarly, advanced branches of natural sciences should develop their meta-theories, first of all, keeping in mind the task of formulating methodological principles for building theoretical systems (Hovhannisyan & Djidjian, 2017).

Studies of the works of Albert Einstein in the light of the theory of meta-argumentation allowed the authors of this article to reveal the following methodological principles for grounding revolutionary scientific concepts.

Principle A. The best way to substantiate a revolutionary theory is to confirm its unordinary prediction.

The history of the explosive spread of Einstein's General Theory of relativity is the most impressive example of the real power of extraordinary scientific prediction. Observations of a solar eclipse on May 29, 1919, organized by Arthur Eddington, confirmed the calculated value of the deflection of the ray of light of another star under the influence of the gravitational field of the Sun. The observational confirmation of this extraordinary theoretical prediction was perceived as undoubted proof of Einstein's revolutionary conception not only to the scientific community but also to all educated humanity.

Principle B. Proponents of a revolutionary theory should reveal fundamental inconsistencies in the old (classical) theory.

Already in the mechanics of Newton, a clear distinction was made between the concepts of absolute and relative space. The introduction of the three-dimensional coordinate system of Descartes finally fixed the idea of the independent existence of absolute world space as the repository of all material objects and the entire natural world. In the years of the formation of special relativity, the main intention of the criticism of classical mechanics was the refutation of the very existence of absolute space and time.

Principle C. Proving a fundamental theory, one should explicitly formulate its postulates, axioms, or basic principles.

The goal of science is to encompass a maximum of empirical contents through logical deduction based on a minimum of axioms. The empiric data are not capable of leading theorists up to the regions of the highest axiomatic abstraction. Though the empirical fact is the "all-powerful judge", its judgment can be handed down only based on the great and difficult intellectual effort that "bridges" the wide space between the axioms and the testable consequences. In the case of fundamental theories, the task of building these bridges requires radically new theoretical constructions which at first are conceived as a "fantasy".

Principle D. The discoverer of a revolutionary theory should suggest radically new approaches to basic concepts.

Today it is generally accepted that new fundamental theories are developed by suggesting revolutionary principles. Often these principles are identified with radically new ideas since natural language allows naming the revolutionary principle according to its cornerstone idea — *the principle of inertia, the principle of relativity, the principle of constancy of the speed of light, the principle of equivalence, the principle of covariance*, etc.

Principle E. The author of a revolutionary theory should not concede even when confronting the most contradictory empirical data.

Einstein may have recognized the significance of the photoelectric effect in the development of a comprehensive theory of electromagnetic phenomena, alongside interference and diffraction, which radically contradicted to his corpuscular concept of photons. Einstein's intuition might have countered with the observation that the photoelectric effect defied explanation from a purely wave-centric perspective. These dialectical considerations could have led Einstein to optimistically suggest that the evolution of theoretical physics would yield a theory of light — a synthesis of wave and emission theories.

2. The Fallacy of Evident Facts

The misleading power of "evident facts" is perhaps the main factor yielding formation of erroneous scientific concepts and theories.

Science as such began by Aristotle. Aristotle succeeded to present his teaching of natural phenomena in such a demonstrative way that for almost two millennia educated mankind was completely convinced in the truth of its principles and laws.

Scientific causality, which explains events of the world accounting them to their natural causes, became a dominant tendency first by the Greeks. Though science made its first steps only, quite mysteriously, educated people of that time believed they possess a demonstrative knowledge of nature and even of the heavens. If one is ready to be satisfied by a simple answer to this mystery then the answer may sound as follows: Aristotle showed that things could not be other way.

Judging strictly, the necessity to introduce the extremely strange concept of the First Mover should force Aristotle to revise the principles of his physics. The basic principles of his natural philosophy were in complete harmony with the everyday experience of the ancient Greek society. Aristotle himself demanded from the explorers to deny concepts that do not agree with observational data. But what could be less compatible with everyday experience then the idea of the First Mover presumed to keep in motion all the objects of the universe while being itself motionless and bodiless?

In actuality, Aristotle's concept of the "super-strange" mover of the Universe necessarily followed from the principles of his physics that in their turn were generalizations of the evident facts of everyday experience. In ancient Greece, life and practice proved that to keep a body in motion one has to push it unceasingly. Another evident fact was well known for centuries: observations of dozens of generations confirmed the eternal uniform rotation of the celestial sphere.

Since the starry firmament was rotating uniformly and eternally while the motion of bodies in the sub-lunar world was fragmentary the question of the source of motion in Aristotelian physics could be only the following: the sphere of the Moon brings into motion the adjoining masses of air that in turn transmit their motion to the lower strata, then to water, earth and eventually to all objects of the sublunary world. But if a celestial sphere brings into motion air or anything else, then some other mover must bring the celestial sphere itself into motion. In the case of the Moon, this mover could be the sphere of the Sun. In its turn, it could be kept moving by the motion of the sphere of some other heavenly body, until we reach the outmost sphere of the fixed stars. Consequently, following this line of thought, one should necessarily accept the existence of some ultimate mover, the so-called First Mover, which had to keep in motion the outermost celestial sphere of the fixed stars.

To this point Aristotle's conception of the source of motion in the Universe does not demonstrate its strangeness. But the picture radically changes when Aristotle proves that the First Mover itself must be motionless. For if the First Mover were in motion there should have been a body that gave it motion. In that case the First Mover would not be the *first* mover. Aristotle concluded in *Metaphysics* that the First Mover always moves the things that are in motion, itself being unmoved (Djidjian, 2004, pp. 203-210).

Nicolaus Copernicus was the first astronomer who built a system of the world that objected the evident and apparent "fact" of uniform rotation of the stellar firmament. In his famous *De Revolutionibus Orbiu m Coelestium* ("On the Revolutions of the Heavenly Spheres") Copernicus presented a revolutionary theory of the heavenly world. It proved that the motion of the Sun on the sky as well as the motion of all heavenly bodies was just an illusion. The real motion behind these apparent motions was declared the motion of the Earth itself.

How could people of those days believe in such a fantastic conception that demanded to put in motion the huge mass of the Earth? Did the *Revolutions* suggest some strong arguments to propagate this extraordinary world-view? What had driven Copernicus himself to believe in this strange conception?

For some historians of science, the most probable driving motif of Copernicus' revolutionary program seemed his dissatisfaction with Ptolemaic system since it could not be regarded as a consistent physical picture of the world.

By contrast to Ptolemy's geometrical constructions, Copernicus' model of planets rotating round the Sun should be first of all conceived as the system of the world. Copernicus could hardly avoid believing that the heliocentric system provides a possibility to build a consistent model of the universe. In the Preface of *De Revolutionibus* he emphasized that in his system "the orders and magnitudes of all planets and spheres, nay the heavens themselves, become so bound together nothing in any part thereof could be moved from its place without producing confusion of all other parts and the Universe as a whole".

In fact, Copernicus also suggested only some possible explanations to apparent contradictions between his heliocentric hypothesis and principles of Aristotelian physics accepted in his days. Most convincingly sounded his explanation of the illusion of the motion of the Sun and the Heavens: It is like what Aenas said in Virgil's *Aeneid* (III, 72): "We sail out of the harbor, and the land and the cities retire". When a ship floats along on a calm sea, all external things appear to the sailors to be affected by a motion which is really the motion of the ship, while they themselves seem to be at rest with everything which is with them on the ship. Doubtless, in the case of the motion of the Earth, it could happen similarly that the whole Universe was thought to rotate.

3. The Fallacy of Uncritical Assumptions

Many fallacious concepts in history of natural philosophy were supported by uncritical assumptions. Isaac Newton was very critical to speculative and baseless hypotheses. But he readily explored the possibilities of very brave assumptions if they followed from empirical observations. For example, Newton suggested his corpuscular concept of light in the third book of the *Optics* as an apparent hypothetical assumption: “Are not the Rays of Light very small bodies emitted from shining Substances? For such Bodies will pass through uniform Mediums in right Lines without bending into the Shadow, which is the Nature of the Rays of Light.”

The interesting point in this text is the argument that rays of light do not bend into the shadow. This argument shows that by that time Newton had not yet observed the phenomena of the diffraction of light. In these circumstances, it was quite natural to prefer the corpuscular conception of light, the general idea of which in this or another form was discussed already by ancient natural philosophers.

The striking thing is how inventive was Newton using the corpuscular conception. Trying to explain observations of the colors of thin plates, Newton introduced the extraordinary assumption of “fits” of easy reflection and easy transmission. Deliberating upon the nature of his hypothetical “fits”, Newton used the strange assumption of vibrations of ether.

In reality, Newton just followed his main methodological principle to draw causes from the phenomena and to be free from preconceived ideas. Vibrations were the only possible cause able to produce the observed periodical stripes in the colors of the thin plates. Newton should have no hesitation to use this idea though it apparently belonged to the domain of the rival wave conception.

But being brave means getting in danger. Newton’s brave assumption of the existence of the ether was always accompanied by the threat of being refuted.

By the end of the nineteenth century physicists believed they had already succeeded to explain all the unlimited variety of natural phenomena. The mysterious point of their tremendous achievement was that all the completely different fields of natural phenomena were given purely mechanical explanation. Factually, all complex and divergent phenomena had been reduced to simple, if not primitive, mechanical models.

From the days of Democritus and Plato, natural philosophy sought the eternal basis of the ever-changing material world. Democritus suggested this eternal basis were atoms; Plato believed the real world was the world of ideas; Aristotle proved this basis was the material essence presented in the form of the four basic elements. To Newton the physical world consisted of inert masses and forces of interaction. With the discovery of the law of conservation and conversion of energy, science introduced a new eternal feature of reality. One thing remained invariable in all the unlimited variety of changes occurring in nature – the total energy. It became a new paradigm of scientific thought to reveal in natural events the conversion of some form of energy into other forms, strictly retaining the amount of the total energy.

Besides theoretical mechanics, the nineteenth century classical science developed two fundamental theories that had essential bearing on the general world picture – the theory of electromagnetism and thermodynamics.

Electric and magnetic phenomena are so essential for our understanding of nature that the development of electromagnetic theory was a very significant contribution to the scientific world picture. Besides the laws of electromagnetic phenomena, the new theory introduced into physical science the idea of the field that later became one of the most fundamental concepts of physical science.

Thermodynamic approach started by the discovery of the quantitative relation existing between heat and work. Soon the laws of thermodynamics were formulated as the most fundamental laws of nature. Thermodynamics proved that all forms of energy eventually transform into thermal energy. And this final form of energy should be distributed uniformly all over the universe. Since the universe is practically infinite, the process of establishing of the thermal balance in the macrocosm should mainly result in the total cooling down of all the stars all over the Meta-galaxy. The main philosophical conclusion from the laws of thermodynamics was the dull picture of the "cold death" of the universe.

The world picture drawn by classical science appeared extremely distressing. The heliocentric world picture was the first hard blow to the self-esteem of humanity so well used to the idea of being the center of all things. The situation became downright unbearable when astrophysicists proved by the end of the nineteenth century that the Sun itself was just a medium size star lost among billions of stars of the Galaxy. Then at the start of the twentieth century Edwin Hubble revealed that the Galaxy itself was one of the innumerable "isles" of stars in the limitless universe. So what importance could have the mankind drifting on a tiny particle undetectable in the infinite dimensions of the universe?

The only consolation for the mankind was the discovery that all the heavenly bodies were composed of the same substance as our earthly world. Being aware of colossal distances to neighboring galaxies which even the light beam had to travel for hundreds years, one should conclude that the mankind will never know anything definite about the composition of stars and processes going on there. But a simple discovery radically changed the situation. Kirchhof and Bunsen revealed in 1860s that the spectra of the beams of light contained essential information about substances that had emitted them. It was soon proved experimentally that stars are composed only of elements, which are well known on the Earth.

Already by the end of the eighteenth century, light was understood as a special type of wave propagation. Leon Foucault experiments designed in 1850 to measure the speed of light supported the wave theory. Due to these experimental results the particle theory of light was finally abandoned. But even the wave concept of light was interpreted in the frame of mechanistic approach. It was quite evident that waves need a medium to be propagated. Physicists readily accepted the existence of a special kind of medium – the luminiferous ether.

The mechanistic vision of the world was so natural for the nineteenth century scientists that even Michael Faraday elaborated his concept of electromagnetism in complete accord with mechanistic approach. Though it was Faraday who first proposed the idea of physical field – the cornerstone of the twentieth century non-classical world picture – his understanding of the field was rather mechanistic itself. According to his concept, forces of magnetic field were acting along the special kind of tubes which filled space around magnetic poles.

James Clerk Maxwell, who built the mathematical theory of electromagnetic phenomena, preferred to interpret the essential points of his own theory with the help of various mechanical models too. Maxwell wrote three papers developing his theory. He introduced in his first paper the concept of "electronic fluid" that should help him to explain the essential points of his approach. The second paper used the concept of molecular *vertices* for the same goal. Only the third paper developed the theory using the concept of *field*. Maxwell was so glad with the latter concept that put it into the title of his third paper "A Dynamical Theory of Electromagnetic Field". Just this paper served the basis of his famous two volume classical work "*A Treatise on Electricity and Magnetism*" (Maxwell, 1873).

By the end of the nineteenth century, Lord Kelvin, then the president of the Royal Society of London, declared that science succeeded to explain all the secrets of nature. There remained only two small "clouds" on the sky of natural science – the distribution of energy in the radiation spectra and the speed of light in the moving substances. But just these two small clouds started the tremendous thunderstorm that shook foundations of classical science.

Besides these two particular phenomena there were at least two basic questions that troubled the minds of adherents of classical physics. The first was the traditional question of the nature of gravitational attraction. The second troubling question arose in regard of the new basic component of physical world picture, the ether.

Possibly, already the nineteenth century scientists had to realize that the question of the nature of gravity is not correct. The law of universal gravitation was the most basic law of classical physics. Demanding to answer the question of its nature, one should realize that this answer is possible only on the basis of a new, more fundamental theory. And this was possible only if one could suggest some new law of nature – more fundamental and more general than the law of the universal gravitation. In actuality, all scientists were completely satisfied by the Newtonian law. Any deliberation on the nature of gravity in the frame of classical physics was principally incorrect. It was like demanding to define gravity with the help of a more basic concept. But already Aristotle explained that the basic concepts of a theory could not be subjected to definitions. Their essence is revealed in corresponding laws, principles, and axioms. Newton's law of gravity was one of the most fundamental laws of classical physics. Asking for additional explanation of its nature in the frame of classical physics was as incorrect as asking for a definition of the concept of gravity.

A basic concept of a theory may be defined only in the frame of the more general theory. Likewise, the question of the nature of gravity may be correct only in the frame of the more general physical theory.

4. Erroneous Preconceptions

A striking example of erroneous preconception is presented Darwin's attitude to the principle of natural selection.

There is a great mystery concerning Charles Darwin's celebrated creation, the theory of evolution. In later life, Darwin claimed that he came to the idea of the evolution through natural selection already in 1838 (Darwin, 1859). But the fact is that up to 1859 none of Darwin's published works contained any slight attempt to prove or just to discuss the idea of evolution. How could it happen that during long twenty years Darwin did not publish a single sentence on his great discovery until Alfred Wallace sent him his paper that suggested the principle of natural selection?

This mysterious gap between the time of the alleged discovery of the principle of natural selection and the publication of Darwin's *Origin of Species* caught the attention of many writers. The sources of such long continued mental effort," mentioned Loren Eiseley, "are not always easy to discern, and it is unlikely that Darwin himself preserved to the end of his life clear memories of all his multiform activity during the years when he was engaged upon his book (Eiseley, 1958).

In actuality, there was a serious factor that almost *excluded* for Darwin the possibility to discover natural selection. This factor was Darwin's unlimited devotion to the alternative principle of *inherited effects of use and disuse of parts* and his strong belief in *the direct action of physical conditions*.

All over the pages of *The Origin of Species* proving the decisive role of natural selection, Darwin persistently mentioned also the role of use and disuse of parts. He insisted that the modification of species has been effected chiefly through natural selection aided in an important manner by the inherited effects of the use and disuse of parts.

To be understood clearly, Darwin emphasized that the latter two forms of variation lead to permanent modification of the structure of organisms "independently of natural selection". It is true that *The Origin of Species* is mostly a demonstration of the unlimited capacities of the principle of natural selection in explaining general features and peculiarities of the evolution of species. Yet, in almost each of these demonstrations, Darwin persistently added that natural selection can or should be helped by the mechanism of use and disuse of parts.

These strong bonds with the hypothesis of evolutionary importance of use and disuse of parts and direct action of external conditions almost push us to a crucial assumption: *the principles of use and disuse of parts and action of external conditions were presumed by Darwin as the mechanism of the variation of species.*

Scientists defend their important ideas and hypotheses, clinging to them even when opposed by strongly contradicting facts and rigorous theoretical objections. By contrast to this universal rule, Darwin was never strong in defending the principle of natural selection.

In 1867, Fleming Jenkin, an erudite Scotch engineer, strongly criticized Darwin's theory. He mentioned that a favorable new character possessed by one or a few rare mutants, which Darwin considered the initial step of evolution, would soon be swamped out of existence in any population group in which it occurred. Jenkin's calculations proved that a new favorable character could survive only if it emerged simultaneously throughout the majority of the population. Darwin too readily admitted that the principle of natural selection was insufficient to build the theory of evolution. Under the pressure of critique, in the later editions of the *Origin of Species* the principle of natural selection was supported by the idea of use and disuse of parts and direct action of conditions.

The *Descent of Man* (Darwin, 1871) directly admitted Darwin's retreat from his earlier view of the principle of natural selection as of leading motif of his theory of evolution. In that volume of his theory of evolution Darwin wrote that he "attributed too much to the action of natural selection".

Darwin's favorable principles of use and disuse of parts and action of conditions are apparently non-Darwinian if natural selection is understood as the corner stone of Darwinism. The assumption of the inheritance of variations emerging through use of parts and action of external conditions is diametrically opposite to the ideology of natural selection. Factually, Darwin's principles of use and disuse are incompatible with natural selection. The latter selects and accumulates favorable variations among a mass of chaotic modifications. While Darwin's principles of use and disuse of parts and action of conditions deal from the start with favorable variations.

How could the increased use of a particular part of an organism bring finally to the emergence of a new variety with a given favorable character? It could happen if only the increased use of that part would modify the organism in a favorable manner. In that case, the inheritance of such modifications through successive generations could be accounted for the emergence of a new variety with the given particular feature.

Darwin believed that variability was generally related to the conditions of life to which each species has been exposed during several successive generations. He tried to show that "changed conditions act in two ways, directly on the whole organization or on certain parts alone, and indirectly through the reproductive system".

The direct action of conditions of life produce well directed favorable modifications that cannot be evaluated as being chaotic. The principle of use and disuse of parts presumes same kind modifications too. But assuming initial favorable variations, one would have no need of natural selection to deal with them. So, any biologist who accepted the principle of use and disuse of parts and direct action of conditions would hardly need natural selection. This implies the crucial conclusion that biologists with such vision of variation of species least of all would be inclined to discover the principle of natural selection.

Thus, we come to the following final conclusion. Preparing and elaborating during long years his manuscript on the problem of species in the light of the principle of use and disuse of parts and action of conditions of life, Darwin did not need the principle of natural selection and had little chance to discover this principle (Djidjan, 2002, p. 232).

Darwin's non-Darwinian principles were not just an occasional misjudgment of an inexperienced investigator. On the contrary, they emerged from Darwin's vast experience in regard of the problem of species and his excessive studies of variation under domestication. Darwin was strongly convinced that under domestication there was more variability and more monstrosities than under nature. This conviction he advocated in many occasions in the *Origin of Species* (Darwin, 1859). Such a hypothetical feature of variability, or "fact" in Darwin's opinion, could be accounted only to the action of change of conditions (Djidjan, 2002, p. 233).

Similar difficulties arise also in regard of max Planck's quantum conception. Could any physicist at the start of the 20^{th} century accept or at least imagine that energy is distributed only in discrete portions? Out of any doubt, answer to this question should be negative. And Max Planck, the discoverer of the quantum structure of energy, could not be an exception among the physicists.

In the last decade of the nineteenth century, the failure of classical electromagnetic theory to treat satisfactorily the experimental data concerning short wave radiation puzzled many theoreticians. Later the situation was labeled as "ultraviolet catastrophe", the term "violet" referring to the short wavelength region of the optical spectrum. Planck approached the problem of shortwave radiation from the point of view of statistical physics, using the conception of entropy. At first sight, Planck's approach may seem absolutely strange since electromagnetic radiation was understood as a specimen of continuity while the statistical physics was applicable only to discrete systems. The study of the statistical model of radiation did not produce significant results. Planck was forced to tackle the problem from another side - that of thermodynamics. In this field he felt himself quite confident since during many years he had profoundly analyzed the laws of thermodynamics.

The intensive research of the problem made it necessary to realize the essential role of the universal constants of the laws of radiation. They were two. The first was the well-known Boltzmann's constant. The significance of the second universal constant appeared more complex. It represented the product of energy and time that physicist called *action*. So the second constant could be viewed upon as the elementary quantity of action or, using the Latin term, the *quantum* of action. These sort considerations could bring Max Planck to the idea of quanta of action, from which there remained only a short distance to the hypothesis of the quanta of energy (Planck, 1949).

Of course, the suggestion that heat radiation is composed of discontinuous quanta of energy was absolutely incompatible with the principles of classical physics. Yet to consider energy in terms of quanta, as a transitional means for reaching the real basis of the nature of heat radiation, could seem quite admissible. Especially, if we take into account that Planck carried on his research in the light of statistical physics and thermodynamics where scientists were used to deal with discontinuous entities, that is, atoms and molecules.

This way or another, Planck suggested his revolutionary hypothesis of quantum structure of energy of radiation. Yet the power of classical continuous preconception of energy was so dominant that Max Planck – after his discovery of quanta of energy – went on about a decade long research of possible classical mechanisms for radiating energy in discrete portions.

The huge power of preconception influenced Erwin Schrödinger's scientific investigations in a special way. He was "taken hostage" by his own discovery of wave functions. Schrödinger wave function is the most effective instrument of theoretical atomic physics. The idea of wave properties of electrons and, in general, of duality of matter and waves came forth in 1923 in Louis de Broglie's doctoral theses. Actually, Louis de Broglie proposed not only the general idea of wave-particle duality, but also mentioned that in the light of the new concept it could be natural to assume that electrons vibrate inside the atom in the form of spatial standing waves. If he had been more mathematically gifted, he would soon develop the wave mechanic theory of atom. This last task accomplished Erwin Schrödinger.

The philosophical difficulties of the wave approach should be very disturbing. But they were significantly stifled due to immense success of wave mechanics as of an extremely productive instrument of theoretical calculations. All the parameters of atomic world were easily described with the help of wave function. It was unanimously accepted soon that the three conceptions of atomic physics – Schrödinger wave mechanics, Heisenberg matrix system, and Dirac operator approach – were equivalent systems of the newly born quantum mechanics.

What regards the philosophical difficulty of the transformation of electrons within the atom into waves of electric substance, Max Born overcame it with the help of his probabilistic interpretation. According to this concept, the wave function described not the actual position of electrons inside the atom but rather the probability of finding an electron in different points of space inside the atom. The wave function became a universal means for the description and calculation of all physical parameters in the atomic world.

But the idyllic picture of complete incorporation of wave mechanics into the framework of probabilistic conception of quantum physics, in actuality, contained a number of serious problems.

Niels Bohr and his colleagues and followers strongly believed that probability was built in at the very foundation of the micro-world. They denied that quantum mechanics was unable to give a deterministic description of atomic world just because of lack of knowledge about the processes going on there at the sub-atomic level of physical interactions. Probability was regarded a necessary feature of each sub-atomic event, independent of the number of interacting particles or conditions of interactions.

Was there a firm empiric ground for such generalization? The answer to this question can be both positive and negative depending on its aspect. The positive answer is grounded on the brilliant experiments carried on by Davison and Germer that proved that a beam of electrons passing through a crystal produces a diffraction picture. This discovery confirmed de Broglie hypothesis and forced physicists to admit that science should reject the classical belief that particles and waves belong to different domains of physical reality (de Broglie, 1973).

But the answer to the above question should be negative if one takes into account that experiments on electron diffraction proved *wave properties* of electrons but not their probabilistic nature. Wave properties could be interpreted as supporting the standpoint of classical mechanics as well.

Niels Bohr, Max Born, and other adherents of the Copenhagen school insisted on the probability as the essential feature of atomic events but apparently underestimated the wave properties of atomic particles. Born denied electron standing waves, but he readily used the wave function. Yet, on the macro level, one could not show any difference between the standing wave of an electron in the atom and the sum of positions of an atomic electron described by the wave function. In both cases, a macro-observer would have the same picture of a cloud of electric charge inside the atom in the form of standing wave.

Schrödinger and Heisenberg held the same orthodox view only in one point. They both denied believing in trajectories of electrons inside the atom. But we would like to point out that Schrödinger and Heisenberg rejection of the reality of electron trajectories did not follow from a deeper insight into the physics of the microworld. In actuality, neither wave mechanics nor matrix system had sufficient means to describe electron's motion along its orbit. If for some reason Schrödinger and Heisenberg found admissible to consider the orbital motion of atomic electrons, they would not be able to describe it by the means of their theories (Bohr, 1958; Heisenberg, 1973).

Returning to the problem of the equivalence of matrix approach and wave mechanics. If Schrödinger had abandoned his far going claim of reducing all micro-world to material waves, he could easily sustain the principle of wave-particle duality in his system. But there is no comprehensible place for the fundamental principle of wave-particle duality in Heisenberg's matrix version. There is no slightest possibility to speak of waves in the Heisenberg version of quantum mechanics. So, one cannot insist unconditionally the equivalence of the main systems of quantum theory. Perhaps, it is time to realize that they are partial theories, which are able to describe the atomic world only combining their efforts. But in this case one should realize the necessity to develop a really fundamental theory of atomic physics (Djidjian, 2002, pp. 233-242).

5. Crazy Ideas and Absurd Concepts

It is really a great mystery that scientist can suggest absurd conceptions. But it is even a greater mystery that the scientific community and wide circles of men of learning could accept these absurd concepts as a respectful and true theory. Quite naturally, present day learned people look at fallacious ideas and concepts of the past in amusement and disbelief. But it should be remembered that we observe ideas of the past epochs from the height of the science of the present time often forgetting historical realities that formed the scientific concepts of the past days.

Evaluating any scientific concept of a past epoch as absurdity, we must first of all take into account the common sense and basic scientific principles of that time. Let us observe examples of scientific concepts that held an important position in the natural science of the past but should be evaluated as absurdities even from the viewpoint of the common sense of their time.

Though there is no limit for my appreciation of Aristotle's great genius, his brave idea of the First Mover appears belonging to the province of absurd concepts. Aristotle proved that the First Mover was the source of eternal motion of the Heavens and all material objects of the sublunary world (Aristotle, 1996). For many thinkers this statement could sound rather strange. But the concept of the First Mover appeared beyond reasonable judgment when Aristotle proved additionally that the First Mover should be unmoved, unchangeable, and having no extension in space. Such an object could not be material since it had no extension and consequently could not be perceived by senses. Thus, we come to a concept of an object unconceivable even from the point of view of the common sense of the ancient society.

Of course, judging a theoretical concept one must bear in mind that the characteristic "absurd" is relative. We find a concept absurd if it is completely incompatible with the common sense or with the fundamental principles of natural science. So, in our evaluations we must be very careful since common sense itself evolves with the progress of the scientific picture of the world.

Modern scientific thought had encountered such a variety of absolutely new domains of reality that explorers, to be able to deal with them, were forced to try completely new approaches, or in Niels Bohr's words, make use of definitely "crazy" ideas. Unfortunately, crazy ideas look out much like the absurd ones. Many crazy ideas eventually finish their life by landing into absurd conclusions.

An unwritten principle of human psychology is that any hypothetical explanation, even seemingly absurd, is better than having none. In actuality, the only thing the theoreticians are really interested in is that of being able to carry on correct quantitative descriptions of phenomena under research. Once the job of correct quantitative description is done, all other points seem superficial. At least, scientists are convinced that it is a matter of time to overcome all other obstacles. This is the way by which emerge beliefs in realities that do not exist. The appearance of absurd concepts is rather unavoidable in the perspective of the development of scientific knowledge. Likewise, the acceptance of an absurd concept by the scientific community of its day is, in a sense, a normal behavior.

Scientists know well that nature never unveils its mysteries easily. Each level of knowledge of nature is achieved through hard and slow step by step advancement. A scientist never comes to the final and complete knowledge of some basic feature of natural phenomena. Each level of knowledge is incomplete, partial, and sometimes simply wrong. Just the latter case often results in absurd conclusions.

The revelation of an absurd conclusion or/and of an apparent contradiction in the framework of a fundamental theory is a clear sign that something is wrong with its basic principles. If colleagues reveal just some minor inconsistencies in a theory of a scientist, he would not even react to it. Men of learning find minor discrepancies quite a normal thing in the process of the development of their concepts.

Principles and laws of natural science grow from the empiric data and its interpretation. The interesting thing is that wrong principles of a natural theory of the past are due, as a rule, not to the fantasy or imagination of a scientist, but rather are related to a "natural" interpretation of certain well-established facts. We put the term *natural* in commas to emphasize that this interpretation had been *natural* just for its time. The appearance of an absurd conclusion signals scientific community that some of the most obvious assumptions as well as some interpretations of empiric experience of the epoch are false.

But how can one differentiate absurd concepts from the crazy ideas, the latter understood as unordinary and strange ideas that bring with them revolutionary changes to natural sciences? It is quite a common place in methodology of science that great ideas are at first conceived as absurdities. A revolutionary idea is accepted as a serious scientific concept only by the power of its striking success in explaining the most serious difficulties.

The difference between crazy ideas, including those that later appeared to be a fantasy, and absurd concepts, involving those ones that are yet accepted by scientific community, is as follows. Crazy ideas are radically new principles designed to solve profound difficulties in a given fundamental theory. Absurd concepts are necessary conclusions from the principles of a given theory signaling a basic crisis in its foundations. Crazy ideas are rather paradoxical than absurd. When even in apparent contradiction with common sense and established scientific principles, crazy ideas contain these principles implicitly as some particular or limited cases. Absurd ideas have no prospective of improving their incompatibility with facts (Djidjian, 2002, p. 276).

We would like to bring in here some illustrations.

Aristotle's striking statement that beyond the Heavenly sphere there was no material object and no space meant a basic solution of the problem of space and time.

Copernicus, substituting by a hypothetical motion of the Earth the "obvious" motion of the Sun, Moon and all innumerable stars, factually suggested a new approach which had to free astronomers from the haunting mystery of the retrograde motion of the planets.

These crazy ideas struggled gradually to the statue of fundamental physical principle providing solutions to insurmountable difficulties of the natural science of their day. By contrast, absurd concepts were necessary conclusions from the principles of a corresponding fundamental theory. The impossible set of properties of caloric and ether were preconditioned by the mechanistic interpretation of heat and electromagnetic field. This list can be continued but not completed. Each epoch is forced to deal with the absurdities of its time. But one should not consider them merely historic curiosities. Already William Whewell had mentioned that failures of science help to disclose important clues of scientific way of thinking (Whewell, 1847).

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References

Aristotle (1996). *Physics*. Oxford: Oxford University Press.

Bohr, Niels (1985/1949). The Bohr-Einstein Dialogue. In French, A. P.; Kennedy, P. J. (Eds.), *Niels Bohr: A Centenary Volume* (pp. 121–140). Cambridge, Massachusetts: Harvard University Press.

Darwin, Ch. (1859). *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life.* (1st ed.). London: John Murray.

Darwin, Ch. (1871). *The Descent of Man, and Selection in Relation to Sex.* (1st ed.). London: John Murray.

de Broglie, L. (1973) The beginning of wave mechanics. In *Wave mechanics. The first fifty years.* London: Butterworths.

Djidjian, R. (2002). *The secret of geniality.* Yerevan: Noyan Tapan Publishing.

Djidjian, R. (2004). *Your way to great discoveries.* Yerevan: Yerevan State University Publishing.

Eiseley, L. (1958). *Darwin's Century: Evolution and the Men Who Discovered It*. (1st ed). NY: Ancor Books

Heisenberg, W. (1973). Erinnerungen an Niels Bohr aus den Jahren 1922-1927. In W. Heisenberg, *Schritte über Grenzen*. Munchen.

Hovhannisian, H., & Djidjian, R. (2017). Building the general theory of meta-argumentation. *Metaphilosophy*, *48*(3), 345-354.

Hovhannisyan, H. (2014). Metaargumentation from the perspective of metaphilosopy. *WISDOM, 2*(1), 79-88. https://doi.org/-10.24234/wisdom.v2i1.47.

Hovhannisyan, H. (2015). Meta-argumentation as an argumentation meta-theory. *Metaphilosophy, 46*(3), 479-487.

Maxwell, J. C. (1873). *A treatise on electricity and magnetism.* (2 vols). Oxford: Clarendon Press.

Planck, M. (1949). *The theory of heat radiation*. https://www.gutenberg.org/ebooks/40030.