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THE DESIGN AND NECESSITY: A NEW COSMOLOGICAL BASIS FOR THE CLASSICAL ARGUMENT

New discoveries in theoretical physics inspire novel attempts to develop a new version of the classical design argument. Very often in these proposals the old philosophy of the nineteenth-century mechanism is combined with new physical theories or with risky analogies provided by computer science. Such seems, for instance, to be the case with the argument proposed by William Dembski who, after developing parallels between biological processes and information processing in computers, tries to adopt the very notion of improbability of emergence of complex biological structures as a basis for his version of the design argument[1]. In spite of the criticisms of such a proposal, I do believe that recent studies dealing with both the Weak and the Strong version of the Anthropic Principle can substantially contribute to the traditional design debate. For the same reasons, many philosophical comments proposed by scientists representing the so-called "third culture approach"[2] may turn out to be inspiring and illuminating on this issue.

Before I refer to particular scientific results in this domain, it is necessary to introduce basic semantic distinctions. In hitherto philosophical praxis, the design argument has been often regarded as an expression of teleological interpretation of nature which can be developed on the level of philosophical study. This teleology presupposes the existence of finality in natural processes that necessarily requires reference either to the purpose of particular processes or to their final state. Contrary to various forms of teleological explanations, modern physics prefers deterministic interpretation of natural processes. The very notion of purpose or of final state can be eliminated from its language because physical interpretation requires merely the description of the initial physical state of a system and the equations of motions. The problem that I would like to discuss at the beginning is: Must there be a necessary opposition

[1] William Dembski, The Design Inference, Cambridge University Press 1999.

[2] The very expression is clarified, e. g., in John Brockman, ed., The Third Culture: Beyond the Scientific Revolution, New York, 1996. It refers to C. P. Snow's Two Cultures to present the methodological approach of these authors who try to bridge the natural sciences and philosophy by clarifying philosophical presuppositions underlying scientific theories.

between the deterministic and the teleological description of physical processes? Can the physically necessary processes, which are subordinated to the deterministic laws of nature, not be regarded as an expression of cosmic design? In this paper I will try to justify the last question in the affirmative.

Purpose, Necessity, and Design

There were a few authors who tried to develop the notion of design without referring to the teleologically understood category of purpose[3]. They spoke, for instance, of cosmic order to introduce a notion of design in which a physical directing of processes to particular future states is more important than the very existence of purpose. There were also authors who accepted the teleological structure of nature but did not support the existence of cosmic design and remained agnostics with regard to the existence of the divine Designer[4]. The overwhelming majority of the authors who defended the design argument accepted, nonetheless, a version of teleological interpretation in which the growth and functioning of the particular system cannot be properly explained without reference to the purpose of the system at stake. The very concept of purpose, according to its many critics, must necessarily imply the involvement of a consciousness. Consistently, one can properly speak of a cosmic design if and only if one accepts the existence of the divine Designer who determines the purpose for cosmic evolution[5]. The authors who were not satisfied with such an approach referred to the Aristotelian concept of final causes and defined the teleological orientation of a system by regarding both the initial and the final states in its growth. In a more sophisticated version of this approach, one distinguishes the status of teleological and quasi-teleological explanation. In the former, the existence of a conscious agent introduces the element of purpose, which attracts the entire evolution of the system. In the latter, without referring to any conscious agent one discovers that the internal structure of the examined processes is such that they can be rationally explained only if we accept that their internal structure in a sense depends on a final state of the evolving system.

An exemplary mixture of traditional theology with Aristotelian teleology can be found in the mathematical writings of Leonhard Euler, who wrote in the middle of the eighteenth century: "since the fabric of the universe is most perfect, and the work of a most wise Creator, [...] there is absolutely no doubt that every effect in the universe can be explained as satisfactorily from final

[3] For instance, James Ward, Naturalism and Agnosticism. Gifford Lectures 1896-1898, Adam & Charles Black: London, 1906; F. R. Tennant, Philosophical Theology, Cambridge University Press, 1930.

[4] "... we say that adaptation is teleological, but do not say that it is the result of design or purpose." Lawrence J. Henderson, The Fitness of the Environment, Peter Smith; Gloucester 1970, 204. Cf. L. J. Henderson, The Order of Nature, Harvard University Press, 1917.

[5] Kazimierz Kłósak, Teleologiczna interpretacja przyrody, in: Pod tchnieniem Ducha Świętego, Poznań, 1969.

causes, by the aid of maxima and minima, as it is from the effective causes"[6]. The growth of modern physics resulted in eliminating teleological categories from scientific explanations. They were regarded either as useless Aristotelian relics or as constituents of the Panglossian paradigm, in which everything could have been explained due to naive anthropomorphisms. Though many biologists still argue that quasi-teleological explanations could at least play a heuristically positive role in biological research, in modern science the key role is played by causal explanations in which deterministic laws, not the teleological or final factors, are essential for explaining the evolution of the system.

This basic opposition between the deterministic and the teleological description of the evolving systems, however, must not be applied to all systems in general. There are physical processes to which one can appropriately apply Euler's statement that they "can be explained as satisfactorily from final causes, as [...] from the effective causes". Conservation principles, for example, in physics constitute such a domain. There are authors who argue that this phenomenon should be regarded as but a mathematical curiosity[7]. Their opponents claim that this mathematical equivalence of the deterministic and the teleological description discloses an important property of nature that has not yet been explained in contemporary physics. We can only trust that a future Theory of Everything will provide a satisfactory explanation of the astonishing correspondence between the causal and the final interpretation of the physical phenomena.

Differential and Integral Form of Physical Laws

Not only teleology but also mathematics brings conflicts into the philosophers' milieu. When used as the language of physics, mathematics even generates conflicts among physicists themselves. When the positivistically minded Ernest Mach criticized the integral approach to classical mechanics as artificial and argued that its teleological component could be destructive for science, Heinrich Helmholtz claimed that this very form discloses a deeper level of physical phenomena and could play a heuristic role in the growth of modern physics. The discoveries in contemporary physics confirmed the latter opinion. In this change of opinions the very important role was played by John A. Wheeler who was largely known for his intellectual courage in looking for non-standard methods of interpreting physical phenomena. Together with his student Richard Feynman, he proposed the integral formulation of classical electrodynamics that is recognized as conceptually simpler than and substantively equivalent to its differential form. This approach is regarded as simpler

[6] L. Euler, Methodus inveniendi linas curvas maximi minimive proprietate gaudentes, Isis, 20 (1933) 72.

[7] A. d'Abro presents the classical critique developed by S. D. Poisson, H. Hertz and E. Mach in his monograph, The Rise of New Physics, vol. I, Dover, 1953.

because it does not require the reference to the electromagnetic field but considers only the mutual interactions among physical particles. In addition, one must be informed also about their future positions. When dependencies between the present and the future parameters are taken into consideration, analogies between the Wheeler-Feynman approach and the teleological interpretations became obvious. This is because the paths between the initial state A and the final state B resemble the teleological dependence of A on B. The state B can be regarded as a counterpart of a physical attractor that allows the interpretation of the evolving physical system at least in quasi-teleological terms.

The teleological conceptual preferences inspired Feynman to propose in 1948 his own sum-over-paths version of quantum mechanics[8]. On the basis of this formulation of quantum mechanics he derived next the so-called Feynman Rules to determine the scattering of elementary particles. Among the authors who criticized Feynman's approach because of its evidently teleological presuppositions was Steven Weinberg. Weinberg, consistently anti-metaphysical in his philosophy of science, referred to quite different theoretical principles to derive the same Feynman Rules since he was afraid that the sum-over-history method underlies philosophical principles inconsistent with the tenets of contemporary physics. He changed his mind after new discoveries concerning the renormalizability of the gauge theories and now affords that the integral approach, criticized by him earlier as unphysical, provides a better method than any of the alternative differential techniques[9]. This evolution in assessment techniques remains important from a philosophical point of view. There was a time when the integral approach to quantum mechanics seemed to be nothing but a mathematical curiosity bereft of any practical significance for real science. Preferences to use it were immediately interpreted as an expression of commitment to this teleological tradition, which seemed closer to eighteenth-century physico-theology than to contemporary science. Today this very technique is used in most attempts to explain the cosmic creation ex nihilo by introducing the wave function of the Universe[10]. Consequently, when summarizing the conceptual evolution in modern physics Barrow and Tipler formulate very strong opinions claiming that "teleological thinking has become essential to modern mathematical physics" because the "non-teleological ... formulations lack the great heuristic power of the sum-over-histories approach"[11].

Molier's critique of Dr. Pangloss and of his version of pan-teleology is certainly much better known than Feynman's integral approach to quantum

[8] Richard Feynman, "Rev. Mod. Phys." 20 (1948) 267.

[9] Steven Weinberg, "Physics Today" 32 (1979, no 12) 18.

[10] James Hartle, Steven W. Hawking, "Phys. Rev." D 28 (1983) 2960.

[11] John D. Barrow, Frank J. Tipler, The Anthropic Cosmological Principle, Oxford, 1986, 152.

mechanics. To recognize, nonetheless, the epistemological significance of the latter, it is important to acknowledge the following:

1. The general critique of the traditional concept of teleology, at least in the version used in pre-evolutionary biology, does not necessitate the absolute uselessness of this concept in particular scientific disciplines. There can be scientific issues or interdisciplinary problems where this very concept turns out to be substantively justified and heuristically inspiring.

2. There is no objective reason to oppose deterministic and teleological explanations. Even on the level of physical studies there are problems where both descriptions are admitted. It depends either on the research context or on methodological preferences regarding which approach should be preferred.

3. Not all versions of teleological explanations imply naive anthropomorphisms. There are many nonequivalent patterns of teleological description for physical and biological systems. The so-called quasi-teleological model, free of any reference to an intelligent agent, seems particularly important for this research.

4. The scientific significance of the quasi-teleological approach, as illustrated by Feynman's techniques, leads to the question whether quasi-teleological interpretation of the evolution of the universe has not been a satisfactory condition to defend a version of the design argument.

Causal and Teleological Constituents in the Laws of Nature

Two different techniques used in quantum mechanics can be interpreted in philosophical terms as two different descriptions of the same physical design. Traditionally, the concept of design is attached only to the teleological and not to the deterministic approach. However, when both approaches have been physically equivalent, we must acknowledge that they describe the same basic structure in which an element of design is recognized without reference to any element of purpose that would require a conscious agent. Therefore, if the same physical structure can be described either deterministically or by techniques implying teleological concepts, it suggests that we should not generally oppose the deterministic and the teleological interpretation of the physical system. Such an opposition was historically conditioned because the growth of modern physics and biology required replacing the final causes of Aristotelian science by the deterministic laws of the new scientific paradigm. This replacement resulted in a psychological lack of confidence in teleological categories; it does not necessitate, however, the conclusion that these categories must always be useless in the search for rational interpretation of cosmic processes. Physical necessity does not exclude philosophical design but only introduces a new cognitive framework in which different explanatory categories are used[12]. To explain philosophically the complementarity of these two approaches, it is necessary to find an adequate theory of the laws of nature and to explain subsequently the structure of the deterministic and the teleological processes in nature by reference to the laws in question.

In contemporary philosophy of science there is no generally accepted theory of the laws of nature. Two main interpretive proposals are provided by the so-called regularity theory and the necessitarian explanation of the laws of nature[13]. The former is defended in the empiricist tradition, the latter mainly in various versions of neo-Platonic philosophy. According to regularity theorists, the laws of nature are nothing but regularities observed in nature. In the spirit of Hume's critique of causality, they argue that all law-like statements of the form (x) (Fx=>Gx) assert merely a constant conjunction of the determined phenomena F and G. In this approach, one avoids referring to a vague concept of physical necessity and regards psychological intuitions or commonplace evidence as the ultimate criterion in explaining the observed order in nature. The necessitarian theory holds that the essence of the laws of nature cannot be reduced to the level of observed regularities, because the latter presuppose the existence of hidden necessary links (i. e., purely possible regularities) that constitute the order of nature, even if in a specific situation no empirical procedures reveals physical instantiation of these links.

The simple identification of the laws of nature with observed regularities cannot explain at least two important elements:

1. that the regularity itself is not a sufficient condition for being a law of nature, since we have many uniformities that cannot be regarded as laws of nature (e. g., no lake contains pure whiskey); and

2. that the observed regularity is not a necessary condition for being a law of nature, because there are probabilistic laws that permit local irregularities, e. g., in stochastic processes when statistical regularities are only discovered on the large scale.

If we try to answer what the expression "the laws of nature" means, we must face the questions: What does the implication operator => signify when we present the law of nature in the form: (x) (Fx=>Gx)? How should the relationship of physical necessity between F and G be interpreted, when it would be psychologically easier to conceive of the universe as uncoordinated chaos with no necessary links between phenomena, no order, and no universal laws? Certainly, positivistically-minded authors can reject all similar questions as meaningless and sterile. Such a practice seems, however, neither intellectually

[12] Cf. William Stoeger, The Immanent Directionality of the Evolutionary Process, and Its Relationship to Teleology, in: Evolutionary and Molecular Biology. Scientific Perspectives on Divine Action, ed. R. J. Russell, Vatican City 1998, 163-190.

[13] One can find also compromise proposals in which, e. g., stochastic regularities on the micro-level result in necessitarian links on the macro-level. Such an approach remains consistent with my argument because it implies that the very regularity is not enough to explain the nature of physical laws and that one must refer to necessitarian connections, at least on the level of macro-processes.

satisfying nor heuristically useful for the growth of science. Contrary to this practice, many contemporary physicists go beyond the level of empirically confirmed theories and formulate the following questions:

1. Why are there universal laws of physics at all?
2. Why is this particular set of physical laws instantiated in nature? Are these laws absolute in the sense that no alternative laws could have been instantiated?
3. Why can we describe complex physical processes by using simple mathematical formulae?

Similar questions cannot be answered on the level of scientific explanation. They require philosophical answers that must not be submitted to Ockham's razor, which, in its classical form, is effective only on the level of research characteristic of the natural sciences. Questions dealing with order, necessity, and lawfulness belong to the classical issues of philosophy. Science cannot answer them for the same reasons that it cannot provide a mathematical description of human goodness. Nonetheless, we can find rational answers if we treat seriously the philosophical doctrine of God immanent in nature. In my opinion, the necessitarian theory of the laws of nature provides a necessary basis to answer these questions. Since it inevitably introduces the element of physical necessity between antecedent A and its physical subsequent B, this form of causality makes possible both the causal link A=>B and the final connection in which the future emergence of B necessarily requires the actualization of A.

In the practice of modern science, the discovery of the laws of nature very often eliminated references to the God of the gaps who was introduced earlier to fill the gaps in the scientific explanation of natural processes. This God, understood in a manner that was presented in Clarke's polemic with Leibniz, was to fulfill his purposes through special interference of a teleological nature, which was dependent on known laws of physics. In such an interpretive pattern, unjustified antagonism arose between God's action in nature and the physical laws, between teleological design and physical necessity. In the approach presented in this paper, I argue that relative physical stability, dependent on physical necessity, can constitute a design that can be described in the teleological categories of philosophy. In such a framework, laws of nature are no longer God's antagonists but an expression of God's immanence in nature. To avoid misunderstanding, which existed already in the eigthteenth-century physico-theology, it is necessary to distinguish between the physical and the philosophical interpretation of nature. It is also necessary to remember that in the process of the growth of science, on the one hand, there are important epistemological and methodological changes in science itself and, on the other hand, new scientific discoveries provide the essential data for classical philosophical discussions.

There are important differences in the methodological status of various scientific disciplines. The rise of quantum mechanics brought important revisions in the simplified image of science that was accepted before the Einstein-Planck revolution. At the present time the search for quantum cosmology brings epistemological issues, which render suspect many of the methodological postulates of early positivism. Cosmology itself provides a counterexample to the traditional ideal of natural science. By definition it can examine only one single object and on the basis of contemporary observations it must explain its initial states that existed 20 billion years ago. It is only in relativistic cosmology where we find controversial issues in which philosophical and methodological presuppositions play a decisive role in the search for adequate explanations. A long-standing controversy in this domain centers around the status of the Weak Anthropic Principle (WAP). Its peculiar position in cosmology summarizes Heinz Pagels, the physicist known for his Platonic preferences and atheism. After conceding that "some scientists, believing science and religion mutually exclusive, find this idea unattractive", Pagels admits that the Anthropic Principle "is the closest that some atheists can get to God"[14].

Weak and Strong Versions of the Anthropic Principle

The very expression Anthropic Principle was used for the first time by Brandon Carter in 1973. During a Copernican conference in Cracow, he advanced the thesis that the position of the earthly observer in the universe is privileged in the sense that the development of carbon-based life could not take place under normal physical conditions, but required special conditions dependent on such properties of the universe as age, rate of expansion, and the values of particular physical parameters. The version of WAP accepted in this paper claims that the observed values of the mutually independent physical and cosmological parameters take on values in the interval that makes possible the emergence of life based on carbon compounds. Whether these cosmological coincidences should be regarded as an accident or as a manifestation of a hidden teleology of nature goes beyond the cognitive competence of the natural sciences. In the philosophical debates surrounding this problem, however, we must entertain the question of how to explain the mysterious cosmic correlations. But in order to do so, it must be realized that to obtain physical systems containing carbon-based life in the process of cosmic evolution, a special coordination of the independently evolving cosmic parameters (i. e., their fine-tuning) is required. Intriguingly, this very coordination is discoverable in our universe, thus raising important questions that were unknown before the rise of relativistic cosmology.

The indicated version of the WAP remains intuitively close to what Ernan McMullin calls the initial parameter constraint (IPC) to denote the highly specific initial conditions that were needed for the emergence of

[14] Heinz R. Pagels, "A Cozy Cosmology", in: Leslie, ed., Physical Cosmology and Philosophy, John Leslie, ed., Macmillan: New York, 1990.

carbon-based life in the universe[15]. The difference between the WAP and the IPC is that in my interpretation of the WAP cognitive attention is restricted not only to an initial process of coordination in cosmic parameters. New forms of such coordination can also emerge in a later stage of cosmic evolution and they must not necessarily depend on any defined set of initial conditions. In this sense, the content of the WAP is stronger than the content of the IPC because it allows for consideration of additional physical parameters, independent of the set of the initially constrained parameters.

It is easy to document that the astonishing correspondence in the set of independent physical parameters, i. e., the correspondence ascertained by the WAP, was far from trivial for cosmologists who studied the physical conditions of evolution in the early universe. Continuous attempts at causal explanation of this correspondence still remain unsuccessful. On the other hand, the series of inflationary models originated in 1980 by Alan Guth eliminated some previous questions, e. g., dealing with the so-called flatness problem, and revealed that some interconnections that seemed statistically improbable at first are physically necessary. Even in these models, however, "calculations yield reasonable predictions only if the parameters are assigned values in a narrow range"[16]. It remains an open question whether the situation changes and in the future all initial parameters of cosmological models must generate the present conditions for the emergence of life. The authors who would like to make these coincidences rational or to derive their existence from ultimate physical principles must refer either to the risky assumption of the existence of parallel universes, for instance, in the Linde-Smolin approach, or to assume unfounded principles, which claim that all physically admissible states are actualized in the ensemble of multiple universes. Such interpretations seem closer to science fiction than to a testable research program. A different approach is suggested by those authors who would like to derive the WAP from the Strong Anthropic Principle (SAP). The latter, proposed by Brandon Carter in its classical version[17], asserts that in our universe physical parameters must assume those values that make possible the development of life in a particular stage of cosmic evolution.

Depending on how *must* is interpreted, this variant can imply essentially different philosophical interpretations. The statement declaring "The Universe must have those properties which allow life to develop" can be interpreted teleologically after accepting that the entire processes of cosmic evolution has for its purpose the rise of carbon-based life. For obvious reasons, such a thesis remains unjustified and unacceptable in the cognitive framework of relativistic

[15] Ernan McMullin, "Fine-tuning the Universe?", in: Science, Technology, and Religious Ideas, Mark H. Shale, ed., University Press of America, 1994, 115.

[16] Alan Guth, Paul Steinhardt, "The inflationary universe", Scientific American, 215 (1984), 127.

[17] B. Carter, in: Confrontation of Cosmological Theories with Observation, Reidel: Dordrecht, 1974, 291.

cosmology. It could be accepted in philosophy only if one proves the existence of the Cosmic Designer who determines the generation of life as a purpose for cosmic evolution. In this framework one could propose a version of the Teleological Anthropic Principle (TAP) which, for methodological reasons, would be completely useless for the scientific study of the universe.

It is possible, however, to interpret the *must* used in the SAP formula in terms of physical necessity. In such an approach, the conviction is expressed that in the future development of the physical sciences the existence of many data, which seem incidental for present physics, would be derived from fundamental principles provided by a future Theory of Everything. If the future growth in cosmology occurs in the suggested direction, the WAP can be regarded as physically trivial after accepting the SAP. Nevertheless, philosophical discussions dealing with the Strong Anthropic Principle would then be focused upon the same questions that are discussed by contemporary opponents and supporters of the WAP. Instead of mysterious cosmic coincidences, philosophers shall interpret then the basic physical laws as disclosing a cosmic design in which the physical evolution of the universe is predetermined, such that the emergence of life is a physically necessary process. What physicists will interpret in terms of physical necessity, philosophers could explain in terms of cosmic design, following the same methodological approach that inspired Feynman to search for the integral description of processes that were already described in differential equations.

B. J. Carr opposes the design argument and the possible confirmation of the SAP when he argues: "the Anthropic Principle may one day be given a physical basis. But what if it inspires that there is no satisfactory physical explanation? In this case, one would have to conclude either that the features of the universe invoked in support of the anthropic principle are only coincidences or that the universe was indeed tailor-made for life. I will leave it to theologians to ascertain the identity of the tailor!"[18] The former position leads to irrational consequences because we cannot explain the astonishing coincidence of cosmological parameters. The latter introduces the Clarkean God of the gaps to fill our ignorance in interpreting cosmic evolution. I admit the possibility that the cosmic coincidences described by the WAP can be explained in a future unified physical theory by deducing them from the SAP. The necessary cosmic connections described in terms of cosmic necessity can be regarded, however, in philosophical explanations as an expression of cosmic design.

To summarize, we may expect that the same attitude will be confirmed by the future growth of cosmology and that the WAP as well as IPC will be deduced from yet unknown physical laws. On the level of physical research, one has to accept this deduction as a final answer to the questions provided by anthropic principles. On the level of philosophical investigations, one has then

[18] B. J. Carr, "Origin, Evolution and Purpose of the Universe", in: Physical Cosmology... 153.

to recognize that the entire cosmic evolution seems directed to the rise of carbon-based life. More than 20 billion years of cosmic evolution aims at the emergence of life as its natural consequence. This process can be regarded as an expression of cosmic design, if only it envisages the essence of the design in the physically necessary laws of nature and in the objective directing of earlier processes to the later states of cosmic evolution.

Who is the Cosmic Designer?

Should we recognize the existence of the Divine Designer when we acknowledge this cosmic design? My answer is negative when by the Divine Designer we understand the God of classical Theism conceived as an omnipotent Person. I agree with John Leslie that to explain the nature of the cosmic design it is enough to refer to a force or to a form of energy imposing rational structures on the physical processes.[19] The neo-Platonic Logos or the philosophers' Absolute would be enough to explain the cosmic design disclosed by anthropic principles. This restriction imposed on the arguments presented, in my opinion, refers to all forms of the design argument not only to those based on anthropic principles. Kenneth T. Gallagher seems absolutely right when he argues that it is impossible to prove that the Cosmic Designer must be "a transcendent being which is self-subsistent, infinitely perfect and personal. It is far from clear that the mind manifested in nature must be so conceived. The hypothesis could certainly be entertained, for example, that a pantheistic Heraclitean logos might be sufficient to fulfill the exigencies of reason striving to comprehend the spectacle of the world"[20].

I disagree, however, with Gallagher when he claims that the design argument is not cosmological in nature because, with respect to its structure, the main role is played by a priori reasoning. The evidence presented above seems inconsistent with Galagher's claim that any form of the design argument cannot be more empirical than traditional metaphysical proofs of cosmic teleology because the thesis "that the world is the expression of mind is not so much a conclusion of our thinking as its presupposition"[21]. It is hard to agree that the parameters' correspondence described by the WAP is nothing but a presupposition of our thinking. John Leslie's claim seems much more justified when he maintains that in reference to cosmic fine-tuning and to the cosmic design it is "tempting to call the fact an observed one. Observed indirectly, but observed none the less"[22].

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[19] J. Leslie, Universes, Routledge, New York, 1989, 165-174.

[20] Kenneth T. Gallagher, „Remarks on the Argument from Design", The Review of Metaphysics, 48 (1994, 1), 30.

[21] Ibid., 31.

[22] J. Leslie, Universes, 198.

The methodological question that would arise in this context can be expressed in this way: may introduction of the design argument be consistent with Ockham's razor? Why should one refer to any philosophical argument when cosmic coincidences can be explained by basic principles of the unified physical theory? In the growth of modern science our belief in epistemological simplicity and economy of explanation resulted in the well-known principle of Ockham's razor. This very principle, however, is methodological and not doctrinal in nature. It could inspire effective research procedure but it cannot provide simple answers to complicated metaphysical questions. Even on the level of physical research, this principle often played a heuristically negative role. Its critics indicate many examples of the unintended consequences of its application in science. It is true that in the nineteenth century the appeal to Ockham's razor retarded the development of extra-galactic astronomy by nearly one hundred years. Dogmatic adherents of Ockham's principle argued at that time that there are no extra-galactic objects because all observed astronomical phenomena can be explained more economically by reference to the objects in our galaxy. This search for simplicity resulted in a false cosmological model. As a result, in contemporary philosophy of science a special de-Ockhamization program has been promoted in which the principle has a relative, not an absolute value. Had Feynman regarded Ockham's razor as a doctrinal principle he could have never proposed his method of summing-on-paths because the same results could have been obtained on the basis of the determinist approach, which was appreciated by prominent physicists of that epoch.

There are many aspects of physical reality that cannot be expressed in physical terms. Paul C. Davies, when awarded the Templeton Prize, spoke of some of them: "It is impossible to be a scientist, even an atheist scientist, and not be struck by the awesome beauty, harmony and ingenuity of nature. What most impresses me is the existence of the underlying mathematical order.... How can one accept a scheme of things so cleverly arranged, so subtle and felicitous, simply as a brute fact, as a package of properties that just happens to be? Of course, science cannot prove the existence of a design, or a designer, but it can reveal the sheer depth of ingenuity that goes to make up this marvelous universe"[23].

One cannot accept the structure of the universe as a brute fact. The explanatory patterns provided by positivists of the past today seem naive and passé. Unjustified oppositions of the past should be replaced by new conceptual patterns in which laws of nature are not God's antagonists but the most evident expressions of his immanence in nature. In this new approach we come to conclusions that are significant for the philosophical controversies of our time. They demonstrate, among other things, the groundlessness of Jacques Monod's metaphysics in which physical necessity was supposed to

[23] Cited in Neville Mott, „Our surprising universe", The Tablet, 6 May 1995, 573.

make impossible any reference to God. In this new framework we can agree with John Leslie when he declares: „it is high time we philosophers took the Design Argument seriously"[24].

The Designer Immanent in His Design

The present state of the philosophy of God's immanence depends on clashes between explanations proposed in theology and in the natural sciences. In the scholarly practice of science, the reference to the laws of nature very often resulted in eliminating earlier theological as well as pseudo-theological explanations. It inspired the rise of the mentality in which God was pursued either in the absence of any physical laws (the God of the gaps) or in capricious behavior contrary to the laws of physical determinism. While Baruch Spinoza in his philosophy tried to equate God and nature, his critics developed an opposite approach in which God was opposed to natural causes. As a result, instead of Spinoza's adage Deus sive Natura, we received the dictum aut Deus aut Natura. This new opposition prevailed against the long-standing approach of Christian authors who were inspired by the phrase "order, number and measure" (Wisdom 11, 20) as well as by the Vulgate translation of 13:1: "quae a Deo sunt, ordinata sunt". It resulted in the idea of the universe as an ordinata collectio creaturarum, which was developed at the School of Chartres in the twelfth century.

Why should we abandon as ungrounded this tradition in which one looked for God's immanence in unpredictable events rather than in the order of causal regularities? Probably it also resulted from an improper form of respect for the thesis of God's transcendence with respect to nature. It seemed more justifiable to search for this transcendence in miraculous events than in constant regularities submitted to the universal laws of nature. We find unusual events psychologically interesting while repeatable regularities seem trivial or banal.

Accepting God's immanence in the laws of nature does not preclude the doctrine of God's transcendence. God, hidden in physical and biological laws, cannot be pantheistically reduced to the level of the natural order. To contend that He is greater than the order of nature, we must not, however, deny His immanent presence in observed regularities. God's immanence in nature as well as his transcendence can be reconciled in the so-called philosophy of panentheism[25]. Saint Paul the Apostle is regarded as its protagonist when he spoke of the world permeated by the immanent God in whom "we live, and move, and have our being" (Acts 17:28).

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[24] Ibid., 198.

[25] There are various versions of panentheism. In its most general form this philosophy contends that the being of God is not only immanent in nature, by including the whole universe and permeating it, but also transcendent, in the sense that the universe does not exhaust God's being.

The thesis of God's immanent presence in the laws of nature should not be regarded as the result of empiricism in which the observed regularities are identified with God. Contrary to such suggestions, it implies overcoming epistemological empiricism because in the process of cosmic evolution an important role is played by these natural laws that were uninstantiated in earlier cosmic epochs. For instance, in the hadron epoch of cosmic evolution neither Kepler's laws concerning the motion of planets nor biochemical laws of human metabolism were instantiated because there were no planets and no human beings during that epoch. The uninstantiated laws of nature revealed their actual existence in the process of cosmic evolution when more complex structures emerged. An empiricist or an agnostic could regard this emergence either as a consequence of more fundamental laws or as a fact resulting from the combination of accidental physical conditions. Moreover, for a theist, the emergence in question reveals God who is involved in the process of *creatio continua.*

The immanence of God in natural laws constitutes the ultimate ground for cosmic rationality because these laws determine the realm of possible cosmic evolution. The analogy with the genetic code seems appropriate here to explain the role of God who influences the process of cosmic evolution. The rise of modern genetics required overcoming common sense stereotypes and thus introducing new categories remote to naive empiricism.

Many authors attracted by the cognitive importance of these aspects of nature, which cannot be articulated in physical terms, develop new conceptual patterns in which God is immanent in the cosmic design but cannot be reduced to it. Paul C. Davies adopts such a position when he argues in his Templeton Lecture: „The idea of God who is just another force or agency at work in nature, moving atoms here and there in competition with physical forces, is profoundly uninspiring. To me, the true miracle of nature is to be found in the ingenious and unswerving lawfulness of the cosmos, a lawfulness that permits complex order to emerge from chaos, life to emerge from inanimate matter, and consciousness to emerge from life, without the need for the occasional supernatural prod; a lawfulness that produces beings who not only ask great questions of existence, but who, through science and other methods of enquiry, are even beginning to find answers"[26].

[26] "Physics and the Mind of God", First Things, 55 (1995), 34. Cf. Paul Davies, Teleology without Teleology: Purpose through Emergent Complexity, in: Evolutionary and Molecular Biology, 151-162.