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PHYSICS – 'ALIENATION FROM' INSTEAD OF 'ORIENTATION TOWARDS' THE CREATOR?

I. INTRODUCTION

This article offers considerations about the morality of the professional work of physicists and suggests, as a consequence, the convenience of an internal reform of Physics. The motivation for this is corroborated by publications like 'The Grand Design – A New Explanation of the Universe', authored by the theoretical physicists Stephen Hawking and Leonid Mlodinow. This book appeared in autumn 2010 and led to considerable reactions, especially in the media. The decisive statement of the authors is that the cause of the creation of the universe exists within it, that is to say a created cause, namely the law of gravitation:

> Because there is a law such as gravity, the Universe can and will create itself from nothing. Spontaneous creation is the reason there is something rather than nothing, why the Universe exists, why we exist. [Therefore] it is not necessary to invoke God to light the blue touch paper and set the Universe going[1].

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[1] H a w k i n g, Stephen and M l o d i n o w, Leonid. 'The Grand Design – A new explanation of the universe'. Bantam Books (Random House) 2010 p. 180.

This argument does not declare God as non existent, but marginalizes Him for being irrelevant. The argument overlooks the philosophical principle 'agere sequitur esse', which is, in its weakest form, self-evident (despite possible linguistic objections) and states that 'effects can arise only from causes which exist'. Or the other way round: 'If something does not exist, it cannot cause effects'. In particular, something cannot make itself exist, if it does not exist previously (in a *logical, not a temporal* sense). But precisely then something cannot make itself exist.

The following considerations do not concern this principle and its metaphysical or logical aspects. They are rather motivated by the fact that Hawking/Mlodinow connect an attitude of marginalization of God with an argument taken from *Physics*. It is equally relevant that the argument quoted above is a purely *mathematical* one. If Hawking/Mlodinow really want to say something about the real world and not only make a purely mathematical statement wrapped in physical language, they have to show the relationship of mathematical theories to this our world and *vice versa*.

Here a difference between Physics, on the one hand, and Biology and Chemistry on the other becomes clear. Only Physics is deeply shaped by another science, namely Mathematics. Therefore, the following considerations concentrate on specific arguments for Physics. They do not aim at solving the problem of the relationship between Mathematics and the material world, but rather take its being unsolved as a temporary condition of doing Physics, for the lack of its solution has a decisive impact on the epistemological climate and certain methods in Physics. This in turn influences the moral assessment of a physicist's professional work, and precisely here is the proper aim of the present considerations. Truly, this moral assessment urges to solve the said problem.

The relationship of mathematical structures to natural things is not made a direct topic in the book of Hawking/Mlodinow. Perhaps it is taken for granted that the obvious and generally acknowledged success of Mathematics in Physics makes superfluous all further considerations. They are not superfluous, as is made clear by the following confrontation, which is representative of many others. The point is that the same theories [above all those theories that have universal application, i.e. Quantum and Relativity theory] have different *interpretations*:

Thesis: These theories mirror a universe that makes sense, is ordered, exhibits beauty, with or without referring to something transcendent, etc.

> For instance Paul Davies: "Some of my colleagues embrace the same scientific facts as I, but deny any deeper significance. They shrug aside the breathtaking ingenuity of the laws of physics, the extraordinary felicity of nature, and the surprising intelligibility of the physical world, accepting these things as a package of marvels that just happens to be. But I cannot do this. To me, the contrived nature of physical existence is just too fantastic for me to take on board as "simply given". It points forcefully to a deeper underlying meaning to existence. Some call it purpose, some design. These loaded words, which derive from human categories, capture only imperfectly what it is that the universe is about. But, that it is about something, I have absolutely no doubt"[2].

Anti-thesis: These theories mirror a universe that does not make sense, but rather is absurd, chaotic, without finality, etc. or do not even refer to one world but to many.

> For instance, the theoretical physicist Steven Weinberg and the philosopher Quentin Smith: "No matter [...] which cosmological model may turn out to be the right one, it will never be of consolation for us. There won't be any escape from the fact that our life is lacking any meaning, as the result of the accidental chain of events of the first three minutes. It is difficult to understand that we are only a very tiny part of the overall hostile universe. Moreover, we can never describe with certainty, how the present universe developed from an initial state, and that it moves to its extinction by infinite cold or unbearable heat. The more we know about the universe, the less meaningful it seems to us"[3]. And: If the Big Bang cosmology is true, "our universe exists without explanation. [...] It exists non-necessarily, improbably, and causelessly. It exists *for absolutely no reason at all*"[4].

The thesis as well as the anti-thesis result from different interpretations of the *same* physico-mathematical theories. Both claim to be *ultimate views* of the world. Both views suffer from the same weakness: while presupposing a certain correspondence of physico-mathematical theories with the real world, *none of them makes any specification about this correspondence and less about its foundations*. This present intellectual situation of Physics could be characterized as "semiobscurity", which admits a certain practical knowledge about how to *use* this correspondence, but no theoretical knowledge about what this correspondence *is* and what its *grounds* are. This is why it

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[2] D a v i e s, Paul. Statement on the occasion of delivery of the Templeton Prize 3.5. 1995; among others published in: D r i e s s e n, A. and S u a r e z, A. (eds.). Mathematical Undecidability, Quantum Nonlocality and the Question of the Existence of God. Kluwer Academic Publishers, Dordrecht–Boston–New York 1997 p. 199.

[3] W e i n b e r g, Stephen. The First Three Minutes: A Modern View of the Origin of the Universe. Basic Books, New York 1977, final section.

[4] C r a i g, William Lane, and S m i t h, Quentin. "Theism, Atheism, and Big Bang Cosmology". Clarendon Press, Oxford 1993 p. 217. Italics by Smith.

is inappropriate to pretend to make *ultimate statements* about the material world, for instance about its being or not being created, its beginning or not beginning in time and its making sense or not making sense.

Thus that the intellectual semiobscurity makes possible, on the level of world-views, opposite interpretations of the same theory. As a matter of fact, there are many physicists whose stance is close to atheism or even agnosticism, motivated similarly as Hawking/Mlodinow by arguments of *theoretical* Physics, not experimental Physics. This gives ground to the conjecture that theoretical Physics as such, as it is today, also fosters atheism or agnosticism.

The word 'semiobscurity' – meaning the existence of a *practical* knowledge and the absence of a *theoretical* knowledge of the relationship between Mathematics and material things – directs the attention towards epistemology. In order to settle the starting point of the following considerations, we sketch the Catholic view of the intelligibility of the material world in general, on the one hand, and on the other, the prevailing view in modern Physics concerning the relationship of Mathematics to the same material world (Section II). The epistemological climate in present-day Physics exhibits itself in several key concepts that mark a *mental deformation* of the experienced nature (Section III).

A physicist finds himself, more or less consciously, in a sort of schizophrenic situation – irrespective of whether he or she is a Christian or not. His mental world splits up into the normal world of everyday life, where spontaneous knowledge prevails, and a scientific world-view. These views cannot be true both together, and therefore such a person finds him- or herself in a more or less explicit need of discernment: *is it morally defensible to adopt professionally an epistemological setting which is at odds with the epistemological climate generated by normal ordinary life experience* (Section IV)? *This is the core question of the paper, and all previous sections serve to prepare this moral assessment.*

For a physicist who is a Christian, the situation of discernment sharpens considerably, because the Christian revelation supports the epistemological climate of the spontaneous knowledge of a normal human person. The epistemological optimism pervading all of the Christian revelation is well aware of its limits. But still, the stress is laid upon the *possibility* to know, not the *impossibility*.

From this, the question arises of whether and how the discrepancy of both views can be overcome. Before this background, it is worth-while to note that major present-day views of the relationship of Christian theology and Physics do not require epistemological or other basic amendments from Physics (Sec-

tion V). Therefore, Section VI. offers after a summary also some remarks about a inner reform of Physics.

II. THE EPISTEMOLOGICAL CONTRAST

The epistemological climate witnessed and confirmed by Christian revelation, insofar as it concerns knowledge of our world, is linked to the permanent *constitution* of these things as *created*. The Magisterium of the Church has explicitly stated a connection between intelligibility of these things and their being created in the following way: it is *possible* that, *without* the knowledge of Christian revelation, a human person reaches the insight that the things of this world are what the Bible calls 'created' and that they, therefore, have a Creator[5]. As the status of a thing as being created extends to whatever belongs to it, no information about this thing can be separated from the insight into its being created. In particular, the laws of nature are somehow connected to the status of being created of the things that follow those laws and, therefore, also the knowledge of the laws of nature are connected with the insight into the being created of those things.

Nothing has been said, in this context, about the intellectual path to be followed, not even whether this intellectual path has been, or will be, realized in history or the future. The statement is confined to saying that the things of this world "give an account" on their being created, and that human mind is capable of understanding this language of reality. From the Catholic point of view, Christian revelation is epistemologically "optimistic". It follows that experience has a positive cognitive value. Therefore, such a person must be deeply ready to accept the cognitive guidance of his or her experience and even, in a way, subdue to it their own creativity: much attention, patience and humility is needed.

Hence it is a *theological conclusion*, that also the investigation of the laws of nature profits from the intelligibility of the world and the cognitive capacity of the human mind, at least insofar as the laws of nature contribute to the knowledge of things as being created[6]. As a consequence, a physicist who happens to be a Christian is almost forbidden precisely by his faith to

[5] Cf. I. Vatican Council. Dogmatic Constitution *Dei Filius*, Cap. 4. De fide et ratione. DS 3015 with a reference to Rom 1:20; cf. also Ws 13:5 and DS 3026.

[6] Cf. DS 3019.

draw on this very same faith in his scientific discourse. He is exclusively relegated to his natural capacity of insight and reasoning. True, his sinfulness darkens his mind and makes its activity laborious, but it does not make it impossible. Christians as well as non-Christians depend, in their scientific reasoning, exclusively on their own intellectual capacity. It must not be silenced, however, that a Christian possesses, by his faith, a guarantee that the thesis of the intelligibility of the world and the cognitive capacity of the human mind *is true*. He *has* more intellectual steadfastness in the laborious activity of investigating this world. Likewise, God's grace and a Christian's striving to follow Christ including moral integrity have their part. But this interior strength does not provide *arguments* which would be less accessible to non-believers, or not accessible at all.

Therefore, the statement "there is no (particular) Christian way of doing science" is ambiguous. A scientist who happens to be a Christian, should not draw on the Christian revelation, or on the Bible in particular, in order to make scientific propositions or to prove them. Rather he should exclusively focus on the object in question. In that sense, the statement cited is right. But if it comes to the existence of truth at all, which touches the very notion of science, or to the fundamental discernment between an "epistemological optimistic (bright) or pessimistic (obscure) climate", this statement is false. The Christian way of doing science is the one in a what we have called epistemologically bright or optimistic climate.

The epistemological climate with respect to the visible world, witnessed and fostered by Christian revelation, includes a certain selfknowledge of the observer of things as described in the two preceding paragraphs. It is a progressively deepening view, which departs from the prima facie – knowledge of things, passes through many stages of distinctions and particular insights and may possibly reach the reflective knowledge of their being created including the insights of the observer himself being created, of the intelligibility of the world and of the cognitive capacity of the human mind. The intellectual climate in present-day Physics, in turn, is characterized by two factors:

1. Nobody knows *why* Mathematics is successful in dealing with processes of material things, while everybody knows *the fact* of that mathematical methods are successful in describing such processes and in predicting results and thus for technology.

2. The success fosters a *steadily increasing mathematization of Physics*. By this, everything non-mathematical in Physics is more and more marginalized. But the cause of the relationship between Mathematics and material things cannot be mathematical. Therefore, the increasing mathematization of

Physics brings about a *deepenig of the ignorance of physicists about the cause of the success of precisely this mathematization*. In other words, *a physicist who thinks only in mathematical terms makes it impossible by this very fact to obtain deeper insights about his science and thus about this world.*

This situation shall be illustrated without entering into details of philoso-phy or history of science. Two voices about the lack of knowledge of the 'why':

> **Einstein** (1950): physico-mathematical concepts have nothing to do with experience, but instead more with the human inventive genius. "Theoretical concepts are absolutely arbitrary" and "free inventions of the human mind"[7]. This is why it is "the most unintelligible of this world that it is intelligible"[8] (obviously Einstein wants to say 'intelligible in terms of physical theories').

According to Einstein, the intelligibility of the world in mathematical terms is a fact, but the world has nothing to do with the coming about of this fact. It seems that the resulting dilemma can be eliminated only by asserting that it is *the world itself* that causes its intelligibility. This assertion in turn is only reasonable if it is acknowledged as evident.

> **Wigner** (1960): "The miracle of the appropriateness of the language of mathematics for the formulation of the laws of physics is a wonderful gift which we neither understand nor deserve"[9].

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[7] Cf. e.g. his "epistemological creed" in 'Autobiographical Notes' in S c h i l p p, Paul A. (ed.). *Albert Einstein: Philosopher – Scientist.* The Library of Living Philosophers vol. 7. Open Court, La Salle, Illinois [1]1949 p. 4.

[8] E i n s t e i n, A. On Physical Reality. *Franklin Institute Journal* 1936 vol. 221 p. 313 ff.

[9] W i g n e r, Eugene P. "The Unreasonable Effectiveness of Mathematics in the Natural Sciences" (last paragraph). *Communications in Pure and Applied Mathematics*. February 1960 vol. 13 No. 1. In the internet: www.dartmouth.edu/~matc/MathDrama/reading/Wigner.html.

Similarly **Feynman**: "I think, it is safe to say, that no one understands quantum mechanics. Do not keep saying to yourself, if you possibly can avoid it, 'But how can it be like that?' because you will go 'down the drain' into a blind alley from which nobody has yet escaped. Nobody can know how it can be like that". F e y n m a n, Richard P., quoted in H e r b e r t, N., Quantum Reality: Beyond the New Physics. Garden City, N.Y., Doubleday Anchor Books 1985 p. xiii. And **Penrose**: "I should begin by expressing my general attitude to present day quantum theory, by which I mean standard, non-relativistic quantum mechanics. The theory has, indeed, two powerful bodies of fact in its favour, and only one thing against it. First, in its favour are all the marvellous agreements that the theory has had with every experimental' result to date. Second, and to me almost as important, it is a theory of astonishing and profound mathematical beauty. The one thing that can be said against it is that it makes absolutely no sense!" P e n r o s e, Roger, Gravity and State Vector Reduction, in: R. P e n r o s e and C. J. I s h a m (eds.). Quantum Concepts in Space and Time. Oxford, Clarendon Press

Wigner is one of the major figures in the quantum theory of the fourties and fifties of the 20th century. We might pass by the quasi-religious accent of his statement. Whether miracle or not, gift or not, the hard fact is that Wigner acknowledges straightforwardly that he finds himself before a fact the cause of which is unknown to him. Perhaps one could even notice a certain disappointment in his words. It is important to notice that the common tenor of Einstein's, Wigner's, Feynman's and Penrose's statements is representative of all physicists, because they have never been seriously contradicted.

Now to the second factor of the intellectual climate in Physics: the ever-increasing mathematization. This is not only due to the idea of a theory of measurement, but the latter is perhaps the most radical and most typical way of a mathematization of Physics. This sort of mathematization is brought about in the following way: To date, experiments in general and measurements in particular have been considered as a *bridge* between the material world and Mathematics and, therefore, as something *outside* of Mathematics. Now, as experiments and measurements are natural processes as well as all others, they too are capable of a mathematical description. That is to say, experiments and measurements are absorbed into Mathematics, namely into a *theory* of measurement.

The idea of a theory of measurement is an implicit acknowledgement that *confrontations of material things*, i.e. experiments and, in particular, measurements cannot be replaced by anything else. Nevertheless, introducing the idea of a theory of measurement is a far-reaching change which is possible only because of a previous deformation, which in turn will be dealt with in more detail in the next Section (III.). At this moment, it is sufficient to document the change as such:

> We shall hope to have established a systematic description of the quantum mechanical measurement process together with a concise formulation of the measurement problem. In our view the generalized mathematical and conceptual framework of quantum mechanics referred to above allows for the first time for a proper formulation of many aspects of the measurement problem *within* this theory, thereby opening up new options for its solution. Thus it has become evident that these questions, which were sometimes considered to belong to the realm of philosophical contemplation, have assumed the status of well-defined and tractable *physical* problems[10].

1986 p. 129.

[10] B u s c h, P., L a h t i, P. J., M i t t e l s t a e d t, P. The Quantum Theory of Measurement. Springer-Verlag, Berlin–Heidelberg–New York ^{2}1996. Preface (final remark) p. IX. Italics by the authors. As far as I know, this book is the first monograph at all on the quantum theory of measurement, after decades of only articles in journals.

The decisive word in the quoted paragraph is '*within*'. The word '*physical*' marks the distinction from 'philosophical', and the adjective 'tractable' makes it clear that the *physical* problems are tractable mathematically. Notice also the claim implicitly contained in these words that *every single* element of the said *physical* problems underlies mathematical shaping and control.

In principle, all this does not contain anything specific for Classical Physics or Quantum Physics or any other branch of Physics. However, since 1960, the peculiar problems in understanding the quantum theory have led to an increased interest in the *quantum* theory of measurement. Certainly, it is true that these ideas are far from dominating everyday practice in Physics, but the quantum theory of measurement has grown up to be a respectable field of investigation of its own. It is a sort of intellectual pilot project that has grown out of the epistemological climate of Physics.

Another crucial characteristic of the idea of a theory of meaurement is that the natural processes named 'experiment' and 'measurement' are absorbed into mathematical theories precisely by using the "old" physico-mathematical theories. Therefore, necessarily traces of the "old" theories remain. *It would have been more consistent to leave those "old" theories unused and to inquire about the "physico-mathematical problem" from the very beginning. Only then the previous deformation mentioned above could have been avoided.*

It is due to the general epistemological climate in Physics that the trend towards more and more mathematization is as unbridled as it is. For instance, Karl Popper defines in the final section of his first and most important book "The Logic of Scientific Discovery" (1935) the thesis of the experimenting scientist's relationship to reality as *theory laden* experience, which he takes over without change into the English editions:

> Even the careful and sober testing of our ideas by experience is in its turn inspired by ideas: experiment is planned action in which every step is guided by theory. We do not stumble upon our experiences, nor do we let them flow over us like a stream. Rather, we have to be active: we have to 'make' our experiences. It is we who always formulate the questions to be put to nature; it is we who try again and again to put these questions so as to elicit a clear-cut 'yes' or 'no' (for nature does not give an answer unless pressed for it). And in the end, it is again we who give the answer, it is we ourselves who, after severe scrutiny, decide upon the answer to the question we put to nature[11].

[11] P o p p e r, Karl R. The Logic of Scientific Discovery. Hutchinson & Co. [1]1959, Routledge (Routledge Classics), London [3]2002. German original: Logik der Forschung. Mohr, Tübingen [8]1984 Nr. 85 (Julius Springer, Wien, 11935).

Empirical success is what guides the physicist when he proposes new theories. But it is in turn theory which determines what success is. Another author is explicit in saying that Mathematics is *necessary* for knowledge:

> If the real things were taken according to their observable properties, mathematical formulations as those in Mechanics would be *impossible*. In order to obtain such mathematical formulations, it is *necessary* to construe fictitious objects which replace real things and may be called 'scientific objects'. […] In a way, they are *unreal*, particularly in the *mathematically* high developed sciences[12].

According to that view, mathematization would only be possible by transition into a fictitious realm. A little bit more radically, one could say: In order to grasp *more reality*, one *necessarily* has to *construct fictious entities*. Nevertheless, the same author stresses that natural science is basically realistic, even though with concessions to the *unreality* of theoretical constructions. This is why this view is unstable:

> We propose a realist view, that is to say that the experimental sciences yield true knowledge of reality. But it is not a naiv realism, for the theoretical [above all, mathematical, transl.] constructions are not simple translations from reality and, additionally, contain conventional elements. Qualifying these constructions as 'true' requires important distinctions and admits different gradations, depending on the case[13].

Summing up, the intellectual climate in Physics is dominated by an *epistemological pessimism* – a view according to which the world resists being known. Our mind has to struggle against this resistance by means of a *strained creative activity of the physicist*. Both parts fit together. But here an impasse comes from that this creativity tries to link mathematical structures to the *material world*, while in modern Mathematics they are linked to *axioms*.

If the theories of measurement tell us anything about the intellectual climate of Physics, it is clear that Physics, as it is practiced now, moves further and further away from metaphysics. That implies that the modern way of doing Physics withdraws more and more from natural theology. On the other hand, Christian revelation explicitly affirms the possibility of natural theology and thus implicitly fosters also philosophical contemplation. Hence the intellectual climate of Physics drives away from the intellectual climate witnessed

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[12] A r t i g a s, M. Filosofía de la ciencia experimental. La objetividad y la verdad en las ciencias. EUNSA, Pamplona, 2ª edición ampliada 1992 p. 113 f. The translation and italics are mine.

[13] Ibid. p. 259 f. The translation is mine.

and fostered by Christian revelation. Even though this discrepancy would not be strictly contradictory, it makes life for a physicist, who happens to be a Christian, increasingly difficult.

III. TREATMENT BY DEFORMATION

In this section we identify in more detail the elements that shape the intellectual climate of Physics. Of fundamental importance is what will be called 'double reduction' or 'reduction in two phases'. By means of that double reduction, the experiences of an experimenter suffer a deformation, and these deformed experiences can be linked to mathematical elements. Therefore a physicist lives in two worlds: in the world of ordinary experience, and a world represented by physico-mathematical theories that come about after the double reduction. The scientific world-view is generated from the ordinary world of experience by means of reductions, abstractions and constructions.

In order to avoid misunderstandings from the outset, the reader needs to remember that the following argument is made from the perspective of an experimenter, not from the perspective of a theoretical physicist. The world-view of the experimenter is grounded in his experience of the material world, not in mathematical reasoning.

The first phase of the double reduction consists in isolating experiments out of their global context by introducing a tripartition:

1. an interaction-free period *before* the experiment,
2. an interaction phase *during* the experiment, and
3. an interaction-free period *after* the experiment.

Step (iii) of this first phase of the double reduction introduces what is called a *result at a given time* of an experiment.

The second phase of the double reduction is even more radical than the first phase. It consists in transforming mentally a relationship *between two unexchangeable things into a* property *of one of them.* These things are called 'experimental object' and 'experimental apparatus'. Part of the relationship between them consists in the fact that the experimental result belongs equally to *both* sides. The second phase of the double reduction consists in transforming that result into a property of the object *alone*. This asymmetry between experimental object and experimental apparatus is particularly striking in the case of a measurement and has no foundation at all in nature. Despite of looking so harmless and reasonable, the second phase of the double reduction is an extraordinarily radical deformation: *it eliminates the symmetry*. This

asymmetry is one of the most radical pieces of unreality that has ever been brought into Physics.

Obviously, the two phases of the double reduction are neatlessly combined: The first phase ('cut-off') makes it possible to speak of results and the second phase is the preferential attribution of the result to one side, together with (almost completely) dropping the experimental apparatus. Both phases together make it logically possible to simulate experiments and in particular measurements entirely within a physico-mathematical theory. In other words, the door towards a complete mathematization of the material world has been opened. As a matter of historical fact, such a mathematization of the physical world has been attempted. The third quotation of the previous Section II. is taken from the first monograph on *quantum theory of measurement*. There have been attempts to develop such theories during the last 50 years, but the success has been minimal due to increasing mathematical difficulties.

From a pragmatic point of view, it might be said that the double reduction is the *only* possibility of obtaining results at all and in a finite time, which in turn is a previous condition for making predictions and having technology. But it is only a conjecture that the deformation by means of the double reduction is *necessary* in order to obtain those benefits. It is unknown, which results would follow the renouncing of the double reduction, from the outset. Certainly, this would require a completely new elaboration of physical knowledge that is based *exclusively* on experience. This new elaboration would completely reverse the order put forth, for instance, by Busch, Lahti and Mittelstaedt. Attempts for this new elaboration have already been made[14].

IV. MORAL ASSESSMENT

In this section we undertake no more than to establish two basic distinctions. The first distinction states a difference between Physics as a science which enables to pursue professional goals according to a common understanding of that word and Physics as a science that is or generates a worldview with ultimate explanations. The second distinction concerns the two effects of every single professional action of a physicist. We begin with the first distinction.

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[14] Cf. L a r e n z, Rudolf. "What Can Thomistic Natural Philosophy Contribute to Physics?", *Societal Studies* (Socialiniu Mokslu Studijos), Research Papers, Mykolas Romeris University (Vilnius, Lithuania), 2011, forthcoming.

The two previous sections have presented two constitutive elements of present day Physics, namely the specific epistemological climate and the mental deformations of experienced reality. Obviously, the deformations by means of simplifications and abstractions, on the one hand, and conceptual constructions on the other, are manifestations of human creativity. Particularly conceptual constructions could be compared with poetry, artistic or musical creativity. They all may well be appropriated to achieve certain *professional* goals, that is to say the solution of any problem in experimental or theoretical Physics or in engineering. In this case, the deformations are not meant to *replace* the experienced reality, but to be *used* as tools to achieve professional results.

But if somebody claims that Physics with its simplifications, abstractions, idealizations or constructions is the basis of a *world-view and not only a means to achieve professional goals,* the situation changes. Then the experienced reality would be *mentally substituted* by the deformations. This seems to be the case in the book of Hawking/Mlodinow: they speak about mathematical objects, which sometimes have physical names, and these physical names in turn give the impression that the mathematical object refers immediately to the physical world. In such a case, Physics would be taken as the science which offers ultimate views or explanations about our world. As Physics deals with processes *within* this world, the explanations offered as *ultimate* would claim to depend on things that are *part of this world*. This is an instance of the move *aversio a Deo et conversio ad creaturas*.

The substitution of the experienced reality by its mentally performed deformations is a sort of imitation of the creation, but *against* its Creator-given perfection. Therefore, the moral value of the decision for this move is, to my mind, particularly close to that of the decision of Adam and Eve by which they followed the temptation of Satan: "you will be like God"[15]. In my opinion, the particular closeness is rooted in that, while every particular sinful action somehow involves this lie – namely the attribution of goodness to something evil, triggered by pride and other defects – the substitutions affect *all professional actions* of a physicists. In other words, they are used to "create" a *physicalist world-view*.

The decision for the mental replacement of experienced reality by deformations has its intellectual roots. In fact, in the background there is an important factor that makes it easy to pass from the level of professional goals to the

[15] Gen 3:5.

level of a physicalist world-view, namely the modification of the concept of nature performed at the beginning of the modern era. As is well known, the Christian concept of creation, which prevailed in medieval thought, began to vanish with the beginning of the 15th century. Its place was taken by the concept of 'nature' as a reality which is primarily and originally given and thus prior to any human intervention[16]. This view is implicit in formulations like 'nature has made it this way' (and not the Creator), 'the wisdom of nature' (and not of the Creator). In any case, these ways of speaking imply an uprooting of nature from its metaphysical foundation. This is deeply at odds with philosophical convictions and religious beliefs of creation.

In the wake of this move the (historically older) thesis of double truth becomes operative: this world is *either* (in the theological sense) created *or* mere nature (in the aforementioned sense); what it cannot be is a *created nature*. A contemporary variation of this idea is the concept of Non-Overlapping Magisteria (NOMA) sketched in section V. These background ideas often go unnoticed, but are quite influential. They give a particular flavour to the moral assessment of the professional actions of a physicist.

In the foreground – in Physics itself – are factors that are not hostile towards agnosticism or atheism. The most influential is, to my mind, the epistemological semiobscurity in Physics, which is brought about above all by the mental deformations of experienced reality and the hypothetical character of physical knowledge. This semiobscurity *can* spread to other branches of life including the fundamental questions of human existence. Likewise the inclination to work under hypotheses *can* spread to other branches of life, in the spirit of a *strained creative activity* mentioned earlier. Not only other branches of life can be shaped by the physicalist *way of thinking*, but also by the *content* of the physicalist world-view itself.

Somebody's physicalist world-view is seldomly result of a sharply defined choice at a given moment. It is rather the final point of a slow transition. For a physicist, this process departs normally from the practice of Physics on the level of professional goals. As the main method in Physics consists of establishing and testing of hypotheses with its inbuilt "logic of success", the intellectual itinerary of a physicist starts with adopting this method. This in turn causes the person to increasingly *depart* from normal experience and to eventually *arrive* at a scientific view of that same experience. In quite a few

[16] Cf. for instance, G u a r d i n i, Romano. The End of the Modern World. Henry Regnery Co., Washington DC [1]1968; ISI Books, Wilmington DE 1938, USA, [2]1998, [3]2001. German original: Das Ende der Neuzeit. Werkbund-Verlag, Würzburg 1951.

physicists the itinerary continues with the increasing conviction that reality works as Physics says it does. It must be repeated that both the intrinsically hypothetical-deductive character of mathematics and the hypothetical character of applying mathematics to nature forcefully shape the mindset of a physicist.

Nevertheless, it is impossible for the physicalist world-view to completely substitute ordinary experience. This in turn means that the itinerary sketched above does not lead to a truly unitary world-view, but only a world-view where Physics prevails, inseparably joined to ordinary experience. It is also for this presence of ordinary experience that the profoundness of the decision for adopting a scientific world-view as fundamental has many gradations and nuances. This in turn makes it possible that, in the circumstances of a particular person, the transition from the level of goals to the level of world-view is not a mortal sin.

After these remarks about a physicist's making his professional actions basis of a physicalist world-view, we turn to evaluate the morality of the same actions as what they are: *professional* actions like many others. From the outset, we limit ourselves to professional actions that, *according to their specific objects, intentions and circumstances*, are morally good or neutral. Thence the abuse of professional actions is excluded; as for instance, the design or production of things that can be used only for morally bad purposes. Furthermore, we disregard situations where a professional in Physics finds himself before the choice of whether or not to realize a *cooperatio materialis ad malum*, where the *malum* is a morally bad action of somebody else. An action is professional precisely if it, while having specific objects, obeying certain intentions and being situated within certain circumstances, *follows certain standards set up by many generations of professionals, who thus have created a "professional tradition"*. In Physics, the most important of these standards, and somehow the root of all of them, is the double reduction.

Every professional action of a physicist has *two* effects: First of all, a professional action has a specific object and, therefore, a specific first effect. Second, by adhering to the professional standards, the same action *eo ipso* contributes to reinforcing these standards and perpetuating the current epistemological climate. Certainly, this holds for the actions of *all* professions, inasmuch they follow a set of standards. What makes the difference in the case of Physics is that, to the date, its standards imply radical mental deformations of the experienced reality and an epistemological semi-obscurity. Therefore, they do not harmonize with the ordinary experience of a normal human being (nor *a fortiori* with that one generated and witnessed by Christian revelation). This is why the second effect of a physicist's professional action is morally bad.

The assessment of the morality of an action with two effects with opposite moral value requires a treatment which takes into account the relationship between the two efects. Now, what we have called the 'first effect', in normal professional life is really intended as the first. Thus the contribution to perpetuate the present standards of Physics is really the *second* effect, because it is not primarily intended. This situation permits an assessment in the light of the principle of the *voluntarium indirectum*.

With respect to the *first* effect, every such action is morally good, while observing the restrictions indicated above. With respect to the *second* effect – the perpetuation of the present standards of Physics – every such action is morally bad. What is more, *this second effect comes about by the mere realization of the professional action and thus is inseparably linked to the first one*. It is difficult to find an action in which its two effects are linked together more intimately.

Nevertheless, the second effect does not necessarily make the *whole* action bad, because it is, while simultaneous with the first effect, *logically posterior to that first effect*. In other words, the professional action *uses* the existing standards and thus brings forth the second effect of contribution. But the contribution is a *consequence* of that individual action's first effect and not – so to speak, retroactively – a *means* for bringing about this very same first effect.

Thence the professional action with *both* effects may be considered morally good, if there is a proportionate cause of acting and permitting the second effect. To my mind, this proportionate cause exists: taking into account that the second effect of a single professional action is real, certain and immediate *but very small*, a physicist's responsibilities *hic et nunc* for his or her personal life (including family) may be considered to prevail against the responsibility of the same person to weaken or even make impossible the second effect. This is backed up by the fact that such an enterprise is practically impossible for a single person. Even if attempted with the cooperation of many, it would probably take decades.

The professional activity of a physicist consists of thousands of such professional actions which are intimately interwoven. Experience shows that the second effect's influence on the intellectual world of a physicist, in the long run, must not be neglected. If the standards of Physics would *conform* to ordinary experience and its epistemological climate, the moral assessment of the second effect would also change and render these professional actions morally good *without restriction*.

Summing up, we can state that *the elimination of the moral badness of the second effect constitutes a third motive for attempting an internal reform of*

Physics. The first motive is the removal of the ignorance about the link of mathematical objects to material things referred to in section II, which in turn is closely related to the "apologetic" one of removing the epistemological semiobscurity referred to in section I.

In order to further dilucidate the preceding analysis, we consider a different situation. The fact that both effects are so intimately linked and only kept apart by the distinction "*using* the standards/*contributing* to perpetuate the standards" makes it possible that their order can be inverted *without altering the external action*. Then the contribution to the perpetuation of standards becomes the *voluntarium directum*, while the professional goal becomes the *means* of realizing this contribution and thus belongs to the *voluntarium directum*, too. Therefore the distinction *voluntarium directum/indirectum* does not apply. Rather the distinction *finis operantis/finis operis* does. Obviously, this alternative is morally bad. In other words, *being interested* in maintaining the present standards of Physics, including their openness to atheism and agnosticism, is morally different from *admitting* these standards, because it is impossible to avoid or overturn them in a single professional action.

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Precisely the possibility of inverting the order of the two effects *without* altering the external action suggests to use the concept of 'situation of sin', 'structure of sin' or 'social sin'. Of course, it must be taken into account that there is no moral assessment of *situations* without referring to the moral assessment of those *actions* which have brought about that situation or structure. This is made quite clear in the two documents of John Paul II, where he uses these expressions[17]. The concept of 'social sin' is used in a threefold meaning[18]. It is replaced later by the expressions 'situation/ structure of sin', which makes it clear that a social entity is not a source of sin, but personal actions are. The same idea is stressed in the Encyclical *Sollicitudo rei socialis*: structures of sin "are rooted in personal sin, and thus always linked to the concrete acts of individuals who introduce these structures, consolidate them and make them difficult to remove [in footnote a lengthy

[17] Cf. J o h n P a u l II. Apostolic Exhortation *Reconciliatio et Paenitentia*. 2.12.1984 n. 16 and J o h n P a u l II. Encyclical *Sollicitudo rei solcialis*. 30.12.1987 n. 36.

[18] J o h n P a u l II. Apostolic Exhortation *Reconciliatio et Paenitentia* n. 16.

quotation from *Reconciliatio et Paenitentia*, n. 16]. And thus they grow stronger, spread, and become the source of other sins, and so influence people's behaviour"[19].

Again, precisely the possibility of inverting the order of the two effects without altering the external action makes it impossible (for us humans) to categorically exclude or affirm that creating and using the standards of present day Physics includes sinful actions. Certainly, nobody would maintain that the existing standards of Physics could have been set up or be used *only* by sinful actions. And on the other hand, nobody would maintain that a net of long chains of many person's entirely good professional actions could have brought about the existing standards of Physics, which are epistemologically at odds with ordinary experience.

Here the difference between professional goals and world-view is relevant: what is unproblematic on the level of the former, might become a problem on the level of the latter. For some professional goals, success in dominating or using nature is relevant and, therefore, abstractions, simplifications and idealizations in general and the double reduction in particular might have their place. (It goes without saying that also science should ultimately aim at truth and thus leave arguments of mere usefulness behind.) On the other hand, a world-view is required to be true and somehow omnicomprehensive, and *therefore must avoid abstractions and deformations.* A physicist, who by his profession is thoroughly acquainted with the standards of Physics, needs a particularly strong intellectual discipline in order to distinguish both levels.

There are as many different forms and degrees of responsibility for the intellectual climate in Physics as there are physicists. Nevertheless, two types of actions can be identified, in which the responsibility of individuals and groups becomes manifest: *lack of criticism* and *omission*. The lack of criticism is located in the *acritical acceptance* of the way Physics is done, despite the fact that a physicist notices sooner or later, more or less clearly, that he suffers of what we have called intellectual schizophrenia (Section I). The omission consists in *remaining passive* despite being aware of the problem – perhaps because of a belief that any attempts to improve the situation are useless. Precisely in the case of omission it becomes clear how the personal responsibility is diversified according to the personal capacities and one's place in society.

[19] J o h n P a u l II. Encyclical *Sollicitudo rei socialis* n. 36.

For physicists who are Christians, the care for an epistemologically luminous or optimistic climate in Physics including philosophy is reinforced by the Christian revelation. Additionally, a person who contributes to such an optimistic epistemological climate in Physics, is preparing the ground for the inculturation of Christianity. The 2nd Vatican Council has not excluded such difficult problems, when it reminds lay people, including physicists and philosophers, of their ecclesial task, "by their very vocation, [to] seek the kingdom of God by engaging in temporal affairs and by ordering them according to the plan of God. They live in the world, that is, in each and in all of the secular professions and occupations. […] They are called there by God so that by exercising their proper function and being led by the spirit of the Gospel they can work for the sanctification of the world from within, in the manner of leaven. […] It is therefore his special task to illumine and organize these affairs in such a way that they may always start out, develop, and persist according to Christ's mind, to the praise of the Creator and the Redeemer"[20].

V. THREE CONTEMPORARY VIEWS OF THE RELATIONSHIP PHYSICS – THEOLOGY

The moral assessment of a physicist's professional actions rests on the principle of the morality of actions with two effects, and more specifically on the moral value of the second effect. The latter depends on whether or not

[20] 2nd Vatican Council. Dogmatic Constitution *Lumen gentium* n. 31. – In the same direction goes a formulation of the Apostolic Exhortation *Christifideles laici* of John Paul II, 30.12. 1988 n. 34: "This vital synthesis will be achieved when the lay faithful know how to put the gospel and their daily duties of life into a most shining and convincing testimony". Cf. also *Christifideles laici* n. 44: "The Church evangelizes when she seeks to convert, solely through the divine power of the message she proclaims (cf. *Rom* 1:16; *1 Cor* 1:18; 2:4), both the personal and collective consciences of people, the activities in which they engage, and the lives and concrete milieux which are theirs. Strata of humanity are transformed: for the Church it is a question not only of preaching the Gospel in ever-wider geographic areas or to ever-greater numbers of people, but also of affecting and as it were challenging, through the power of the Gospel, mankind's criteria of judgment, determining values, points of interest, lines of thought, sources of inspiration and models of life, which are in contrast with the Word of God and the plan of salvation. All this could be expressed in the following words: What matters is to evangelize humanity's culture and the cultures of the human family [...] the split between the Gospel and culture is without a doubt the drama of our time, just as it was of other times. Therefore, every effort must be made to ensure a full evangelization of culture, or more correctly of cultures" (entirely a quotation from: P a u l VI. Apostolic Exhortation *Evangelii nuntiandi* 8.12.1975 nn. 18-20).

there is a difference between the epistemological climates of Physics and ordinary experience which in turn is cnfirmed by Christian revelation. Therefore, it would be interesting to know whether and how currently discussed views of the relationship between Physics and Theology pay attention to the difference of epistemological climates. In general, little attention is paid, and less so to the causes of such differences. In this section we sketch the views of three authors – Ian G. Barbour, Michael Heller and Thomas F. Torrance -, but understandably *only* insofar as they touch upon the relationship of Mathematics to material things. This is not meant as an exhaustive survey; rather the three samples are chosen in order to exemplify the existing variety of approaches. We begin with a remark about the unity of truth as foundation of the relationship of theology and science.

The occidental culture is deeply shaped – contrary to some oriental cultures – by the thesis of the indivisibility of truth. The thesis of double truth has never been able to take roots. For a person – believer or not – with occidental upbringing it is absolutely necessary to reach a *unified* world-view. In this sense, the three views to be sketched below owe their justification to that thesis.

For a Christian – irrespective of whether his cultural home is in the West or in the East – it is all the more insufficient to be satisfied with a sort of intellectual schizophrenia. He would be (perhaps unconsciously) unfaithful to his religion, if he stressed his belief into creation in a fideist manner, based on the veracity and immutability of God and his revelation, but without looking for ways of getting science and Christian theology into a harmonious relationship.

The second point in which these three authors coincide is that they accept, at least implicitly, the shift in scientific reasoning from metaphysics or philosophy of nature to mathematics, as if they were alternatives alien to each other. This shift from individual material realities to abstract laws of nature has been the key change in the modern scientific revolution.

Each of the three views is well known in the present discussion. Other views either are less known or do not comment on present-day problems, for instance those originating from the theory of relativity (cosmology) or quantum theory.

The classical Christian view (cf. Section II.) has a great weight, but not in the present discussion, and it does not make detailed pronouncements about particular problems. Anticipating the result of this section, it can be said that none of the three views to be presented identify any fundamental problem in Physics. In other words, they accept Physics as it presents itself.

Therefore it seems that they do not see any problem in the relationship of Mathematics to the material world.

The classical Christian doctrine on the relationship between theology and others fields of knowledge states the absence of contradictions between them on the basis of the Christian concept of Creation: Irrespective of their formal differences, authentic theology and any other authentic human knowledge cannot be at odds, because behind both stands the Creator as their primary cause, who cannot be at odds with Himself. For a Christian, the harmony between theology and any other field of knowledge is garanteed from the very outset, and possible or *de facto* existing conflicts indicate failures or misunderstandings on one or both sides. History has tought more than once that this is easily said, but that real conflicts are healed less easily.

The affirmation about the absence in principle of any contradiction between true theology and any other true human knowledge is complemented by the affirmation about the "optimistic" epistemological climate witnessed and generated by Christian revelation. As has been pointed out in section II., in this matter a sharp contrast with respect to Physics has existed since a long time. Dominant has been here the hypothetical-deductive rationality typical for Mathematics, but its embedding into the proper rationality of Physics has been neglected.

Certainly, one might desire more detailed statements of the Church about concrete issues such as the beginning of the universe, of life and about evolution. Perhaps also the topic of epistemological climates, in the light of the unity of truth, belongs to this group. Perhaps also the topic of epistemological climates, in the light of the unity of truth, belongs to this group. But the Church is confined, in her pronouncements on issues accessible to investigation by natural sciences, to their relationship to faith and morality, as in the case of the creation of each individual human soul, unaffected by any evolution. This leaves much initiative to individual researchers who freely choose the objects of their investigations according to a hierarchy of relevance suggested by theology. In the case of Physics, that choice could well be the 'epistemological climate' and the problem of 'how Mathematics relates to material things'.

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In 2005 appeared the first publication of the project STOQ ("Science, Theology and the Ontological Quest", www.stoqnet.org) with the title "Some

Mathematical Physics for Philosophers"[21]. The project STOQ is headed by the Pontifical Council for Culture and financed by the Templeton Foundation. The title clearly suggest that philosophers are expected to learn. The book is authored by the Polish priest and physicist Michael Heller. As is well known, Heller was awarded the Templeton-Prize 2008. According to its present internet page, the Templeton Foundation presents itself as a "philanthropic catalyst for discoveries relating to the Big Questions of human purpose and ultimate reality". In his statement of March 12th, 2008 made on the occasion of the Award[22], Heller says:

> If we ask about the cause of the universe we should ask about the cause of mathematical laws. By doing so we are back in the great blueprint of God's thinking about the universe; the question on ultimate causality: why is there something rather than nothing? When asking this question, we are not asking about a cause like all other causes. We are asking about the root of all possible causes. Science is but a collective effort of the human mind to read the mind of God from question marks out of which we and the world around us seem to be made.

In Heller's eyes, Mathematics is the result of a sort of projection of God's thoughts about the creation into the human thinking. Therefore, the theory--shaping power of individual material things and their individual dynamics seem to be irrelevant to him. Accordingly, the causality of material things seems to be irrelevant or non existing. Therefore, the connection {God's mind $\rightarrow$ laws of nature} is relevant, not the chain of connections {God's mind $\rightarrow$ real things $\rightarrow$ laws of nature}. That in turn makes it understandable that he keeps in high esteem idealizations, which might be considered to include also abstractions and simplifications. Referring to Wigner's expression "unreasonable effectiveness of mathematics in the natural sciences", Heller stresses the value of idealizations:

> "We often read in philosophy of science textbooks that the mathematical description of the world is possible owing [sic!] to *idealizations* made in the process of constructing our theories. […]. This is a typical half-truth. At least in many instances, it seems that the idealization strategy does not consist in putting some information aside, but instead it is one of the most powerful mechanisms of the creation of information. For instance, the law of inertia (uniform motion under the influence of no forces!) has led us into the heart of classical mechanics. […]. *The quantum world would remain closed to us forever if not*

[21] Pontifical Council for Culture and Pontifical Gregorian University. Vatican City-Rome 2005.

[22] http://www.templetonprize.org/downloads.html

> *for our mathematical models and idealizations on which they are based*"[23]. And finally: "Mathematics, as employed to reconstruct physical situations, enjoys another "unreasonable" property – it has enormous unifying power"[24].

> What is meant here by the *effectiveness* of mathematics in the natural sciences is rather obvious (at least for those of us who are accustomed to the methods of modern physics). We model the world in terms of mathematical structures, and there exists an admirable resonance between these structures and the structure of the world. By means of experimental results the world responds to questions formulated in the language of mathematics. But why is this strategy *unreasonable*? In constructing mathematical theories of the world, we invest into them information we have gained with the help of the joint effort of former experiments and theories. However, our theoretical structures give us back more information than has been put into them. It looks as if our mathematical theories were not only information-processing machines, but also information-creating devices[25].

Heller does not pay attention to the problem of where that "admirable resonance between these structures and the structure of the world" comes from. As a reason for using Mathematics he rather alleges that it discloses informations about reality that is not accessible otherwise. This is tantamount to claim that reality does not disclose itself completely. Rather, Mathematics is claimed to disclose what reality does not. But then the question arises of why – according to Heller – on the one hand, mathematical thought in human minds corresponds to God's thoughts about the material world, while it is "we [who] model the world in terms of mathematical structures".

Even though Heller does not make an explicit declaration, the conclusion is obvious that he does not see any need for investigating the role of Mathematics in Physics.

At the beginning of his statement Heller addresses another topic:

> Science gives us Knowledge, and religion gives us Meaning. Both are prerequisites of the decent existence. The paradox is that these two great values seem often to be in conflict. I am frequently asked how I could reconcile them with each other. When such a question is posed by a scientist or a philosopher, I invariably wonder how educated people could be so blind not to see that science does nothing else but explore God's creation.

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[23] Ibid. p. 128 f. Italics of the last sentence are mine. Cf. the stance of Artigas quoted in Section II. (footnote 12).

[24] Ibid. p. 129.

[25] H e l l e r, Michael. Creative Tension: Essays on Science and Religion. Templeton Foundation Press, Philadelphia–London 2003 pp. xii + 183. Chapter 11 (Chaos, Probabililty, and the Comprehensibility of the World, http://www.templetonprize.org/downloads.html) p. 127.

By the words "Science gives us Knowledge, and religion gives us Meaning" Heller associates his view with the label NOMA (Non-Overlapping Magisteria). This idea was put in circulation by the biologist Stephen Jay Gould in the Nineties and reads in Gould's own words:

> The net of science covers the empirical universe: what is it made of (fact) and why does it work this way (theory). The net of religion extends over questions of moral meaning and value. These two magisteria do not overlap, nor do they encompass all inquiry (consider, for starters, the magisterium of art and the meaning of beauty). To cite the arch cliches, we get the age of rocks, and religion retains the rock of ages; we study how the heavens go, and they determine how to go to heaven[26].

NOMA has often been criticized, not the least by atheists. As has been mentioned in the beginning of this section, the fundamental concept for Christians is the 'absence of contradiction' and the 'deep harmony between different branches of knowledge'. Perhaps, the concept "non overlapping" is still compatible with "non contradictory", but it has no correspondence at all with the idea of 'deep harmony'. This lack of unity, in other words, the mere partition of a whole into different, hermetically separated sectors, does not match with the absolute unity of God mirrored by his creation. Being and meaning are inseparable.

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The American physicist and theologian Ian G. Barbour is praised in some circles as the Grand Old Man of bridgebuilding between Theology and Science. He has suggested to classifying the possible views of the relationship between theology and science by means of four categories, namely 'independence', 'conflict', 'dialogue' and 'integration'[27]. Barbour himself is much in favour of the category 'integration', and he formulates a far-going dependence of the contents of faith and of theology on science. While speaking of religion or theology in general, he addresses mainly Christianity, and one central affirmation of his is this:

[26] http://www.stephenjaygould.org/library/gould_noma.html

[27] B a r b o u r, Ian G. When Science meets Religion. Enemies, Strangers or Partners? HarperCollins Publishers LLC, New York 2000 p. 205.

> God is not the transcendent Sovereign of classical Christianity. God interacts reciprocally with the world, an influence on all events though never the sole cause of any event[28].

This shows his intellectual neighbourhood to the theology and philosophy of process, which he acknowledges explicitly elsewhere[29]. Additionally, Barbour is sympathetic with the dominating ideas in scientific epistemology and methodology: scientific data are "theory-laden"[30] and theories follow paradigms which change from time to time, if they cannot be maintained any longer because of the overweight of falsified theories. With them the idea of God changes. Accordingly, Barbour is not in keeping with the Christian concept of creation and makes science an independent reality:

> Here science and Religion are considered to be relatively independent sources of ideas, but with some areas of overlap in their concerns. In particular, the doctrines of creation and human nature are affected by the findings of science. If religious beliefs are to be in harmony with scientific knowledge, more extensive adjustments or modifications are called for than those introduced by proponents of the Dialogue thesis. It is said that the theologian should draw from broad features of science that are widely accepted, rather than risk adapting to limited or speculative theories that are more likely to be abandoned in the future. Theological doctrines must be consistent with the scientific evidence even if they are not directly implied by current scientific theories[31].

Process theology is a way of thinking the roots of which we reaching as far back as antiquity. In those times God was conceived as part of the world. The Christian God, in turn, is not part of the world, but its Creator. According to the Catholic understanding, the divine revelation in Tradition and Scripture is by itself sovereign and immutable. Also the human understanding of this revelation, though limited by the finiteness of creatures, has a part in this immutability, notwithstanding the fact that it is growing. According to Barbour, this understanding has to be unconditionally subdued under the spirit of present-day natural sciences and their intrinsic variability. This cannot possibly work out. It is not a militant atheism, but a disguised and insidious atheism.

In Barbour's thinking, the question of the relationship between Mathematics and material things does not receive any particular attention. The conclusion seems justified that he does not see a problem there.

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[28] Ibid. p. 35.

[29] Ibid. p. 3, 4, 38, 179.

[30] Ibid. p. 25.

[31] Ibid. p. 35.

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A completely different stance is that of the Scottish reformed theologian Thomas F. Torrance (1913-2007)[32]. He initiated in 1989 the series 'Theology and Science at the Frontiers of Knowledge'. In the general introduction, which is reproduced in all volumes of the series, Torrance announces programmatically:

> We must now reckon with a revolutionary change in the generation of fundamental ideas. Today it is no longer philosophy but the physical and natural sciences which set the pace in human culture through their astonishing revelation of the relational structures that pervade and underlie all created reality. At the same time, as our science presses its inquiries to the very boundaries of being, in macrophysical and microphysical dimensions alike, there is being brought to light a hidden traffic between theological and scientific ideas of the most far-reaching significance for both theology and science[33].

But only from the whole of his thinking it becomes clear, what Torrance really means. In our context, two basic ideas are important: first, Torrance restricts the possibility of knowing God to the mediation of the Humanity of the Son of God. The fact that the Son of God took part in the creation *before* His Incarnation, and therefore might have left open the possibility for a real knowledge of God the Creator that is independent from the Incarnation, is not taken into account. The following passage expresses Torrance's unconditional view of the epistemological function of the Incarnation:

> He (the Incarnate Son) is ομοούσιος with the Father, of the same substance as he. But the Son has taken a human body in and through which he has appropriated human nature for himself, including human life and action and feeling, human thought and speech. In him the Logos, the eternal Reason and Word of God, the Son of the Father, is fully incarnate in human life and being, and *as such is the source of all our knowledge of God and of our communion with him*[34].

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[32] Torrance was one of the 97 foundational members of the *International Society for Science and Religion* (2001; http://www.issr.org.uk). Founding president is the theoretical physicist and later Anglican pastor John Polkinghorne, Cambridge, UK. The website of this society contains links to the *Center for Theology and Natural Sciences* (www.ctns.org), to the *John Templeton Foundation* and to a dozen other similar institutions.

[33] General Introduction to the series 'Theology and Science at the Frontiers of Knowledge' initiated by Torrance, Scottish Academic Press, Edinburgh, 1989. This Introduction is reproduced in every volume of that series.

[34] T o r r a n c e, Thomas F. Divine Meaning. Studies in Patristic Hermeneutics. T&T Clark, Edinburgh 1995 p. 230. Text quoted in: L u o m a, T. Incarnation and Physics. Thomas F. Torrance's Christological Bridge between Theology and the Natural Sciences. Dissertation

Torrance goes on saying that, on the basis of the Incarnation, there is only one way of human knowledge, applicable in every field of investigation. There is no other way of obtaining trustworthy knowledge:

> There is no secret [=distinct] way of knowing either in science or in theology, but *there is only one basic way of knowing*, which naturally develops different modes of rationality in natural sciences and in theological science[35].

The second idea concerns the rejection of any form of dualism and thus acts as a confirmation of the unicity of the way of knowledge acquisition.

> *Dualism* – the division of reality into two incompatible spheres of being. This may be cosmological, in the dualism between a sensible and an intelligible realm, neither of which can be reduced to the other. It may also be epistemological, in which the empirical and theoretical aspects of reality are separated from one another, thereby giving rise to the extremes of empiricism and rationalism. It may also be anthropological, in a dualism between the mind and the body, in which a physical and mental substance are conceived as either interacting with one another or as running a parallel course without affecting one another. In the Judeo-Christian tradition man is regarded as an integrated whole, who is soul of his body and body of his soul[36].

Torrance's thinking is heavily influenced by the reply of St. Athanasius to the Arian heresy, because Arianism means for Torrance dualistic separation of God from the world, on the basis of Platonic philosophy. Torrance opposes dualism most strongly advocating the Nicean ομοούσιος. Luoma summarizes Torrance's view as follows: "Dualism is a paradigmatic, most often unconsciously applied but deeply internalized way of perceiving reality which is seen as consisting of two principles. In the final analysis the poles are God and the world, or the Creator and the creation, between which there is no real interaction or dynamic relation as indications of the ontological and epistemological openness of God and the universe towards each other, thus offering a negation of the *homoousion*. A distinction or existence of two distinct poles

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at Helsinki University 1999 p. 62. Italics are mine. This Dissertation is published in a slightly abbreviated form as: Incarnation and Physics: Natural Science in the Theology of Thomas F. Torrance. Oxford University Press, Oxford–New York 2002.

[35] T o r r a n c e, Thomas F. The Ground and Grammer of Theology. University Press of Virginia and Christian Journals Limited, Belfast 1980 p. 9. (Dissertation Luoma p. 141). Italics are mine.

[36] T o r r a n c e, Thomas F. (ed.). Notes on Terms and Concepts. Belief in Science and in Christian Life. The Relevance of Michael Polanyi's Thought for Christian Faith and Life. Handsel Press Ltd., Edinburgh 1980 p. 136 (Dissertation Luoma p. 153).

as such is, therefore, not to be seen as dualism, but the distorted or missing *relation* between the poles results in unbalance or total disruption, determining the dualistic character of a distinction"[37].

The conclusion of Torrance's basic assumptions, which is highlighted in the first quotation, is not at all a marginal or isolated phenomenon[38]. The assumptions of the exclusive mediation of knowledge through Christ and the rejection of any form of dualism provide a theological discourse that, in practice, tends to the same final result as what Barbour intends by his concept 'integration'. With respect to the relationship between Mathematics and material things in Torrance's thinking: he does not address the question at all. Here, too, the conclusion seems justified that he does not see a problem there.

Altogether, the problem of the relationship between Mathematics and material things does not play any role in Torrance's thinking. Science is rather as a whole epistemologically absorbed into the Christology.

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[37] L u o m a, T. Incarnation and Physics p. 92 f. (Dissertation p. 166).

[38] As a representative of many others, the well known Lutheran theologian Wolfhart Pannenberg might be quoted with respect to his sympathetic attitude towards Torrance's ideas. For instance, Pannenberg points to Torrance in the context of the physical concept of 'field', which certainly has a central role in modern Physics: "To Th. F. Torrance belongs the merit to have called attention – perhaps as the first – to these connections and to have pleaded for introducing the concept of field into theology: 'the field that we are concerned with is surely the interaction of God with history understood from the axis of Creation – Incarnation. [...] Our understanding of this field will be determined by the force or energy that constitutes it, the Holy and Creator Spirit of God'". (P a n n e n b e r g, Wolfhart. Systematische Theologie. Vandenhoeck & Ruprecht, Göttingen, I, 1988, S. 102, Anm. 212; the inner quotation from: T o r r a n c e, Thomas F. Space, Time and Incarnation. Oxford University Press, Oxford 1969 p. 71).

The terminology of Pannenberg himself in dealing with the same topic is apparent from quotations like the following (page numbers refer to volume I of the work cited): "The assertion that the turning of modern Physics to field theories of ever more natural phenomena has an implicit theological relevance is suggested by the metaphysical origin of the concept of field. The idea of a field of forces can be traced through the Stoa back to the presocratics (p. 101). [...] Insofar as the concept of field corresponds to the old doctrines of *pneuma* [spirit], it is not at all nonsensical, but rather suggested by the history of concepts and mind, to put into relation the field theories of modern Physics with the Christian doctrine of the dynamical operations of the divine pneuma in the creation" (p. 102). [...] "As a matter of fact, such reasons for introducing the concept of field into theology have taken place in the framework of the doctrine about God, namely linked to the interpretation of the traditional speech about God as a Spirit" (p. 104). (The translation of Pannenberg's text is mine).

VI. FINAL CONSIDERATIONS

The discourse of this article began with stating that the present status of Mathematics in Physics is unclear (I). There exists a sharp contrast between the epistemological climate of ordinary experience and that of Physics (II). This contrast is due to heavy deformations imposed on experienced reality in order to use mathematical tools (III). The professional actions of a physicist remain good, but their goodness is somehow weakened by a bad secondary effect. This situation is precarious. It could be compared with the professional actions of an entrepreneur in an economical system not centred upon the human person (for instance, capitalism or communism).

One and the same professional action of a physicist can be realized with a good or with a bad intention. The good intention is the normal one considered at length in section IV. The second intention inverts the order of the two effects of a professional action: perpetuating the standards becomes the *goal* and the normal professional goal a *means* for perpetuating the standards.

Therefore, it is convenient to attempt an internal reform in Physics such that the perpetuation of its standards ceases to be morally bad. This means that the standards of Physics themselves ought to be reformed so that they harmonize with the epistemological climate of ordinary life. If such were the case, they would automatically also be in harmony with the epistemological climate generated and witnessed by Christian revelation.

This reason on moral grounds is the third motive for attempting an internal reform of Physics. The first one concerns the removal of the ignorance about the link of mathematical objects to material things. It is simply due to the necessity of having a sound selfunderstanding of Physics. This in turn is closely related to the "apologetic" motive of removing the disharmony between the epistemological climates referred to above.

It is rather astonishing that three major views of the relationship of theology and Physics (or natural sciences in general), discussed in section V, do not pay attention to the problem at hand. Neither the directive function of Mathematics conceived as a sort of projection of the thinking of God about the material world into the human mind (Heller) nor the primacy of science (Barbour) nor the epistemological function of the Incarnation (Torrance) address to Physics any requirements of reform. Nevertheless, the difference between epistemological climates makes a fruitful dialogue between Christian theology and Physics extremely difficult. Things can change only if this difference is directly addressed.

It should be noticed that the separation of the concept of nature from creation renders the classical Christian argument of non-contradiction and harmony between theology and science inoperative. For where is separation, there is hardly contradiction or non-contradiction, let alone harmony. A similar effect is due to the impact of the idea of NOMA. Additionally, the mere existence of deformations is a continuous threat to the harmony, not only when they are meant to *replace* the experienced reality, but also when they serve to achieve professional goals. This threat can only be removed if one completely renounces of such deformations. This in turn means the renouncing of hypothetical applications of mathematical structures to material things and to search instead for a sort of derivation of mathematical structures from them. This is nothing less than reversing the shift from Metaphysics to Mathematics, which has been the major operation of the modern scientific revolution. But 'reverse' does not mean at all an attempt to *eliminate* mathematical theories from Physics, but rather giving *mathematical theories in Physics a metaphysical foundation*, that is to say, giving Mathematics its *real* place in Physics. This out to be the key piece of a substantial internal reform of Physics.

As a different, though intimately connected matter, arises the question whether or not the solution of the problem of relationship between Mathematics and material things leads to a natural theology, for instance in the sense of the classical *quinta via*. This would also support the classical doctrine of non-contradiction and harmony between Christian theology of creation and natural sciences.

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Is it possible to carry out such a reform? *The change from disharmony to harmony with ordinary experience requires the change from the "spirit of deformations" to making no deformations at all. This is not a gradual but a radical change, which requires a completely new development of Physics.* At least, there are no *obvious* hindrances for such an enterprise, because **(i)** the claim that the deformations mentioned in section III. are *necessary* for obtaining the actually obtained scientific results is unfounded; **(ii)** accordingly, there is no convincing argument that a Physics made without such deformations would be *incapable* of yielding such or better results. On the other hand, **(iii)** it has not been proven that a Physics without deformations *does include* mathematical theories. In other words, the question is entirely open.

It must be stressed that in this view mathematical structures and metaphysical structures are *united and at the same time distinguished*. A derivation of mathematical structures from the metaphysical structure of material things would make it clear that physico-mathematical theories are not only instrumental tools that are useful for obtaining practical results, but for nothing else. Rather they participate in the truth of the metaphysical constitution of material things. On the other hand it would make it clear that Mathematics and Metaphysics are not confused or mixed up.

From the point of view of work-economy, it seems to be best to work on **(iii)**. Renouncing of deformations from the outset requires to start *exclusively* from experience-based knowledge. This is an enterprise which does not presuppose any religious conviction. *It is an enterprise which starts from a problem within Physics, develops within Physics by means of philosophical reflection and experience and yields insights within Physics. There is no imposition from outside*. Besides knowledges of Physics and Philosophy of Nature, it requires the conviction of the intelligibility of the material world and the cognitive capacities of the human mind. Additionally, it should be required that the new rationale yields a better Physics, together with an explanation for why the former Physics has worked so successfully. This is a clearly defined enterprise, but it requires an extremely hefty amount of work.

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PHYSICS – 'ALIENATION FROM' INSTEAD OF 'ORIENTATION TOWARDS' THE CREATOR?

Summary

The religious attitude of many physicists is atheist or agnostic. In the present article, it is argued that this attitude is favoured by the present shape of the natural science called Physics. The first reason is that the modern concept of nature is alienated from that of creation. The second is that, according to the dominating view, nature is epistemologically silent about itself. Additionally, the view of the axiomatic and thence hypothetical-deductive character of modern Mathematics and the conjectural character of its applications to the material world make impossible an organic connection between mathematical objects and material things. There exists only a *practical* knowledge of the *successful use* of Mathematics in Physics. This peculiar epistemological climate in Physics has become more and more alienated from the intellectual

climate generated by ordinary experience and its evidence, which in turn is confirmed by Christian revelation.

It is this peculiar intellectual atmosphere in which a physicist carries out his professional actions. Their moral assessment is done with the help of two distinctions: the first between the views of Physics as providing a physicalist world-view or as a field of professional activity like others. The second distinction is between the two effects of a professional action of a physicist: every such action tends to its immediate object, and every such action, by upkeeping the existing professional standards, contributes *eo ipso* to perpetuate the present intellectual climate in Physics. While such actions may be still morally acceptable, the situation is precarious. Therefore it is convenient to have Physics reformed *from within*. Such an internal reform should be experience-based and thus start from the very outset from the epistemological climate generated by ordinary experience, which is in harmony with the epistemological climate generated by Christian revelation.

This reason on moral grounds is the third motive for attempting an internal reform of Physics. The first one concerns the removal of the ignorance about the link of mathematical objects to material things. It is simply due to the necessity of having a sound selfunderstanding of Physics. This in turn is closely related to the "apologetic" motive of removing the disharmony between the epistemological climates referred to above. – Surprisingly, some current views of the relationship between Theology and Physics (I. G. Barbour, M. Heller, Th. F. Torrance) do not envisage any need for an internal reform of Physics. Instead they promote an increased influence of Physics upon Theology.

Key words: Physics, Mathematization, Epistemology, *voluntarium indirectum*, Atheism, Re-Evangelization.

FIZYKA – „ALIENACJA OD" ZAMIAST „ORIENTACJA W KIERUNKU" STWÓRCY?

S t r e s z c z e n i e

Postawa religijna wielu fizyków definiowana jest jako ateistyczna lub agnostyczna. Postawę tę wspiera, choć nie powoduje, ambiwalencja interpretacji teorii matematycznych w fizyce. Interpretacje te z kolei są konieczne ze względu na fakt, że *nieznana* jest relacja matematyki do rzeczy materialnych. Dlatego interpretacje te mogą być jedynie hipotetyczne i zależą od ich sukcesu: obecnie istnieje tylko *praktyczna* wiedza pomyślnego używania matematyki w fizyce. Razem z hipotetyczno-dedukcyjnym sposobem myślenia w matematyce definiuje to szczególny klimat epistemologiczny w fizyce. W tle funkcjonuje pojęcie natury *odseparowanej* kilka wieków temu od pojęcia stworzenia. Zarówno interpretacje, jak i pojęcie natury zachęcają do umysłowych deformacji doświadczanej rzeczywistości w celu zastosowania matematyki i tym sposobem kształtują klimat intelektualny w fizyce. Oczywiście staje się on coraz bardziej wyalienowany od klimatu intelektualnego generowanego przez zwykłe doświadczenie i jego dowód. Alienuje się *eo ipso* od klimatu intelektualnego w odniesieniu do widzialnego świata potwierdzonego i tworzonego przez chrześcijańskie Objawienie. Świat intelektualny oraz życie chrześcijanina, który jest fizykiem, ukazuje się w jego profesjonalnym otoczeniu czymś obcym.

Ocena moralna profesjonalnych działań fizyka dokonuje się za pomocą dwóch rozróżnień: po pierwsze, czy rozumie on fizykę jako naukę dostarczającą fizykalnego punktu widzenia lub jako pole działania profesjonalnego, jak każde inne. Po drugie, dystynkcja między tymi dwoma skutkami profesjonalnego działania fizyka: każde takie działanie zmierza do swojego bezpośredniego przedmiotu i każde takie działanie przyczynia się *eo ipso* do utrzymania klimatu intelektualnego w fizyce. Działanie profesjonalne fizyka, które jest moralnie dobre, zgodnie ze swoim przedmiotem, intencją i okolicznościami jest moralnie dopuszczalne, jeśli dokonuje się w ramach profesjonalnego działania, w innym przypadku nie. Jest to sytuacja krytyczna. Wskazane jest zatem zbadanie, czy możliwe jest zreformowanie fizyki *od środka*. Wydaje się, że deformacje, o których mówimy, prowadzą prosto do punktu wyjścia takiej wewnętrznej reformy. Jednakże zakresu tego przedsięwzięcia nie da się jeszcze oszacować. Rzecz dziwna, obecne poglądy dotyczące relacji pomiędzy teologią i fizyką (I. G. Barbour, M. Heller, Th. F. Torrance) nie uwzględniają żadnej potrzeby reformy fizyki. Raczej zalecają bezkrytycznie zwiększony wpływ fizyki na teologię.

Z języka angielskiego przełożył Jan Kłos

Słowa kluczowe: fizyka, matematyzacja, epistemologia, *voluntarium indirectum*, ateizm, reewangelizacja.