

Mokslo ir tikėjimo dialogai. Tiltai. Priedas: Mokslo darbai

No 6 (2020)

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The abstract of the article

A Case of Human Reason's Liberation from its Positivist Self- Limitation. The Return of Philosophy Through the Solution of a Problem of Physics is a Flanking Aid to Evangelization

is located at:

<http://journals.ku.lt/index.php/MTD/article/view/2202>

The full text is located at:

<http://journals.ku.lt/index.php/MTD/article/view/2202/pdf>

A CASE OF HUMAN REASON'S LIBERATION FROM ITS POSITIVIST SELF-LIMITATION

The Return of Philosophy Through the Solution of a Problem of Physics is a Flanking Aid to Evangelization

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Abstract

The idea of human reason's positivist self-limitation is used by Benedict XVI and others to characterize an aspect of the long-lasting intellectual situation of Western technological-scientific civilization. Liberating human reason from its positivist self-limitation requires, in general, an overcoming of the historical process of Natural Science's drifting away from Philosophy. In the case of Physics, it requires a point where both physics and philosophy have to deal together with the same problem. This paper first identifies a problem caused by specific reductionisms in Physics. These reductionisms cause certain deformations of physical knowledge, which in turn makes it desirable for physicists to dispose of an assessment of them. The paper then proposes specific steps in philosophically assessing these reductionisms. Such an assessment in turn is based on common experiential knowledge which is not restricted by any reductionisms. That excludes experiments and, thus, cannot be done with physical means, but only with philosophical ones. All this already constitutes a grain of sand of human reason's liberation from its positivist self-limitation. It is not any imposition from outside physics, but a desideratum from inside physics. The second purpose of this paper is to briefly present the main ideas of that assessment. Implementing its consequences would bring about an epistemological mindset in Physics as a whole that is open to natural theology. Furthermore, it is suited to mitigate, or even eliminate, a certain quasi-contradiction in a physicist's mind and professional work. To show that is the third purpose of this paper. Precisely these two issues offer a certain flanking aid to, though not a part of, the Evangelization. More specifically, that flanking aid consists in offering the epistemological mindset of Natural Realism and can be circumscribed by four aspects: the first is a general corroboration of the stance that Natural Realism is the true form of man's relationship to reality; the second is a sort of contemplative mindset; the third is the elimination or the mitigating of the quasi contradiction referred to in the preceding paragraph, and which can be called 'unity of life'. The fourth aspect is a ripe fruit of the three aforementioned: an uncommon quietness and serenity of the spirit.

KEY WORDS: *philosophy, physics, evangelization.*

Anotacija

Žmogaus proto pozityvistinio savęs apribojimo idėjų Benediktas XVI ir kiti pasitelkia apibūdindami ilgalaikės Vakarų mokslinės-technologinės civilizacijos mentalitetą. Siekiant išlaisvinti žmogaus protą nuo pozityvistinio / racionalistinio / materialistinio apsiribojimo, reikia turėti omenyje neteisingą istorinį gamtos mokslų nutolimo nuo filosofijos procesą. Fizikos atveju tam reikia bendro taško, kur fizika ir filosofija turėtų ir galėtų spręsti tas pačias problemas. Šiame straipsnyje analizuojama specifinių redukcionizmų fizikoje sukelta problema. Jie deformuoja fizines žinias, lemia klaidas, dėl ko fizikams tenka disponuoti nevisavertėmis tiesomis. Straipsnyje siūloma, kaip šiuos redukcionizmus filosofiskai vertinti. Vertinimas pagrįstas bendražmogiškėmis ir mokslinėmis žiniomis, kurių jokie ribojimai praktiškai nevaržo. Į šią analizę neįmanoma įtraukti empirinių eksperimentų, apskritai vien fizinėmis priemonėmis vertinti tiesos, pasaulio realybės negalima, būtinos filosofinės kategorijos. Visa tai jau yra žmogaus proto išsivaidavimo iš savo paties pozityvistinio / racionalistinio siauro mąstymo pagrindas. Tai ne tik koks nors išorinis fizikos tiesų primetimas žmogaus mąstymui, bet tarsi kylantis (lot. desideratum) iš paties fizikos mokslų vidaus. Kitas straipsnio tikslas – glaustai pristatyti pagrindines tokio vertinimo idėjas ir prielaidas, kurias įgyvendinus fizikos moksluose įsivyravų epistemologinė mąstysena, atvira natūraliajai teologijai, transcendencijai, Dievo egzistencijos pripažinimui. Ji leistų sušvelninti ar net pašalinti tam tikrą prieštaravimą tarp fizikų teorinio mąstymo ir praktikos. Šiam prieštaravimui atskleisti – trečias straipsnio tikslas. Šie du veiksniai teikia tam tikrą papildomą pagalbą krikščioniškajai evangelizacijai, nors ir nėra jos tiesioginė dalis. Turima galvoje gamtinio realizmo nulemta epistemologinė mąstysena, kurią galima apibūdinti keturiais aspektais: 1) patvirtinimas, kad natūralusis realizmas yra tikroji žmogaus santykio su tikrove forma; 2) kontempliatyvus mąstymas; 3) minėto vidinio prieštaravimo pašalinimas arba sušvelninimas, kurį galima įvardyti kaip gyvenimo vienovę; 4) trijų minėtų veiksnių rezultatas – žmogaus sielos ramybė.

PAGRINDINIAI ŽODŽIAI: *filosofija, fizika, evangelizacija.*

DOI: <http://dx.doi.org/10.15181/mtd.v0i6.2202>

Introduction

The positivist self-limitation of human reason and, implicitly, the liberation from that self-limitation, is a topic which has been repeatedly addressed by Benedict XVI and others. For instance, in the second part of his important Regensburg address of September 12th, 2006, Benedict XVI speaks about the “modern self-limitation of reason, classically expressed in Kant’s “Critiques”, but in the meantime further radicalized by the impact of the natural sciences” and of the need to “overcome the self-imposed limitation of reason

to the empirically falsifiable” (Benedict XVI, 2006). Yet, the subtitle may initially provoke amazement. Instead of illuminating the title, it seems to stir up confusion. In fact, how could the philosophical solution of a problem limited to the natural science named physics possibly relate to the religious-theological enterprise of Evangelization?

In an earlier contribution to this journal (Larenz, 2019), it has been argued that it is not easy for a present-day physicist to genuinely be a Christian. The reason is the considerable difference of epistemological climates. The object of Physics consists in the entirety of material objects and their processes. It is viewed, by physics, in the light of an epistemological mindset that owes much to Immanuel Kant, whence it is rather skeptic. On the other hand, the object of Christian revelation is God and his creation, insofar it refers to God. When Christian revelation speaks about material things, it does so within an epistemological mindset close to that of Natural Realism.

As the epistemological mindsets of both physics and natural realism differ deeply from each other, it is not easy for a present-day physicist to genuinely be a natural realist. This is why it is not easy either for a present-day physicist to genuinely be a Christian. Conversely, if the mindset of Physics comes closer to the epistemological mindset of Natural Realism, it will also come closer to the epistemological mindset of Christian revelation, insofar the latter speaks about material things. This would make it easier for a present-day physicist to genuinely be, or to become, a Christian. Such a move of Physics would be a flanking aid to, yet obviously not part of, the Evangelization.

But why should the epistemological mindset of physics change? Putting into effect human reason’s liberation from its positivist self-limitation can be a desire of philosophers, or of theologians, or of both, but such a desire does not seem to obey reasons that stem from physics. Therefore, it should not be allowed to enter the intellectual domain of physics. However, the point is that physics itself *has* a reason to look for an assessment of certain specific shortcomings or reductionisms that are to be performed in every single experiment, in whatever branch of physics. And physicists should reasonably implement that assessment.

In fact, the existence of reductionisms in physics thoroughly changes the situation. Again, what physicists could and should desire, is an assessment of

the consequences of the reductionisms that are specific for physics. Whether or not this entails a change of epistemological mindset, is for the interests of physics less relevant, at least at first sight. Physicists are used to be primarily interested in the progress of physics. The two interests – theologians for an alignment of the two epistemological mindsets, on the one hand and physicists for an assessment of what the reductionisms entail, on the other – should be carefully distinguished.

The present article focuses on achieving an assessment of the deformation of physical knowledge due to those reductionisms that are done when performing physical experiments. The assessment will yield two sorts of results: on the one hand, a list of what could be called ‘fragmentations’ of what previously to the experiment was something united and, on the other hand, some consequences that suggest ideas for physico-mathematical theories. With respect to the latter, it will turn out that the connection between material things and mathematical objects, which is only known to exist in a practical way through performing experiments, is founded in what could be called the constitution of material things.

The assessment’s epistemological mindset must allow to recognize the reductionisms as such, i.e., as cut-offs from a reality leaving only a part. This requires taking serious experience as a primary *source* of physical knowledge. This epistemological stance is typical of natural realism. As physicists are used to another epistemological mindset, the assessment constitutes a challenge for physicists to incorporate it into their traditional way of thinking and working. Section II is devoted to the historical development of physics inasmuch it concerns the mathematization of physics. Section III contains a sober outline of the starting point, procedures and results of the proposal for a certain philosophical embedding of physics. In the near future, the proposal with all details will be published elsewhere.

Complementarily, we take into account that the epistemological mindsets of physics and natural realism must, by force, coexist in the mind of *individual persons*, above all physicists. The reason is that physicists grow up, as every healthy human person, surrounded by ordinary life and its spontaneous epistemological mindset, which is precisely that of natural realism. We’ll have a look at the situation that has developed in the last centuries and pinpoint a specific sort of moral

dilemma a physicist finds him or herself in (section IV). As can be expected, this dilemma is of greater entity for a person who happens to be a Christian. This, in turn, confirms the argument sketched in this introduction that *problems in the relationship between physics and Christianity arise precisely then when arise problems in the relationship between physics and natural realism*. This topic is touched upon in the final remarks (section V).

1. Mathematization of Physics and its Fruits: Technology and Reductionisms

First of all, it is necessary to know that the modern natural science called ‘Physics’ has a historical antecedent, which is ordinarily called ‘Philosophy of Nature’ and has existed since Antiquity. There was a change, not an absolute beginning. The essence of the change does not consist in particular discoveries, even though there have been great discoveries such as the discovery of inertial movement by Galilei, or Newton’s insight that heavenly and earthly bodies behave the same way. Also the Copernican astronomical picture has played an important role. These three and other discoveries occurred during the 16th, 17th and part of the 18th centuries, a period that is usually called the *Scientific Revolution*. *But the greatest single factor of the Scientific Revolution was the mathematization of Physics*.

The systematic mathematization of Physics set into motion a development that has grown out into a split between empirical and theoretical branch of Physics. The declared goal of theoretical physical knowledge is not a sort of contemplative vision, as the word might suggest following the Aristotelian use of the word ‘theoria’. Physical theories – always in mathematical form – have not, or not only, and not primarily, the purpose of pure knowledge or contemplation, but the capacity of predicting future events on the base of what is called laws of nature, so that the actions in the present moment can be arranged accordingly. In other words, theoretical physics has (also) a *practical* goal!

Theoretical physics is at the base of all technology, which gives an idea how powerful is the impact on human life style, exercised by the turn from theoretical insight previous to the Scientific Revolution to practical prediction after. Based on this vast success, Physics has provoked in Philosophy

a trend from Philosophy of Nature towards Philosophy of Physics (and, more generally, Philosophy of Science). In other words, it has shifted the attention from philosophically formulated questions to mathematically formulated ones. Even though it might stir up protests, I dare to say that this is a form of *philosophical malnutrition* of Physics.

The change of names is significant. In philosophy of *nature*, it is nature that determines the content of that philosophy. In philosophy of *physics*, it is physics that sets the stage for another sort of philosophy. Replacing 'nature' by 'physics' means relegating 'nature' to a secondary role. [Here is an insert for Christian readers: using some words of the Encyclical *Fides et ratio*, it may be said that Natural Sciences have practically lost their *sapiential horizon* (John Paul II 1998, Nr. 106, p. 2). To be more accurate, the Natural Sciences were increasingly moving towards the positivist claim to be themselves the sapiential horizon. In this way, also Physics has become an important part of a "scientific sapiential horizon".]

As is well known, physico-mathematical theories are born little by little in a process, where experiments and laws of nature or whole theories are interwoven. To be more precise, experiments have a double function: discover natural phenomena and inspire the formulation of theories about such phenomena, on the one hand, and testing such theories in domains outside the original ones. Theories, too, have a double function: giving a conceptual framework to the experimental discoveries and guiding the design of future experiments. What is wrong here? The answer is simply that nothing is *wrong*, but the interplay of experiment and theory contains severe *reductionisms*, which will be explained in section IV, taking into account what has already been said in the previous section.

The most important feature of the reductionisms occurring in the interplay of experiment and theory is that their origin is not nature, but exclusively the experimenter-theoretician. Looking at the achievements with the eyes of an engineer, he or she would be satisfied if only theories and experiments match to a satisfactory degree. Looking at the same achievements with the eyes of a philosopher, things are quite different. The philosopher is not interested in predictions and technology, but in understanding. For him, the existence of reductionisms is an alarm sign. A philosopher might think that, while physics continues with its job, philosophy might try to elaborate a *philosophical*

assessment, estimate or control of the reductionisms, because they are likely to entail deformations of physical knowledge.

Here the argument has arrived at a decisive point, for accepting such a philosophical assessment means that physics has radically changed its relationship to philosophy. This is so remarkable that it could be called an intellectual turning point of physics, namely from directing philosophy to accepting orientation from it. That intellectual turning around of physics is profound, because it is precisely *an internal problem of physics* which that science itself cannot solve and therefore sees itself urged to approach philosophy. Thus, the mindset of the philosophy in question would begin to influence the mindset of physics. The philosophy in question is natural realism. This is important also for the reason that it is the only way of doing Philosophy that cannot be completely left by human mind. It would be a return to the spirit of the antique philosophy of nature, but now modernized by the confrontation with a modern topic: the assessment of the reductionisms occurring in the connection between experiment and theory.

However, all of this would possibly leave physicists quite unimpressed, if the aforementioned assessment or control of the deformations of physical knowledge would just be that: a philosophical assessment, a mere analysis without possibilities of implementation. Things might change if the assessment would bring about *positive* results that have been inaccessible so far because of the reductionisms. This would be a completely new situation, because Philosophy would have begun telling Physics something about its very own topic. Then, a Physics *with* such a control, which also brings new insights and a brighter epistemological climate or mindset, would be really better off than a Physics *without* any control of losses of knowledge.

2. The Assessment: Starting point, Procedures and First Results

In this section we are going to substantiate what are the interventions of the experimenter in order to link experiments with physico-mathematical theories, and which are (partly) characterized by *reductionisms*. They are performed by the experimenter only and, thus, *have no counterpart in nature*. For convenience, they may be briefly recalled here (cf. Larenz, 2019, p. 15–16):

- (i) The *practical choice*, for the purpose of an experiment, of two material things and assigning to each one, in one of two ways, the functions of *object* and *apparatus*;
- (ii) The *mental choice of spatial limits* of the experiment, even though its real connection with the rest of the world continues unaltered;
- (iii) The *practical ending of the experiment* by the experimenter, while “nature goes on”;
- (iv) The *mental isolation of the experiment's result* from the whole experimental process;
- (v) The *abstraction from the apparatus after use, and the attribution of the result to the object alone*;
- (vi) The *weakening of the relevance of the observations concomitant to the experiment*.

The word ‘reductionism’ clearly does not mean that reality itself is reduced to a part of it. Nothing disappears. Rather, the reductionisms listed above incorporate external actions – reductionisms are *practical*-, and also incorporate abstractions, which are mental operations by which something is *retained* and something else is *left out*. Such operations might be attractive or desirable, because they produce a certain ‘simplicity’ or ‘tractability’ in terms of logical or mathematical operations.

It would lead too far away, if we explained each one of the six reductionisms in detail. It may be sufficient to summarize their effect in terms of the three general characteristics of present-day Physics, namely *model*, *success* and *reductionisms* as outlined in (Larenz, 2019, p. 9–17). Among these three key words, the most fundamental is *reductionism*. It supports the other two; the key word *model* belongs into the context of prediction and technology and, thus, exhibits the genuinely *practical* aspect of Physics. The key word *success* refers to the *quality* of prediction and technology; it is always *gradual* (never 100% precision) and *sectorial* (never over the whole range of energies, speeds etc.). Truth is never gradual nor sectorial; something is simply true or not true. Therefore, graduality and sectoriality somehow picture the difference between success and truth.

After having specified the starting point, the question of possible procedures arises. Two topics will be addressed: the purely mental character of the assessment and its power or effectiveness to change the epistemological mindset. The purely mental character of the assessment corrects the purely mental deformation of physical knowledge, brought about by the reductionisms. The methodical principle is simply that the assessment *does not use* the three key words mentioned: *model*, *success* and *reductionisms*. They are certainly not used, if one aims from the very outset at drawing the consequences of *not* performing the reductionisms, thus *not* searching for predictions and technology and *not* trying to construct models. Therefore, the assessment belongs to the realm of *theoretical* philosophy and is headed, from the very outset, at an estimate of the losses or deformation of knowledge by the said reductionisms.

The assessment's effectiveness can be seen as follows: Obviously, only what *remains after* the reductionisms will be object of, and contribute to, physical knowledge. However, this goes hand in hand with that the experimenter-theoretician has not "forgotten" that it is the *full* reality he or she is interested in and wants to understand. This "not having forgotten" always has to be added to the knowledge obtained from what is retained. Then comes about the unpleasant yet unavoidable consequence that knowledge of less means also *less* knowledge, or *poorer* knowledge. As a comparison could be helpful to consider that understanding a machine on the basis of some of its parts cannot be complete and sometimes might even appear enigmatic. Likewise, the understanding of nature through the filter of reductionisms cannot be complete.

In other words, while the reductionisms and abstractions might lead to 'simplicity' or 'mathematical tractability' of what is a partial knowledge of a full reality, there is a sort of disproportion between that partial knowledge and the full reality. One might even say that partial knowledge is a *deformation* of full knowledge. Knowing that the full reality exists gives to understand that it is not completely faithfully depicted by the partial knowledge, even though one might not be able to further specify the expression 'not completely faithfully'. The classical expression for this situation is that the partial knowledge is not the *truth* about the full reality, even though it might be a sort of "approximation" and be *successful*, as it happens in fact. Another term expresses the same

situation: from within the partial knowledge, the full reality (which is implicitly always meant) appears to be less or not at all *intelligible*.

These considerations make it clear that the reductionisms (i) – (vi) listed above are not at all little re-arrangements for the experimenter-theoretician's convenience. For purposes of *engineering*, the reductionisms are appropriate even to the degree that they make technology possible at all. But for purposes of *understanding*, they are pernicious. The first pernicious effect is the fragmentation introduced by the mere multiplicity of reductionisms. It is followed by the spatial (ii) and temporal (iii) fragmentation, which make physicists speak of 'isolated systems'. This is in deep contrast with what is commonly perceived as 'the universe' which possesses a profound unity.

Now let us have a look at the assessment's principal ideas. Properly speaking, there are no results in the sense of reaching something which was not already contained in the experience with which the assessment starts. Rather, the initial ideas are sharpened and made explicit more and more. As presenting the assessment's details would fill a book, the presentation of the main ideas in their thoroughly organic concatenation has certain lacks. For the reader less familiar with the field, this might cause the impression that what is presented is not consistently thought through till the end. Nevertheless, we try our best to present the assessment's essential ideas [(a)–(f)] as clearly as possible, so that one can get an overall impression of their substance. That should be sufficient to show that the whole enterprise of assessment points to something else than to just get a fast solution of a minor problem. That and only that is the purpose of the following paragraphs.

(a) – The philosophical embedding of physico-mathematical theories contains a *theory of individuality of material things*. An incipient idea of what individuality means is learnt from sense perception: I see *this* thing *here* and the *other* thing *there*, and *point to it* with my finger and so distinguish it from other individual things. This incipient idea can be elaborated further. On the contrary, physico-mathematical theories are abstract in the sense that they cut off traits of individual material things.

In order to appreciate, in the context of Physics, such a statement about individuality, one must take into account that, before the discovery of atoms and the like in the 19th century, the experimenter-theoretician was able to unite, by his cognitive capacities, his perceptions of individual material things with objects of an abstract physico-mathematical theory. And it worked out to the satisfaction of physicists. But atoms and the like are *not* perceived by the experimenter so that he could not unite missing perceptions, by his own cognitive capacities, with a mathematical object. Only perceptions of individual macroscopic experimental tools can be united in that fashion with mathematical objects. And it is the individual macroscopic experimental tools, which interact with atoms etc. Obviously, the gap between theory and reality has become deeper.

Although the philosophical embedding can only be formulated by means of abstract concepts, this can be done in a way that material individuality is implicitly present *without* cut-offs. For instance, an incipient reference to individuals without cut-offs of their individual traits is the affirmation, that there are *many* electrons (as opposed to *one* electron). This seems to be extremely “poor”, but it allows to conceive what is their interaction, which only exists between several individuals. Additionally, one might find ways to characterize the interaction with other means.

A good illustration of the importance of a theory of individuality for assessing the loss or deformation of knowledge in physico-mathematical theories is the so-called paradox of Schrödinger’s cat discussed in quantum theory. It is a thought experiment invented by Schrödinger and meant as a criticism of quantum theory. It goes as follows: the death of a perceivable macroscopic body (cat) is linked to the decay of a non-perceivable microscopic body (atom). The cat is described by sense perception, the atom is described by quantum theory. According to sense perception the cat *has* a definite state at any given moment. According to quantum theory, the atom *has no* definite state at any given moment (decayed or not decayed). It is not necessary to go into more details. Rather we limit ourselves to quote Schrödinger himself: “The typical of these cases is that an indeterminacy in principle limited to the realm of *atoms* turns into a *macroscopic* indeterminacy, which however can be decided by direct observation” (Schrödinger, 1935).

(b) – Since Antiquity, *the question of the relationship between “one and many” has stimulated philosophical thinking.* Suffice it to remember Plato, who thought of a separate world of non-individual ideas, in which each individual thing of our visible world “participated”, i.e. took part. There are several variants of this basic idea discussed in Platonism and Neoplatonism. The competing view stems from Plato’s disciple Aristotle who, roughly speaking, had the view that the idea and the thing partaking in the idea are united, so that one could speak of an individual material thing “T” and, at the same time distinguish two aspects united in this thing: *T as non-individual* and *T as an individual*. It is the same T, but viewed inasmuch it is a non-individual, respectively an individual. The technical name for this view is *hylomorphism*, described by Aristotle in his *Physics* (II, 3) and his *Metaphysics* (books VII–IX). The classical name for *T as a non-individual* is *substantial form*, and the classical name for *T as an individual* is *prime matter*.

Nowadays, the concept of hylomorphism is only used by few authors for dealing with the relationship between the human soul and the human body. Analytical philosophers have taken over the platonic idea to a certain degree by speaking about ‘natural kinds’, as found among animals, plants and humans. Modern natural science urges to dedicate philosophical efforts to this issue, because one of the greatest modern findings is the periodical system of chemical elements (Chemistry) as well as the ordered manifold of elementary particles (Physics). This means that it is not enough to consider energies, characteristics of their interactions and other single properties of material things. Rather it is necessary to take into account that these things are individuals of a species.

As a matter of fact, this is what chemists have done since the late 18th century, and physicists since the beginning of the 20th century. After the classification of chemical elements with the accompanying simple theory of atoms (e.g. Dalton, 1808), the discovery of the components of the atom (protons, neutrons and electrons) has fostered in Physics what one could call the “classification enterprise” of those things that ended up being called elementary particles. But this line of thinking in individuals of species might not yet have reached its central position that it should occupy, because there a still many influential geometric ideas, perhaps with a Cartesian inspiration.

(c) – The most basic characteristic of the interaction of material things is that *it is the things themselves which act upon others and receive actions from others*. There is no such thing as an intermediate agent. In other words, action and receiving action is *intrinsic* to that material thing. The view of interaction or dynamics as something *intrinsic* to material things was common from Antiquity to early modern times. From Newton on, that view was replaced by the opposite view that material things (or “matter”) are inert and need to be moved *extrinsically*, i.e. by third agents. (Clearly, here is a conceptual problem with what has come to be called “inertial movement”, which is seen as being *intrinsic*.) This view prevails also today, as can be seen by the division of particles in the so-called Standard Model of Elementary Particle Physics. This model has the notion of *matter particles* (such as electrons, protons, neutrons etc.), and *interaction particles* (photons, several types of Z-Bosons, several types of gluons) which are thought to “carry” interactions between matter particles.

(d) – *Beyond the affirmation that action and passion are intrinsic, it is necessary to specify them more*. Since immemorial times, one spontaneous way of referring to a (material) thing has been by using characteristics of its structure or shape, for instance, as proposed by Democritus or Descartes. But also, the behaviour or interaction of that thing has been used to refer specifically to a thing. For instance, both the so called ‘strong interaction’ or ‘weak interaction’ among elementary particles are inspired by their strength. This insight was denoted in medieval philosophy by the principle “*agere sequitur esse*” [acting follows (= is proportional to) the being] and also “*omne agens agit sibi simile*” [every agent causes something similar to itself]. The word ‘proportional’ in this context has nothing to do with the mathematical concept of proportionality between numbers or other mathematical objects. A better word, that is not yet used otherwise, still must be found. Anyway, the spontaneous understanding makes a link between what a thing *is* and what it *does*.

Combining the insights about the link between constitution and dynamics, on the one hand, and the hylomorphic constitution in particular, one finds that the acting of a material thing upon others is due to its being something non-individual (a substantial form), while the receiving actions from

other material things is due to its being something individual (prime matter). From this derives the important consequence that an elementary particle is acting and receiving action *without interruption throughout its "lifetime"*.

(e) – Most authors think that what is called *space* is a sort of container, real though invisible, which is needed as a point of reference for the observed individual material things. Einstein put forth the alternative idea of conceiving space as a *positional quality* of every single material thing. That second alternative has never been seriously discussed in the literature. However, if one admits this alternative in the absence of evidence for a container space, the general experience that material things never relate indifferently to their surroundings fosters the view that every single elementary particle relates to each other by such a positional quality. The very first thing to be noticed is that this quality is dynamic. From (c) we have that the action and passion of a particle is *intrinsic*. From (d) we have that the difference of intrinsic activity and passivity is due to the hylomorphic structure of that particle. Now we have eventually that every single elementary particle uninterruptedly interacts with every other elementary particle. The positional quality of a particle is, in a metaphysical sense, the particle's *first property*. Any other property is metaphysically (and logically) posterior.

(f) – In other words, our world consists of material things that generate a mutual order. Therefore, *a basic global characteristic of that order* can be expressed as follows. It begins with stating that material things are either elementary particles or agglomeration of elementary particles, as solid bodies in particular. It continues with stating that elementary particles are discovered and classified by experiments that consist of solid bodies, i.e. agglomerations of elementary particles. All that comprises all and every single material thing, and without interruption. This leads to the affirmation that *the micro and macro world are not alien to each other; but rather intimately related to each other*. The global situation is something like a gigantic *self-disclosure* of the material world.

This expression might sound quite vague and even might seem useless. However, the remarkable point is that the philosophical assessment of physics

attains both the universal and the individual. In other words, human mind really has an access to the individual elementary particle, *but only in the horizon of the whole universe*. And natural realism signals that this is, above all, a reality, as expressed with the cognitive capacities of a human experimenter-philosopher. This allows to see the enormous contrast, with respect to intelligibility, between natural realism and the skepticism found in present-day Physics.

At this point, the objection would have to be discussed that the view (a) (f), and (f) in particular, is materialistic, because it does not allow for life, neither human nor animal or plants. Therefore, it is not a realist picture of reality. However, we consider that life is not at all impossible in this framework but cannot enter here to discuss this important point in detail. Rather, we proceed to mention three consequences of the hylomorphic structure of elementary particles:

(a) – The *global dynamical order* constituted by all elementary particles together as indicated in (f), *has a basic level* which is indifferent to the diversity of species these particles belong to. It has a structure that is also indifferent to the number (>2) of particles and can be derived from the hylomorphic structure of elementary particles together via the principle *agere sequitur esse*. Thus, the global order derives essentially from what has been said in (d) about the “proportionality” between the particle as something non-individual and its action, and between the particle ad something individual and its passion.

After the hylomorphic structure of elementary particles, which are the basic components of all material things, the basic level of the global dynamical order is the second constituent of the unity of nature. This is notable contrast with the fragmentation of hitherto known physico-mathematical theories. The most known part of that fragmentation is the non-fitting together of General Relativity Theory and Quantum Theory. At present, to their making fit together are devoted many efforts. It should be noted that here is not only the contrast between a *given unity from the very outset* and a *unity to be constructed*, but also the place of this unity: in *reality*, which comes first, and in a *theory*, which incorporates reductionisms and comes second.

(β) – As an essential aspect, the hylomorphic structure of elementary particles is a dualism {*particle as something non-individual – particle as something individual*}. It essentially sharpens what physicists call {*wave – particle dualism*}. In the latter, a material thing is conceived as behaving like a wave, if not in interaction with something else (including a registering device), while being conceived as a particle, when registered. This sort of dualism is linked to the pair *observable vs. not-observable*. The wave is unobservable, but rather a theoretical interpretation of what might be the physical reality before observation (or registration). The other aspect of that dualism, ‘particle’, is the only observed or registered on a screen. This is well known in experimental physics.

On the other hand, the dualism {*particle as something non-individual – particle as something individual*} can be learned from observation, however without observation being necessary for its existence. Rather, the dualism {*particle as something non-individual – particle as something individual*} refers to the material thing itself, independent of others. This is an essential deepening in comparison to the *wave – particle* dualism.

(γ) – The Newtonian axiom *actio = reactio* gives a quantitative account of how much impuls is transmitted by interaction from one material thing to another, as is well known by common experience. But at the same time, the axiom admits the interpretation that any two interacting material things *do not mutually influence their action upon each other at all*. The influence of a material thing on another thing’s action is often called perturbation.

Now, the hylomorphic constitution of elementary particles excludes any mutual perturbation. As it is elementary particles that constitute atoms and bigger material things, their immunity against perturbations influences also the behaviour of the compounds giving them a specific stability. As a consequence, the observed perturbations, which gave rise to the axiom mentioned, must (surprisingly) be considered as a property of the agglomerations of elementary particles, and not of these elementary particles themselves. This probably has a lot of consequences.

The affirmations (α) and (β) are universally valid, but (α) in a collective way like “one order for all individuals”, and (β) in an individual way, like “every single individual contributes equally to one universal order”. They also tell that space is generated by material things themselves. After the dismissal of dynamics as something intrinsic to material things, a space would have to be offered by a hypothesis made by the theoreticians. Therefore, (α) and (β) are a recovery of physical knowledge.

(γ) is more on its own. It tells that the source of much of the material world’s stability is precisely the non-perturbation of elementary particles. Directly, (γ) resolves an ambiguity inherent in the axiom *actio = reactio*. This certainly is a gain of physical knowledge. Indirectly, (γ) tells that the assumption made by theoreticians that elementary particles can suffer perturbation like their agglomerations do is an extrapolation and, thus, a sign of a loss or deformation of physical knowledge.

Altogether, there is no need of having an in-depth knowledge of Physics in order to see that the affirmations (α)–(γ) are fundamental and, therefore, yield an incipient assessment of the losses of knowledge *in the whole of Physics*. It should also be kept in mind that the intended assessment is *definitely not* an incipient phase of a derivation of existing physico-mathematical theories from experience. The reason is simply that it is impossible to (correctly) derive from something, where the reductionisms are omitted from the very outset, consequences which are connected with these reductionisms, as it is the case of the existing physico-mathematical theories. The content of the assessment goes in another direction. A thin guess of that direction might be seen from that the global feature (α) is not only intimately connected with, but constituted by, a feature of every single individual (β). Such a relationship is unthinkable in the known physico-mathematical theories.

The major ideas just presented deeply contrast with the mainstream thinking. For instance, the concept of space might be so widely accepted also for the reason that the other alternative – a positional quality of every single material thing – seems to raise huge problems. Not the least of them seems to be, how to deal with such a huge number of material things (the current

estimate of the number of protons in the observable universe is about 10^{86}). It turns out that quantitative considerations are not appropriate. As has already been said, they altogether point to something different than the solution of just a limited problem.

In order to be more specific, one can use the idea that the map is not the territory it represents, one could nevertheless think that every geographical map has a certain scale. If the scale is small, the map exhibits many details; if the scale is high, then only the overall shape of the territory is exhibited, but only few details or none at all. In contrast to the idea of maps representing a territory, the consequences (α), (β) and (γ) are not details that can appear or disappear depending on the map's scale. They are present throughout the material world, but nevertheless are missed in physico-mathematical theories.

All this sounds rather innovative, because it means that Philosophy has to tell something to Physics, meanwhile the general opinion is that Physics, and natural sciences in general, are the ones who have to tell something to Philosophy. A good number of voices continue that thought by saying that natural sciences are the ones who have to tell something to Theology, too. Using the expression quoted in the very beginning of this article, the strategy just outlined could be called a case of human reason's liberation from its positivist self-limitation. Obviously, such a liberation has to come from the very resources of human reason itself. In other words, the view expressed in (a)–(f) and the conclusions drawn from it and expressed in (α)–(γ) are, in fact, a beginning a self-liberation from human reason's positivist self-limitation.

The last remark is a bit psychological: as these arguments do not occupy any role in present-day physical thinking, they can be understood in a “linguistical sense”, because they are based on ordinary experience and communicated by ordinary language. But because of the deep contrast between them and mainstream thinking, they need also to be reflected and interiorized, so that one moves within them like a fish in the water. To achieve that goal lasts years, if not decades. But taking into account the far-reaching range of these fundamental ideas, the guess is reasonable that interiorizing these fundamental questions will enhance a physicist's professional competitiveness.

3. The Mindset of the Physicist's Professional Actions at Odds with His Convictions

After having dealt with doctrines without focusing on their human carriers, this last section is devoted precisely to dealing with the same doctrines as possessed by their human carriers. In practice, that means that, after having estimated the losses or deformations of physical knowledge through reductionisms which happen outside the mind, the attention turns to the epistemological climate or mindset of individual persons. The losses of knowledge correspond to the “dark” epistemological climate or mindset of physics as it is done to date. Accordingly, the recovery of knowledge by omitting the reductionisms corresponds to the “luminous” epistemological climate of natural realism. This contrast has made it difficult (if not impossible) that physicists intellectually feel at home in natural realism, while performing their professional work.

Such a background makes that a physicist who has grown up as a natural realist, finds him- or herself before a difficult and even unpleasant task, namely to keep coexisting two different mindsets in his or her mind and, simultaneously, keep them away from each other in order to impede their mixing up. This is an unnatural situation. What is worse: scientific tradition has its revolutionary times but, in certain topics, it is very slow in making changes, and our topic presumably is one of them. On top of it, the need of physicists to do their professional work in teams entails a pressure that this unnatural situation becomes more and more petrified. Therefore, it is desirable to make serious attempts for mitigating that situation by getting right the fundamental property of any knowledge, namely the epistemological mindset, which is equivalent to the right view of intelligibility of the objects known. All this together is another motive for performing the assessment of losses or deformations of physical knowledge. The very beginnings of the assessment have been sketched in the sections II and III, as a continuation of the previous paper mentioned (cf. Larenz, 2019, p. 35).

Now we continue to consider the situation of a physicist's “interior world“, inasmuch it affects his or her religious convictions. The link from them to our topic consists in that natural realism is, so to speak, a channel of Judeo-Christian revelation: God reveals himself through ordinary language that expresses things in a way intimately related to natural realism. It has

been argued that the contrast between the epistemological mindset of natural realism and professional work as a physicist has made it difficult for a physicist to genuinely be a Christian (Larenz, 2019). This view is further illustrated by the view of the theoretical physicist Carlo Rovelli (*1956) reported in the English version of Wikipedia: "Carlo Rovelli", section "Religious views". According to Wikipedia, Rovelli holds the view that physical laws of nature, e.g. the Maxwell equations of Electrodynamics and the belief in creation are *not at odds* with each other. After all, electromagnetic processes are something different from creating. The real problem lies in the *mindset* linked to each of these realms: the rigid dogmatism of religion apparently suggested by Rovelli *is at odds* with the flexibility and openness of physicists for trying to explain natural phenomena, not even excluding scientific revolutions. Thus, according to Rovelli, it is due to that difference of mindsets, that Theology would not be an adequate dialogue partner for present day Physics.

Now, sections II and III suggest a reason why almost the opposite of Rovelli's opinion is true, i.e. that present day Physics would not be an adequate dialogue partner for Theology. The reason's first part is that Physics is not an adequate dialogue partner for Natural Realism, because Physics admits reductionisms and its consequences, not excluding paradigm shifts, while Natural Realism does not admit reductionisms or paradigm shifts with their consequences for the epistemological mindset. The reason's second part is that (as has been mentioned) Natural Realism is close to Theology, and Theology does not admit reductionisms or paradigm shifts, either. The stances, Rovelli's and a theologian's, are not exactly opposite, because the theologian takes into account philosophy (key words: intelligibility, natural realism), while Rovelli does not. The only way to discern between the two stances seems to be an argument that shows that reductionisms have bad "side effects". Precisely this has been the result of sections II and III.

Notice that both stances are omnicomprehensive in the sense that, if there existed some agreement in the basics, and the only disputed questions were particular issues like the Earth's "true age" or the "true age" of the Universe, or other issues referred to in the Bible, there would most probably exist – perhaps in a hidden form – a basic common understanding. But it is the epistemological mindsets or, in other words, the stances persons take towards all

reality, that are irreconcilably different. It is a situation comparable to what Kant describes in his own intellectual development as the 'critical turn'.

The point of this whole section is the following: as long as the bad side effects of the reductionisms in physics are not under control, the positivist self-limitation of reason causes a moral disorder in which today's physicists willy-nilly find themselves. Here, the term 'moral disorder' does not refer at all to an *abuse* of professional work. Rather, it is the standards of a physicist's professional work which prevent him from unrestrictedly following the epistemological mindset of natural realism. Hence, he consciously or unconsciously suffers from a kind of division within his mind as follows: the characteristic epistemological climate or mindset of Natural Realism flows from the natural intelligibility of the things of this world (even though they might appear at first as enigmatic). He has grown up in that epistemological mindset. Professionally, however, he has to adapt his way of thinking and working to the recognized standards of physics and, therefore, work almost in a way *as if* natural intelligibility did not exist. This disorder necessarily leads to "tensions" or "turbulences" in the physicist's mind, which might gradually affect all areas of his life. He may be aware of this situation without necessarily realizing what its cause is.

As has already been mentioned, the fact that physicists use to work in teams generates a "collective" pressure, that each member of the team does his or her part to *petrify* this state of affairs. This happens irrespective of the convictions and intentions of the team's members and, on top of that, it happens precisely by means of each member's professional work. The opposition that shows up here is not one between two contradictory *conceptions*. Nor is it one between two opposing *actions*. It is an opposition between one *conception* and an *action* at odds with that conception.

However, even though this situation does affect every single physicist, it must be conceded that it does not so to the same degree. Experimental physicists are in close contact with the "real reality" and have to deal with it in a practical way. Common sense suggests that they are closer to natural realism. On the other hand, the more theoretical the work of a physicist is, the less he or she will be in contact with the "real reality" and, accordingly, the farther away they will be from natural realism.

In the case that a physicist's religious convictions culminate in believing that the Creator of this world exists, it follows that the creativity of a creature is something secondary. Remember how much creativity Rovelli demands if a physicist's professional work is devoted to fundamental questions as opposed to just developing a new technique. For Christians, this panorama receives its profile from the Pauline advice to do *everything* in honour of God, who is known to be the Creator (cf. 1 Cor 10: 31). But how can a physicist seriously think that "behind" the things he sees is the Creator and His creative mind, when the physicist's creativity supersedes the Creator's, because he is in the prison of a skeptical epistemological mindset? And then, how can a physicist seriously want to dedicate his professional work to a God, who is, perhaps, merely invented?

In this context, the greatest challenge is addressed to Catholics, because it is they who know through their faith corroborated by the explicit teaching of the Catholic Church that natural realism is open to natural theology, which in turn leads into a certain intellectual neighbourhood of revealed Christian theology. Conversely, any departure from Natural Realism also brings a departure from natural theology and thereby gnaws at the living connection of faith with the whole of life. In general, every physicist, who believes in a Creator, comes under an increasing pressure with respect to both the theological doctrine of his faith and his personal spiritual life. This pressure ultimately stems from the epistemological climate of physics. This gives an impression of the scope of the moral dilemma we are dealing with and posits the question of 'how to react' to that pressure.

In general, such a reaction departs from that a believing physicist – irrespective of whether Christian, Jew or Muslim – is motivated by his own worldview and relationship to the Creator to *protect himself* from opposite thoughts. Because the *absence* of a reaction to that pressure leads a physicist eventually to depart into religious indifference, agnosticism or irreligiosity, more rarely into atheism. A *moderate* response to that pressure will limit itself to creating a personal *modus vivendi* by assigning different times to different areas of life; roughly speaking, science from Monday to Friday, leisure on Saturday and religion on Sunday. However, this is only an emergency response, for it is the *same person* who lives on work days this way and on Sundays the

other way. A *strong* response seeks measures to *radically liberate* philosophical Natural Realism, Theology and personal spiritual life from this pressure by *eliminating its cause*. Of course, this cannot mean eliminating *Physics*. Rather, it will end up with searching for and carrying out an *internal reform* of *Physics*. The assessment presented in the previous sections II and III contains the first elements of such a liberating internal reform.

4. Final Remarks

It has turned out that the self-limitation of human reason from Theology and Philosophy to Natural Sciences, and to Physics in particular, is linked to a quite different problem, namely to the lack of assessment of the losses or deformation of physical knowledge due to reductionisms that essentially belong to the method of Physics. The assessment offered in the previous sections give to understand that, in order to be an adequate partner of dialogue with both philosophical Natural Realism and Theology, it is Physics that has to react to such an assessment based on philosophical Natural Realism. As Christian Theology endorses Natural Realism, this assessment also benefits the relationship between Physics and Theology. In other words, Natural Realism is a sort of mediator between Physics and Theology. It can be expected that such an assessment is also beneficial for the professional competitiveness of physicists.

In view of the relevance of that couple of problems for the mindset of the scientific-technological civilization, a tiny remark should not be omitted concerning the relation of a thorough philosophical assessment of Physics to Modernity. Modernity is a rather complex phenomenon, but it is possible to single out two fundamental characteristics, namely that Philosophy has begun to drift away from Theology and, on the other hand, that Natural Science has begun to drift away from Philosophy. Within the modest scope of this article, we limit ourselves to just mention four internationally known authors who deal with these two important aspects of Modernity, each with one book: the philosopher Hans Blumenberg, *Die Legitimität der Neuzeit (The Legitimacy of the Modern Age)*; Blumenberg, 1966); the philosopher Charles Taylor, *A secular Age* (Taylor, 2007), the philosopher-theologian Cornelio Fabro,

Introduzione all'Ateismo moderno (God in Exile. Modern Atheism, Fabro, 1964), the historian Brad S. Gregory, *The Unintended Reformation. How a Religious Revolution Secularized Society*. (Gregory, 2012). As one can figure out from the titles, the first author defends the emancipation of Philosophy from Theology, the others rather defend the opposite. The emancipation of Natural Sciences from Philosophy has been touched upon at the beginning of section II. by discussing the change from Philosophy of Nature to Philosophy of Physics and, in general, Philosophy of Science.

Despite the merely incipient phase of the assessment of a problem of Physics presented, one cannot avoid the impression that in that enterprise the two movements of divergence – Philosophy's drifting away from Theology and the drifting away of Physics from Philosophy – begin to be somehow reverted, within the very restrictions due to the particularities of the problem. It remains to be seen how far that impact really goes, which will decisively depend how far the assessment can be developed. To a good scenario also belongs that, in view of the relevance of Physics for a scientific-technologically minded society, the come-back of Natural Realism to the mindset of Physics would have an impact not only on physicists and engineers. Rather, that come-back is likely to cause, on the long run, a notable shift in the whole society, from an intellectual climate determined by science and technology towards the intellectual climate of Natural Realism.

Precisely for that reason, the philosophical assessment of a problem of Physics can be considered as a flanking aid to the Evangelization, though not a part of it. That flanking aid can be circumscribed by four aspects: the first is a general corroboration of the stance that Natural Realism is the true form of man's relationship to reality and that a philosophical deepening of this stance leads to a consistent worldview in general and in detail. The truth *of reality* is a specific notion in Natural Realism. Furthermore, it is open for a natural theology and thus carries into the intellectual neighbourhood of Christian Theology. The second aspect highlights that the mind's gaze is caught by reality and is, at least in part, an immediate consequence of the first aspect. It is, so to speak, a certain contemplative attitude. This word means above all an *intellectual* attitude and thus differs from a specific Christian notion of

contemplation, which unites to the intellectual attitude an inclination of the will towards the object of contemplation.

The third aspect can be pinpointed by the elimination or the mitigating of the practical contradiction referred to in section IV. It is likewise a deep interior attitude that transcends somehow the mind and will show up in many other fields, too. It can be called ‘unity of (intellectual) life’. Finally, the fourth aspect is a ripe fruit of the three aforementioned: an uncommon quietness and serenity of the spirit, which marginalizes any sort of superficiality as well as an exaggerated tendency for speed, which can be observed in the digitalized civilization.

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