

Discussions with K. V. Laurikainen

“Science has its limits”

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Abstract. The paper is a brief account of the author's relation to prof. K. V. Laurikainen (KVL) since 1958. It covers the central themes of the mutual discussions. The problem of knowledge and faith or science and religion was a central subject of common interest, particularly the question, how physics should affect the world view. The paper reports points of agreement and disagreement between the author's interpretation of KVL's ideas and his own conceptions. The discussions were tinged by the different missions of the counterparts, on KVL's part the establishment of natural philosophy as an accepted field of science, on the author's part the development of a basic teaching philosophy for physics teacher education. The problems taken up include the mutual roles of empiry and theory, intuition and logics, knowledge and beliefs, rational and irrational, and finally Pauli's conception of unus mundus and God.

1. Preface

There is a special reason for the title of this article. In March 2007, Dr. H. Siemsen from Ernst Mach Institute for Philosophy of Science, Emden, contacted me to discuss the Science Education in Finland. This led to long discussions and correspondence in preparation of his extensive article [1] on the subject. In this context, the question arose about the relation of my ideas to those of my “predecessors”. Particularly, I was challenged to assess the relation of the basic ideas of my “teaching philosophy” [2], [3] to those of the “natural philosophy” of Professor K. V. Laurikainen alias KVL.

On the other hand, the title is not quite justified, because these “discussions” can be only fictitious. I have no recordings, and my memories are only allusive. They also remain necessarily one-sided, because KVL is no more present to respond my argumentation. The reader can seek his responses only from the multitude of books and articles he left behind; particularly, from his last book with the title *“SCIENCE HAS ITS LIMITS. Ontological Implications of Quantum Theory”* [4]. It was intended to be his doctoral thesis of natural philosophy, and it is very much like his spiritual testament for the posterity.

2. Two Missions

I have had the privilege to know KVL since January 1958. As a young doctoral student I was commissioned to act as his assistant on a course of Mathematical Means of Physics. He was already an honourable senior scientist, and our relation was formal. Once a week, he gave me, without any further instructions, the problems to be solved and discussed in the seminars, which I held independently as best I could.

From the next several years, I have no special memories of him. In 1967 he, unexpectedly, invited me (*avec*) to discuss worldview problems on the basis of some articles which I had written. Much later, in an interview on account of my 60-years anniversary [5], I mentioned incidentally KVL's thinking on "Knowledge and Faith". KVL did not like the wording of the text and reacted [6]. In my reply [7] I referred to this discussion as follows:

"... A young boy was once invited to the home of an authoritative scientist in Klaukkala. You wanted to discuss something I had written about knowledge and faith. ... I understood that some of your relatives or friends had passed it to you and you felt obliged to glance it. You explained that you were thinking in a completely different way. You declared yourself as a freethinker and atheist, and your world view was materialistic. Some years later, when I encountered again your thoughts, I was surprised to realize that they had turned, being in many respects parallel to mine – to my experience, as if you had read my writings ..."

Although KVL denied, my impression of the tone of the discussion was quite strong and was equally shared by my wife. In passing of years it became obvious, that we shared a serious interest in the relation of knowledge and faith or of science and religion and, particularly, in the ways how modern physics affects, or should affect, our worldview. For KVL this was a central theme of his natural philosophy which was his great mission of life. This was clear already in his enthusiastic public activity as a speaker and writer beside his great professional efforts on behalf of theoretical physics and experimental elementary particle physics.

I had the same primary interest. It also resulted in comparable public activities beside my scientific career as a theoretical crystallographer, although in a smaller scale. This interest was strengthened and expanded by my own "mission of life", "didactical physics", as I called my efforts in developing physics teacher education in Finland [2], in creating principles of "perceptual approach" and in establishment of a special physics syllabus for teacher education. For me, "natural philosophy" meant, in the first place, the philosophical background of physics teaching.

Our common interests are clearly visible in my evaluations of his books [8], [9], [10]. I found our thoughts "in many respects parallel, even more than what was regarded suitable for a Finnish physicist of that time", as I wrote in my above mentioned reply to KVL [7]. With some hesitation, I dare to say, that, by and by, a friendship developed between us. KVL seemed to accept my main ideas, in principle. A couple of times he asked me to lecture on the complementary education courses for physics teachers, which he arranged annually since early seventies. In the eighties I attended regularly his seminars of natural philosophy. Occasionally, he even asked me to conduct the seminar in his absence. I became naturally

one of the founding members of The Finnish Society for Natural Philosophy, founded in 1988 on KVL's initiative.

KVL persuaded me to get more deeply involved in the natural philosophy and in the activities of "his Society". I got the impression that he wanted me to adopt his mission in order to continue his work. I was, however, completely devoted to my own mission and, at the time of his passing in 1997, it was in a crucial phase. Thus, for me this interaction with KVL served only my trials to formulate the principles of my teaching philosophy.

3. Theory and Empiry

There was much in common to our lines of thought. However, now and then, some discrepancy occurred. Mostly, it concerned the roles of theory and empiry as the basis of our conceptions of "reality". At the same time, I saw the weak role of empiry in the Finnish school physics as one of the most difficult and challenging problems within my own mission.

In principle, KVL seemed to agree with my emphasis of empiry as the primary basis. He also nodded in acceptance of my conception of the basically intuitive nature of concepts as *gestalts* born by perception, where empiry and theory are inseparably intertwined. All empiry is theory-laden and all theory is empiry-laden. But the empiry is primary. Every physical concept has an empirical core meaning, preserved in all further developments [2]. Once, I noted that he had started to use the concept of *gestalt* in his own lectures. I was wondering whether this was due to an impact of our discussions, until I learned that he had been a student of E. Kaila, who had introduce Gestalt psychology in Finland [1] – which I was not at all aware of.

In his lectures and writings, he often emphasized the basic role of both empiry and intuition in principle. Still, his detailed argumentation was often based on theory. A couple of examples:

3.1. *Die and Electron*

KVL argued, as I understood it:

The die is a macroscopic body and, hence, a classical object. Classical mechanics makes possible accurate prediction of its motion.

Electron is a quantum mechanical object. Quantum mechanics does not allow other than probabilistic prediction of its behavior.

I objected:

Calling objects classical or quantum mechanical implies, that the attention is drawn to theoretical models instead of the "real entities", the die and the electron, as they are perceived empirically on the basis of observations and experiments.

In fact, classical mechanics does not make possible "accurate prediction" of the motion of a die or of any real object or system.

Empirically, the whole idea of "accurate prediction" is senseless, simply because "accurate empirical verifications" are impossible in general. This phrase is just a verbal interpretation of the mathematical fact that the differential equations modeling the dynamics of a known mechanical system have a unique solution, when the "initial state" of the system is known accurately.

However, "knowing accurately" the initial state is impossible, not only due to the impossibility of accurate measurements and of its realization in a definite instant of time, but also in principle due to the basic conceptual "inaccuracy" of the quantities defining the state of a system. Also, as we know from the chaos theory, an arbitrarily small change of the initial state may result to an arbitrarily large change of the final state. Moreover, even knowing the differential equation, or rather the group of equations, "accurately" is impossible. It would require identification of all degrees of freedom of the system and assessment of a mathematical representation of the laws of interaction, both external and internal, in terms of the coordinates representing the degrees of freedom. Also here a basic conceptual inaccuracy occurs, because the underlying assumption of the existence of such accurate mathematical laws and their mutual independence is a radical idealization.

As to the electron, the impossibility to predict the occurrence of single electrons in an experiment is not a consequence of quantum mechanics. It is an empirical fact, concluded initially from the double-slit experiment. To the contrary, quantum mechanics was developed because of the "empirical compulsion" due to this fact and other empirical evidence.

3.2. *The Double-slit Experiment*

The "great message" of KVL was that modern physics requires a radical change of our conceptions of reality. I agreed. But, while he argued that it is the quantum mechanics which compels us to a change of our ontological views, I emphasized the primary role of the empiry. In my view, the necessity to change views does not come from the theory, but from the empirical evidence, which has made the development of the theory necessary. The theory can then guide us to build up mental images compatible with the empirical evidence. The double-slit experiment played a central role in KVL's argumentation. He, however, explained several times on his lectures that, in fact, a one-slit experiment is already sufficient to show the evidence of what is called the wave-particle dualism, because it already produces a diffraction pattern.

I agreed that the double-slit experiment is definitely one of the keys to modern physics. But, to my view, in a one slit experiment, the interpretation of the intensity distribution as a diffraction pattern offers only theoretical or explanatory evidence. It is concluded from the successful mathematical modeling of the phenomenon as linear superposition of monochromatic waves. The empirical evidence of the wave-particle dualism and the consequent ontological conclusions cannot be obtained without the second slit which makes possible a three-phase experiment $A-B-AB$:

The same radiation is first let to pass through the slits A and B separately and then through both slits simultaneously. The resulting intensity patterns consist of single "hits",

like particle impacts on the screen or film. The decisive observation is that the pattern AB is not a superposition of the patterns A and B , as it would necessarily be in the case of a beam of classical particles with definite paths. This non-additivity of the intensity distribution, $I_{AB} \neq I_A + I_B$, is the empirical evidence, not the occurrence of the pattern itself, even when observed as an accumulation of local and instantaneous events.

It is then another matter that, when measured, the pattern AB can be interpreted as a superposition of two waves in terms of an additive "field-quantity" Ψ . Assuming that the intensity is proportional to the square of the field quantity, $I_A \sim \Psi_A^2$ and $I_B \sim \Psi_B^2$, as is the case with classical waves of almost any kind, the result $I_{AB} \sim (\Psi_A + \Psi_B)^2$ is verified. There is no observable field quantity. Ψ is just a mathematical abstraction introduced to enable the interpretation.

It is important to note, that the intensity of the beam can be weak enough to give just one "hit" at a time. The spots of the single hits are unpredictable. Thus, the "diffraction pattern" represents a probabilistic law, which governs the single "hits".

3.3. *Ontological notes*

As to the ontological implications of the double-slit experiment, KVL emphasized the non-predictability of single atomic events and the probabilistic nature of atomic phenomena. He appealed to Bohr's conception of complementarity: "*Different experimental results can give incompatible results (complementary to each other) [4, Appendix] and "Objects of the micro world are contradictory to themselves" [4, p. 28].* Such statements imply that both particles and waves are still regarded as "valid models" of the electrons and photons. The results of the double-slit experiment, where both natures appear simultaneously, are therefore internally incompatible. This incompatibility is eluded by transferring it to the era of psycho-physical phenomena with the aid of the concept of complementarity.

In fact, the empirical evidence of the double-slit experiment does not concern anything but the single events and their distribution. There are no indications of any existence of particles before or after the events, and there is no observable field quantity to support the wave model. Therefore, rather than sticking to the validity of these classical models, one should simply reject both and revise our conceptions about the ontological nature of electrons, photons etc.- regardless of the observer. In the absence of any contradicting empirical evidence, we can draw following conclusions, which make the acceptance of the incompatibility of the double-slit experiment or of internal contradictions of "objects" unnecessary.

The electron and the photon etc. have no continual existence. They are realized only as instantaneous and local events in interactions. The concept of path of a particle becomes meaningless. Also, particles do no more possess any individual identity; only their "species identity" is left.

From the concluded probabilistic nature of atomic phenomena KVL, referring to Pauli, Born and Heisenberg, cleared the path to the possible interpretation of quantum mechanics as a representation of our knowledge of "the reality" instead of "the reality" itself, further to

the psycho-physical problem of the relation of the mind and the reality, and ultimately to the relation of science and religion. I agreed with the main lines of these thoughts. Avoidance of the inconsistency does not change anything essential in the argumentation. But it is important to draw attention to the uttermost significance of the other conclusions, beside the probabilistic nature of atomic phenomena.

The loss of continual existence and the individual identity leading to the conception of "species identity" have a revolutionary effect on our world view. They have an essential role in the ontological crisis of modern physics [11]. They also point much further forward in the development of physics. They anticipate the conception of the identity of particles, the so-called second quantization and the division of the particles into fermions and bosons, which lead to an intelligible explanation of the macroscopic particle and wave observations.

4. The Human Dimension

In considerations of the creation of scientific knowledge and of its effect on our world view, it is not sufficient to concentrate on the roles of theory and empiry. The human aspect, both on the individual and on the social level cannot be neglected. The interaction of theory and empiry is the driving force of the progress of science, but the whole dynamics is embedded in the social process of "negotiation about meanings", and it originates from the basically intuitive creation of meanings [2].

These two "human aspects", the intuitive basis and the social character of all knowledge, had an important role in KVL's natural philosophy, as well as in my "teaching philosophy". The efforts of KVL to evoke interdisciplinary discussion and, ultimately, the foundation of the Society offer strong evidence of his conviction about the necessity of the social process and of the support which it can give to formation of personal conviction about matters of world view.

4.1. Knowledge and Belief

According to the old definition of Plato "knowledge is justified true belief". Knowing cannot mean anything but believing that something is true. This is obvious already because nothing is true *a priori*, without a justifying basis. Mathematical and logical statements come closest, but they are of the type "if A then B", which also indicates that every statement requires justification.

On the other hand, there are no unjustified beliefs. Everybody has his own grounds for his beliefs. Therefore, the key question is: What kind of justification is necessary to make belief knowledge?

The process of scientific concept formation teaches us that, always, three kinds of justification are needed: empirical, theoretical and social. This applies to all kinds of beliefs.

Empirical justification is obtained from observations and experiences about the "objects" concerned. In science we require so called controlled observations and experiments, which can be repeated. But, in principle, any experiences have the nature of empiry. And they can

be experienced very strong and convincing. This concerns most of our everyday knowledge. We don't plan our life and daily work on the basis of knowledge which would fulfill the criteria of science.

Theoretical justification refers to the structure of knowledge, to the mutual relations of the pieces of knowledge. More generally, the mutual compatibility of experiences has the nature of theoretical justification.

Social justification originates from similar or related observations and experiences of other people. "Private belief" cannot be knowledge. Knowledge must have the common approval of some society, convinced about the sufficiency of both the empirical and the theoretical justification..

Conviction in these three ways, at the same time, makes beliefs knowledge:

Knowledge is *empirically justified* if **all** our empiry support it.

Knowledge is *theoretically justified*, if is a part of a **consistent** structure of knowledge.

Knowledge is *socially justified*, when the "knowledge society" agrees, that the above attributes "all" and "consistent" are realized to a sufficient degree.

The problem of knowledge is, thus, transferred to the concept of "society", to the sufficiency of its extent, competence and unanimity. The sufficiency, in all respects mentioned, is a question of conviction. This statement includes the essence of the reason, why even the "scientific knowledge" has the nature of belief and is basically intuitive. Conviction is intuitive.

4.2. *The Problem of an individual*

The knowledge of an individual is ultimately based on a personal intuitive conviction about its reliability. It is basically subjective. Science aims at objectivity, at knowledge which would be independent of the opinions of individuals. Everybody ought to be able to gather a conviction about the validity of its justification.

This is an unattainable utopia, because a priori knowledge doesn't exist. And both the empirical and the theoretical scientific grounds are far beyond the reach of "everybody".

Intersubjectivity is the closest possibility of objectivity. Knowledge is knowledge only if it is common to a society, which shares the conviction about the sufficiency of its empirical and theoretical justification. This necessity of social justification excludes the possibility of any "private knowledge".

Still, ultimately, every individual decides privately himself:

- what empirical and theoretical grounds he finds convincing,
- what kind of society owns a conviction which he can share
- what knowledge or belief he can adopt as his own knowledge.

Every individual is alone in his thinking. Even when "adopting" thoughts of authorities, he himself decides whom he will accept as his authority. Therefore, "*everybody is for himself the best thinker.*" No one can escape this responsibility of thinking himself. Declaring oneself agnostic has the flavor of escape from this obligation.

4.3. The Problem of Science

Knowledge is created in the interaction of the "mind" and the "nature" [2]. The meaning of this statement is implied by the two mottos of my teaching philosophy (1) "*Meanings first*" and (2) "*Ask nature*".

In this interaction meanings are born in the "mind" as gestalts perceived in the observations and experiences offered by the nature. This is the intuitive core of the empiry. Meanings cannot be derived or founded by anything but the process of perception itself. *This is the origin of the empirical justification.*

Knowledge is created by conceptualization of meanings. New concepts are adopted only because they are needed for representation of the perceived empirical meanings. In conceptualization we seek rational representation and structural order for the meanings. *This is how the theoretical justification is built.*

The three kinds of justification have a definite order in this process. The empirical justification is primary. The theoretical justification is secondary, submitted to the empiry. *The social justification means just agreement about sufficiency and validity of them.*

Obtaining knowledge from the nature requires an active attitude. This is realized in three phases: "Ask nature!" (empiry) – "Interpret the answer!" (theory) – "Submit the conclusion to the society!" (social justification.) People often appeal to the authority of science saying: "Science has proved" or "It cannot be proved scientifically." This is then supposed to solve the matter definitively.

On the basis of what has been said above, science does not **prove** anything. It is true, the scientific knowledge is the surest knowledge mankind is able to produce, but even it is just belief. Also the progress of science is an intuitive perception process by nature. Ultimately, it is standing on an intuitive ground.

As to its basic nature science is *intuitive, not logical*. Great efforts are made to present the results of scientific research in form of a rational structure, as if they would have been reached logically. The intuitive perception process behind them is tried to be kept out of sight of "outsiders". The pretended logic is the white lie of science.

The problem of science is this tension between intuition and logics or between rational and irrational. Physics is regarded as a rational science. KVL often emphasized "*The Irrationality of Reality*". He seemed to regard it as a conclusion following from the quantum mechanics. I would go further and speak about "the unavoidable irrationality of science as a whole". The rationality of physics is a fake. Although we can regard the theories as rational conceptual structures, the empirical meanings they represent are basically intuitive and, thus, irrational. Without the empirical meanings theories are no physics. Hence, physics is irrational.

"Ask nature" is what science does, when people wish to "ask science". We should like to know and understand the ultimate nature of all entities and phenomena, life, consciousness, existence. The opening phrase of the chapter on electricity in a basic school text-book said dramatically: "No-one knows what electricity is!" This would be fine at the end of a philosophical course, but it is certainly not a very encouraging entrance to a field which

represents one of the very best known areas of physics.

We ask science, but to be able to provide an answer science must ask nature. Science cannot answer anything but its own questions. Science must reformulate the intuitive questions of people into its own rational questions. The question must be *operationalized*, interpreted and translated to the language of a research problem and an experimental setup, worked into a question to nature. This is a rational reduction of the question. But it removes the intuitive core meaning which cannot be operationalized.

The scientific world picture, based on knowledge collected in this way, is a reduction of the perceived meanings into rationality. Referring to Pauli's metaphor, often cited by KVL, the veil hiding the reality from our sight is not yet here. To my understanding it is one step deeper, between the "reality" and our intuitive perception.

Nature can be forced to answer only such rationalized questions. The results of the experiments provide the answer. But, what is still needed is an intuitive interpretation of this answer in order to link it to the original question.

4.4. *The Problem of Atheism*

"Discussions with KVL", whether genuine or fictitious, would be essentially defective without reference to the God and religion, which for both of us meant Christianity. As mentioned, this was also the subject in the very beginning of our discussion. KVL never hesitated to take up the question of his faith and its relation to science. I myself did not think it was appropriate to touch these subjects in my lectures on physics or didactical physics, unless asked directly. Perhaps KVL also experienced that I did not support his views sufficiently in his seminars, since he had characterized me as a "Sunday Christian" in a discussion with a friend of mine.

In any case, after the early disagreement, our conceptions on these subjects approached each other and, finally, differences in our views were probably just a matter of different wordings, as I can note from the last couple of pages of his "second thesis" [4]. KVL seldom spoke about atheism. He rather preferred to describe his own conceptions and defend them against criticism, than to criticize directly the religious attitudes of the others. Still, I think he would have accepted the following thoughts about the foundations of atheism:

"There is no God" is the basic belief of the atheism. Can this be a justified belief in the light of the three necessary kinds of justification, in order to be called knowledge?

The *social justification* is clearly strong. The voiceful "atheist society" seems to be unanimous in their conviction about the sufficiency of the empirical and theoretical justification. But, what are they?

The "non-existence of God" is regarded as a part of a structure of knowledge, which the society is calling the "scientific world view". And they are convinced about its consistency. This is certainly, for them, a valid *theoretical justification*.

There is not much to say against, because science is based on the "methodical atheism". It is investigating the internal causal relationships of nature called laws of nature. The causes of natural phenomena are the cause-phenomena, the laws of which can be investigated

empirically, independently of the phenomena they are causing. This "methodical atheism" was launched by Newton with his great insight of the interactions as the cause-phenomena of the dynamics of the material world. God is not a cause-phenomenon obeying laws which could be investigated empirically. Thus, God is excluded from the scientific structure of knowledge at the outset.

One should also ask about the degree of consistency of the "scientific world view". How wide is the coverage of the "scientific explanations"? Does it explain **all** empiry consistently on the basis of the laws of the known cause-phenomena? Life, consciousness and existence are certainly wide phenomenal areas covered by lots of empiry, but without any such scientific explanation, – in spite of the conviction of the atheist society, that such an explanation will be found sometimes in the future.

The empirical justification, the most important one, the starting point of all "true beliefs" is lacking, however. The existence or non-existence of God cannot be an answer to any operationalized question, because such questions do concern only internal causal relationships of the nature. Moreover, even though non-existing things are sometimes observed, observation of the non-existence does not make sense. Lack of experiences does not prove anything.

The impossibility of the empirical justification is replaced in two ways, which are interpreted as empirical evidence.

1. "*Negative justification.*" The mankind possesses an immense amount of consistent experience-based knowledge about the existence and influence of God and, more generally, of the world of spirits. The "atheist society" has an endless task of denying, invalidating and disparaging this continually recurring and accumulating empirical basis. This can be regarded as an indication of an unscientific attitude.

2. "*God of the gaps.*" Accumulation of the empirically, theoretically and socially well founded scientific knowledge is interpreted to leave God less and less freedom to act. This conception, adopted by the materialistic ideology as its starting point, is just a mistake. It is based on a complete misunderstanding of the nature of science. In light of the scientific knowledge, it has been clear, since more than hundred years, that God has an unlimited freedom to act, even within the framework of the natural laws, without the slightest possibility of man to observe it.

5. Unus mundus

For KVL *unus mundus* was, in agreement with Pauli, a kind of final summary of his considerations of the relation of the human mind and reality. As I understand its meaning, all aspects of the mind, knowledge and intuition, conscious and unconscious, physics and psyche, theory and empiry, rational and irrational, science and religion etc. are understood to form "one world", united into an inseparable whole.

This resembles the "unifying dualism" of my teaching philosophy as a general principle or attitude. It was intended to describe the intertwining of apparently mutually opposing counterparts of many dualisms. It originated from considerations of theory and empiry [12,

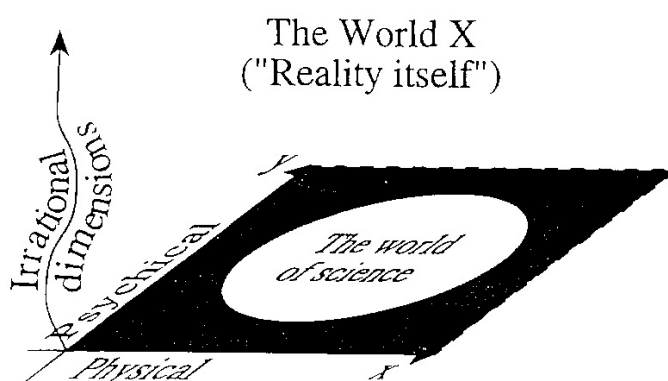


Figure 1. Pauli's 'World X' [4].

Ch. 2.3.1]. Ultimately, it was extended to the relation of the human mind and reality [12, Ch. 5.1].

KVL, referring to Pauli, had the quantum mechanics, the unpredictability of atomic phenomena and complementarity as his starting point. My path originated from considerations of the roles of empiry and theory in physics in general, and from the idea "meanings first" including the insight of the basically intuitive nature of empiry and, ultimately of all scientific concept formation [2]. I was considering quantum mechanics just as one theory among the others.

Our different paths, however, lead us to rather similar views concerning the relation of science and reality. I could quite well adopt *unus mundus* as a general stamp on my world view. My interpretation may differ in details from that of KVL. Considering his illustration of *Unus mundus* [4, p. 80], I note some differences. It is up to the reader to judge, how important they might be

In the lengthy figure caption KVL explains the idea saying: "*The 'reality itself' ... contains irrational dimensions nondescribable by science. In Figure the 'reality itself, or Pauli's 'World X', is the three-dimensional space. The rational world of science is just a two-dimensional cut of reality. The irrationalities – or better: the irrational dimensions – are reachable only by faith.*

My personal image of God: God is the same as reality itself, the basis of existence unreachable by reason. "In him we live, and move, and have our being."

In my *unus mundus* all elements are "within each other". I would not locate the irrationality into different dimensions. Rather than speaking of God as the reality, or vice versa, I would speak of the "whole reality" as "God's reality", without rejection of the message of the cited Acts 17:28. For me, the person of God "fills the reality".

I am not able to illustrate the relation of the different aspects of "reality" with a drawing. Instead, I can resort to a mathematical metaphor of the continuum of numbers illustrated in terms of a geometrical line. The whole infinite line would correspond to "God's reality".

The scientific knowledge is rational. On this line, it is represented by the points

corresponding to the rational numbers, i.e. by the integers and fractions. The infinite enumerable set of all rational numbers corresponds to the possibilities of the scientific knowledge, in principle. It fills densely the whole continuum, every part of it. The actual scientific knowledge, in any phase of its development, is represented by a finite subset of this set. It extends up to some finite distance from the origin decreasing in density with the distance. With the progress of science, it is spreading further and getting denser. But it stays as a finite subset of all rational numbers. But as we know, the measure (Lebesgue measure), or the "combined length" of an enumerable set of points" is zero! The finite length of any segment of the line and the infinite length of the whole line is due to the irrational numbers.

Similarly in my *unus mundus* the reality, "God's reality", and any part of it, is irrational, and the "measure" of the rational scientific knowledge about it is zero.

"Science has its limits." God has no limits. SDG!

References

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