Knowledge in Science and Non-Science

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Abstract: *It may seem obsolete to address the old question 'What is science?', once again. However, it is the very basic question of the philosophy of science and we must know our roots. In what follows is not an attempt at a consistent historiographical analysis of this basic question. Rather, in order to create a Baltic connection, an explanation is offered for why it is only physics that is considered science proper. Rein Vihalemm has introduced an interesting conception called 'φ-science', which is a theoretical model of science. It is a concept of an idealized science, just like a model can be. The characteristic feature of φ-science is the idea that the researcher constructs the object for himself or herself to study. However, he or she does so still on the basis of the empirical experience that she has obtained from objective reality. The model has been elaborated on the basis of physics. It is preferable to apply a neutral model here as physics itself, a developing science, may transcend the borders of what once was called science proper. At this point in time, however, we are in the position of declaring physics (in its idealized form) the only science fitting entirely into the model of φ-science. What about everything remaining that is often called science as well? All of this part of intellectual activity can be called 'non-science', although it can be divided into several subgroups of non-science.*

The high reputation of science is often due to the belief that scientific knowledge is especially valuable because it is true, it is well-justified, it is trustworthy. If so, it is physics that produces the best kind of knowledge we can imagine. If we evaluate scientific knowledge more highly than any other, physics is being brought into a special position that it is not ready to share with any other field, even mathematics or chemistry. It is true that mathematical knowledge may be even more trustworthy than physical. But mathematicians do not normally claim presenting knowledge about the objective reality. Their

knowledge concerns the mathematical language itself. Chemistry, however, does not unfortunately fall under the scope of φ-science or, to be more correct, can be called φ-science only partly. We can have knowledge based on social science and the humanities as well. Creation of such knowledge, however, cannot be based on the model of φ-science. The article is going to analyse, in further detail, how to understand non-scientific knowledge, what can be its relationship to scientific knowledge and is it knowledge that has to be the goal of our intellectual efforts after all. Perhaps, from some point 'wisdom' would be the correct word.

Keywords: *knowledge, knowledge-inquiry, wisdom-inquiry, Nicholas Maxwell, φ-science, physics*

Introduction

The basic question of the philosophy of science 'What is science?' has been studied from very many aspects. Normally, these analyses have focused directly around the problem of demarcation, namely, the problem of differentiating 'science' from 'non-science'. This is the topic that we have to start with. However, the main issue here is knowledge. The core problem, therefore, can be stated as follows: What is the role of knowledge, if any, in solving the problem of demarcation? Is scientific knowledge in any way different from non-scientific knowledge? If so, what kind of difference is it? Is it something that can contribute to the traditional solutions of the problem of demarcation based on defining a scientific method or language?

Now, before we can proceed to the main issue, it is absolutely necessary to make it clear where we are going to draw the demarcation line between science and non-science. First, it has to be noted that by 'non-science' we shall mean everything that is not going to be included into science in the narrow sense modelled by idealized physics here. However, from time to time we have to account for some subdivisions in non-science, i.e. differentiate between social science and the humanities in order to keep the focus on our main purpose. The question of 'pseudo-science' will not become an issue for us because the conception of producing knowledge in the classical sense would hardly be an issue here. Pseudo-science can only produce pseudo-knowledge.

What is science?

There is a broad and a narrow perspective we can follow here. The broad one would mean that we include the entire natural as well as social science under the scope of science as such. However, we shall be narrowing down, at least for the beginning. An easy, but by no means obsolete, answer to the basic question for us here is that science is everything that copes with the model of φ-science. Naturally, this statement requires further explanation as the notion of φ-science is not generally accepted or even known among philosophers of science so far.

The term was coined by the Estonian philosopher of science and chemistry (not the same thing) Rein Vihalemm, who speaks about the model of science he has called φ-science. Naturally, the model is not identical to the original. "The model is an idealization, an abstract, non-linguistic entity, which resembles the real object in certain respect and to a certain degree" (Vihalemm, 2007, p. 227).

Vihalemm also introduced another distinction—namely, the two main types of cognition:

1) scientific (more precisely φ-scientific) cognition, being of a constructive-hypothetico-deductive character;
2) non-φ-scientific (or natural historical) cognition, being of a classifying-historico-descriptive character (ranging from classical biology to the humanities) (Vihalemm, 2007, p. 230).

The basic idea is the following: φ-science is a model for framing the constructive-hypothetico-deductive type of cognition. This means that we are speaking about an intellectual activity that constructs the object of research for itself rather than relying on reality as it appears to our senses.

Rein Vihalemm specifies:

> *The theoretical study of science in the narrow sense can, indeed, identify its object on the basis of the relevant aims and methods, and it does not depend on the peculiarities of objects or spheres of reality; when the aims, methods and principles of inquiry are very different, the descriptive studies have to differ accordingly, and, consequently, no unified general theory can be proposed* (Vihalemm, 2007, p. 229).

In the analysis that follows we shall adhere to the position that it is just some specific intellectual fields that are close enough to the model of φ-science that qualify as science, namely physics and a specific part of chemistry. Anything else

is non-science. At a later point, however, we probably have to differentiate inside non-science. Biology is by all evidence still quite different from social science or the humanities, not to mention literature, art or music. The main purpose of the latter trio, however, is not to provide us with knowledge, at least not in the classical sense of a true belief, which has to be justified, i.e. in the meaning of knowledge that can be called scientific. They are important components of human culture that contribute to the development of our intellect. But they do not attempt to provide us with an account of how the world is or what is true about it. Rather their purpose is to raise our quality of life, contribute to the human wisdom.

What is knowledge? Our core question concerning knowledge

In order to get started, it has to be noted that we adhere to the classical Platonic definition: knowledge is justified true belief. Obviously, we can have a true belief about anything and concerning anything based on any intellectual discipline. "Virtually all theorists agree that true belief is a necessary condition for knowledge" (Honderich, 1995, p. 447). Therefore, the core of the problem is justification. It was once thought that justification yields a necessary and sufficient condition for knowledge. Its sufficiency, however, was disproved by Gettier (1963, pp. 121–123). Still, contemporary epistemology has provided us with ways of analyzing and defining knowledge that avoid the Gettier type problems (see, for instance, Lemos, 2010, pp. 27–43). We can fine-tune our main question as follows: is knowledge acquired by means of applying a φ-scientific method in any way better than any other type of knowledge, i.e. whether it can be justified in a better (more rigorous) way in any sense compared to justifications that can be applied in non-φ- or non-science? Obviously, the formulation of the main question engages us with propositional knowledge. Acquaintance knowledge and 'how-to' knowledge do not play any significant role in our analysis.

What do we get to know as the result of research in science and in non-science?

Science, as defined above, enables us to obtain knowledge that can be called physical in the sense of the discipline of physics. What kind of knowledge is that? It is rigorous knowledge, which often has been experimentally tested and therefore well-justified based on application of a relatively well formulated method. Such

knowledge is a well-justified true belief in essence, almost by its definition. Sounds good, does it not? However, in the current context 'justified' does not mean 'verified' or 'falsified'. By 'justified knowledge' we mean knowledge that has been produced following some clear and strict rules as it is when we apply the scientific method. This does not necessarily mean that the result cannot be refuted by means of applying a different, possibly more advanced, method.

What is the content of scientific knowledge? In principle, physics covers everything. But it is only a highly selected aspect of everything as Nicholas Maxwell puts it:

> *Physics, and that part of science in principle reducible to physics, is concerned only with what may be called "causally efficacious" aspect of things, that aspect which, ultimately, everything has in common with everything else, and which determines (perhaps probabilistically) the way events unfold* (Maxwell, 2010, p. 54).

What is left once we single out the causally efficacious? It is the look of things, the feel, the smell, the sound, the sense, and what it is to be such and such a complex system of cells, of interacting molecules. "Physics fastens onto the wavelength of light and ignores its colour; it specifies vibrations in the air and ignores the sound of the human voice, and ignores, too, what the person says" (Maxwell, 2010, pp. 54–55).

This critical evaluation by Nicholas Maxwell can be viewed from two angles: negative and positive. Maxwell has his own reasons for being critical, which will not be analyzed here. But his criticism is well formulated from an objective point of view. Physics has its own definite approach to worldly matters concentrating on everything "physical" and leaving the non-physical out of the picture as irrelevant from the scientific point of view. Anything non-physical is simply not rigorous enough for being looked at with a "scientific eye" as the classical scientific method cannot be applied rigorously enough. It is true that the hypothetico-deductive method can be applied to the so-called cultural objects as well. In that case, however, there are two options: these objects are either not specified clearly enough to be called scientific or they are constructed to the degree that would justify their being called physical. The latter is probably a rare development, if ever applied at all, but it definitely remains a possibility. The positive side of Maxwell's criticism, however, rests on the excellent line of argumentation on what physics is about. In this context we can just extend it slightly and claim that this is what science is about. "Physics might cover all the incredibly complex *physical* processes going on inside my head, but it says nothing about what it is to

be me, what it is I experience, feel, think, see, hear, imagine, understand, desire, fear, intend, decide" (Maxwell, 2010, p. 55). So the sphere of science has been very clearly specified by Maxwell. There is something that is inside it and there is something that is clearly left out. Everything of importance from the point of view of a human being's everyday life remains outside the scope of science in our current narrow sense. Worse than that, to paraphrase Maxwell loosely, we might claim that science is not about what I know. Fortunately, this does not mean that we cannot have scientific knowledge.

Now, we are facing the question: what is more important? Should we care more about a unified theory of everything or some method or discipline that helps us directly in the matters we are constantly facing in our lives. In our broad context we have to ask: what kind of knowledge is more important, physical one or the one concerning issues we really do care about?

One of the main goals of scientific research is prediction. If we are able to predict, we get to know what would happen in the future. That would really be most valuable knowledge. But what about the situation concerning objective reality? Can science (physics) predict new phenomena? Well, physics can predict the evolution of only the very simplest of systems. This is due to the problem of the initial conditions. There is always some inevitable imprecision in the initial conditions of any system, even the simplest ones. The reasons for that imprecision are not important in this context, but, to briefly mention, there are two main reasons: First, the initial conditions of any physical system have their history, which physics is normally not able to account for. Second, while expressing the values of the initial conditions in decimal fractions, we always have to round the result. No device at our disposal, not even the fastest modern computers, is able to account for infinite precision and never will be. This is an everlasting fundamental problem, not anything we can hope to overcome some day. It is not any kind of deficiency in our standard of knowledge. (This issue has been addressed in more detail in Näpinen & Müürsepp, 2002, p. 473.)

True, there is an approach in contemporary physics, advocated mostly by Ilya Prigogine and his followers, according to which the deterministic simplicity of the classical physical approach has been severely criticized and overcome in a way (see, for instance, Prigogine, 1997). Still, even Prigogine has not succeeded in making physics anything else than a constructive-hypothetico-deductive science and probably has not attempted to do so after all.

Science—that is, physics and a definite part of chemistry—helps us to obtain a special kind of knowledge, scientific knowledge. It is a kind of knowledge

that can be taken apart and analyzed, criticized and corrected if necessary, even though it is a simplistic kind. As most scientists claim, the silence of physics about the experiential means that sensory qualities do not exist objectively out there in the world and, at best, exist only in us, as sensations (Maxwell, 2010, pp. 59–60). This is true. Physics has its own (physical) reality. It does correspond to the rational reality of physicists, but does not correspond to how an average human being experiences the world around. There is a very clear demarcation line. Now, if we take a closer look at the essence of knowledge, we are facing this line as well. Probably there is even another one. This hypothesis rises from the question, what kind of mental condition does knowledge represent? What is the content of knowledge so that it would not disturb the classical definition we promised to adhere to above?

The classical definition of knowledge does not specify what we need to have the justified true belief about. It can be about physical reality, it can be about mathematical relations, it can be about studies in comparative literature, art or music, and last but not least—it can be about the way how we experience the world out there. So, by all evidence, we are back to the basic question of practical epistemology, the problem of justification.

Obviously, physical knowledge can be justified relatively well. 'Relatively' applies because of the fact that mathematical knowledge can be justified even more rigorously, although even mathematical rigour has its limitations, as specified for instance in Imre Lakatos' *Proofs and Refutations* (Lakatos, 1976). As far as the rigour of the method is concerned, however, there is no match for justification, in the sense pointed out above, in either mathematics or physics. (We are including logic into mathematics here.) Therefore, knowledge connected to these intellectual fields has special quality. Does that mean that this quality is higher compared to knowledge in any other field, however, remains an open question.

The role of explanatory power

Let us confuse the discussion by bringing in the phenomenon of explanatory power. Here, science has the upper hand over non-science, at least seemingly so. Normally, scientists can explain their findings quite well. Even if they go wrong, there normally is an explanation as to why the failure happened. In any kind of non-science, there are great problems with this issue. Of course, it is always possible to come up with an explanation. But explanations in those fields remain subjective and do not necessarily work universally.

It appears that we have discovered an aspect that has a lot to do with the quality of knowledge. Still, it is possible to question this issue based on the scepticism whether explanatory power has anything to do with knowledge. Well, an easy answer here would be that explanatory power may not have anything to do with 'true belief', but while dealing with justification it is difficult to deny the connection. A belief the truth of which is explained can definitely be better justified than just some belief that happened to turn out to be true. Therefore, we can claim that the greater explanatory power, the higher the quality of the corresponding type of knowledge. The claim is not a universal one as the more explanatory theory need not be better supported empirically.

However, there is an "old" new problem that disturbs the picture. It is old in the sense that it has been addressed above already. The problem is in the value of the pieces of knowledge we are able to collect. Or, to put it differently, that what is the essence of the quality of knowledge. For instance, we just found that explanatory power has a lot to do with the quality of knowledge. Are we justified to believe that greater explanatory power necessarily means higher quality of knowledge, remains an open question. Why cannot we say that the real measure of the quality of knowledge is its value for the human being in their everyday life? Well, probably we can, but then a new, and a bigger, problem arises—namely, the question, what is of value for a human being? Is there and can there be any general measure at all? By all evidence, there can be a general measure, but its universal nature can still constantly be questioned. Maybe it is still scientific knowledge that constitutes the highest values for us all in the long run.

A possible solution

An interesting framework of a possible solution to the 'value problem' has been proposed by Nicholas Maxwell by his conception of cutting God in half, separating the God-of-Cosmic-Value from the God-of-Cosmic-Power (Maxwell, 2010). It is science (physics) that is the realm of the God-of-Cosmic-Power with all of its shortcomings pointed out above. It is the God-of-Cosmic-Value that can help us to come forward with the solution to the problem of what is of real value in the human life, including the question of knowledge—that is, what do we really need to know.

But what is the God-of-Cosmic-Value? Nicholas Maxwell gives a long ten-step explanation at this point. Our task is not to analyze Maxwell's definition. Let us just concentrate on those aspects of Maxwell's explanation that have a connection

to our main problem, that of knowledge. At first it seems that anything concerning value has nothing to do with knowledge. Knowledge must be objective, after all. If we know something then that is how it is. In order to discover what is of value, however, we need to attend to our desires and feelings (Maxwell, 2010, p. 86). Desires and feelings tend to be individually unique. That is something that can hardly apply to knowledge. But desires and feelings cannot just be a chaotic mass. We must still know something. How can we make the connection? According to Maxwell: "But this does not mean that value features of things are irredeemably subjective, and do not exist objectively, in the real world" (Maxwell, 2010, p. 86). Maxwell is quite right in claiming that value features are like perceptual features such as colours, sounds, and tactile properties of things. The perceptual sensations (visual, auditory, tactile) we need to have in order to perceive these features cannot be purely subjective. Obviously, we can exchange thoughts about issues based directly on perceptual sensations and make sense of our thoughts. This would be impossible in a chaotic world of subjective images.

But still, what about knowledge? Each of us can hope to know something, to know at least a fragment of all that is of value in existence. The crucial moment is knowledge and appreciation of another person. Here we need our powers of empathy, intelligence, imagination and perception. "We need to know the other person from within, as it were, so that we have an imaginative experience of the other person's hopes and fears, joys and sufferings, relationships, struggles, feelings and desires, their life, history and world" (Maxwell, 2010, p. 88). This would be knowledge of real value. Unfortunately, physical science cannot provide it. In order to achieve knowledge of this novel type we need to apply something else: the humanities, arts, social science.

It may seem that social science would not do the job either, that it is not 'subjective' enough. Still, contemporary social science makes use of methods that are said to enable us to measure complicated and personal phenomena, like achievement. Of course, this is measurement in a completely different sense compared to measurement in physics, but still provides some degree of objectivity into the results of the enterprise of social research. We get into touch with objective knowledge about the real human condition here, but it is almost as remote connection as in the case of physics. The only difference is that physicists quite openly construct the object of research for themselves. They construct the objects applying the empirical data that they have obtained. Therefore, they quite possibly still retain connection to the world out there. Even if they do not, they are dealing with a kind of reality—namely, scientific reality. Social scientists are somewhat in between here. They cannot construct their objects, human individuals, but can still play around with connections and trends they are interested in.

As a matter of fact, the process of knowledge creation in social science has been coined after the model of the methodology of natural science. What do we get in this way is the only possible result, that is, a vague copy of the results obtained by physicists. The results of the physicists correspond to the reality of the physical world, although a constructed one. The results of social science hardly correspond to the social reality. They rather show something pseudophysical about society, some trends and phenomena that may even be useful to know from the pragmatic point of view of social engineering. Anything really important from the individual human being's point of view, however, does not come to the fore. In order to reach for knowledge about social issues, a new approach has to be invented. This new approach does not necessarily need to be, may be even should not be, anything like research. What it has to be remains an open question so far. The call of Nicholas Maxwell for wisdom-inquiry seems to be looking for a way to bypass the quest for knowledge in social science and taking a different path.

Basically the same applies to the humanities. The current situation here is easier in a way. Although there have been voices advocating taking the method of physicists as an example here as well, nothing special has been done yet. There is no general universal method in the humanities.

The existence of the definite method is the main reason why physics has become the most fundamental science. Now, in order to get to know about the real needs of humans, in order to face the global problems effectively, may be even to solve some of them, we should turn the situation around here. Namely, we have to make the humanities the most fundamental field of intellectual activity, a field of knowledge of real value.

How to achieve the solution?

The short answer is that we have to overcome knowledge and keep reaching for wisdom. According to Nicholas Maxwell, intellectuals have to surpass knowledge-inquiry and apply wisdom-inquiry as the goal (Maxwell, 2010). What does Maxwell mean by this? He claims that all scientific research based on the classical method has been knowledge-inquiry, pursuit of knowledge in the sense of the classical definition.

There are two great problems of learning that confront humanity: learning about the universe and ourselves as part of the universe and learning how to become

civilized (Maxwell, 2010, p. 164). The modern scientific method concentrates solely on the first problem and deals with finding the solutions quite efficiently. That is very acceptable for science in the narrow sense, φ-science. For the development of the humanities, however, we need to achieve wisdom, not just knowledge. Therefore, knowledge in non-science cannot be an achievement. It is rather something like knowing 'what is the date today' or recognizing a person walking on the other side of the street. We have to aim higher, namely at wisdom.

How to understand wisdom-inquiry compared to knowledge-inquiry? Nicholas Maxwell gives the following answer:

> *Whereas knowledge-inquiry demands that emotions and desires, values, human ideals and aspirations, philosophies of life be excluded from the intellectual domain of inquiry, wisdom-inquiry requires that they be included. In order to discover what is of value in life it is essential that we attend to our feelings and desires.* (Maxwell, 2010, p. 182)

It would be a grave misunderstanding, however, to leave knowledge out of the picture. We have to be able to assess critically our feelings, desires and values. As we know, not everything that feels good is good by all measures.

How can we know, what kind of subjective good is objectively good? Unfortunately, the short answer to this query is that we cannot. As fallible creatures, we, the human beings, can never be sure that any good we discover is objectively that. Still, once again, it seems that the solution is possible. We need to follow Nicholas Maxwell's aim-oriented rationality. The point of takeoff is traditional rationalism, of course. From that we have to proceed to sceptical rationality and include emotional aspects of life, that is, emotional honesty. This way we achieve the interplay of mind and heart (Maxwell, 2010, p. 183). This is the essence of aim-oriented rationality. It produces a kind of rational faith, consisting of knowledge and emotion. The role of knowledge becomes reduced to the formula, 'I know what I want, what I like, what I desire'.

Knowledge becomes mixed with emotion in the sense of involuntary occurrent individual mental states, leaving dispositional or lasting emotions out of the picture. It may seem at first that this development confuses the classical idea of knowledge as justified true belief. How could emotion be rationally justified? There is, however, another possible interpretation. We may look at the situation as emotion being added to justified true belief. In the humanities we can do this with ease. The issue of social science is more complicated. In the direct sense, emotion cannot be included. But the methodology of social science provides us with an understanding of how to measure emotion. The problem is,

however, that the emotion of the rational faith is meant to be the nonmeasurable component here.

Therefore, achieving knowledge in social science is a task that still has to be accomplished. What we can say today is that the classical definition of knowledge is inadequate for social science, not to mention the humanities.

Instead of a conclusion

We have proceeded from the classical definition of knowledge, which is trapped in the Gettier problems into a new understanding of what is really important to know. We may still call 'What is knowledge?' the key question. But the classical definition does not satisfy us any longer. It has lost its significance. Formal-analytical justification is not what we need to be looking for. It is rather the knowledge of the other person's hopes and fears, joys and sufferings, feelings and desires, the whole life, history and world. Formal justification is not needed here. The Gettier problems have been solved by surpassing them.

We really do know what is knowledge in (φ)-science. We do not yet know what knowledge is in non-φ-science. We are still looking for the most appropriate approach, either a direct one or a bypass. In that sense, scientific knowledge is better, but it is more sterile as well. Does it provide us with what we really need (to know), do we need to keep the platform of knowledge in order to be able to advance towards wisdom, will remain important open questions.

References:

Gettier, E. (1963), 'Is Justified True Belief Knowledge?' *Analysis*, vol. 23, no. 6, pp. 121–123.

Honderich, T., ed. (1995), *The Oxford Companion to Philosophy*, New York: Oxford University Press.

Lakatos, I. (1976), *Proofs and Refutations: The Logic of Mathematical Discovery*, New York: Cambridge University Press.

Lemos, N. (2010), *An Introduction to the Theory of Knowledge*, New York: Cambridge University Press.

Maxwell, N. (2010), *Cutting God in Half – And Putting the Pieces Together Again. A New Approach to Philosophy*, London: Pentire Press.

Näpinen, L. & Müürsepp, P. (2002), 'The Concept of Chaos in Contemporary Science: On Jean Bricmont's Critique of Ilya Prigogine's Ideas.' *Foundations of Science*, vol. 7, no. 4, pp. 465–479.

Prigogine, I. (1997), *The End of Certainty: Time, Chaos and the New Laws of Nature*, New York: The Free Press.

Vihalemm, R. (2007), 'Philosophy of chemistry and the image of science.' *Foundations of Science*, vol. 12, no. 3, pp. 223–234.