12. Krause's Importance for Philosophy of Science

To see that Krause could be a source of insight and inspiration for the philosophy of science, it is necessary to briefly reflect on the state of the art of philosophy of science. First, a concept of science will be developed that helps to distinguish science from pseudo-science and provides the framework in which we can evaluate the plausibility of Krause's concept of science. Based on the elaborated concept of science, it can be shown that Krause's conception of science as an organic system of science is in line with the current rejection of reductionism and the appraisal of holism. Furthermore, Krause's emphasis on intuition as the starting point of philosophy of science, although currently not popular, can be shown to be a consistent and coherent methodological starting point for the development of a system of science that aims at ultimate explanation.

12.1 Concepts of science in philosophy of science

I assume that there is a single concept of scientificity that is applicable both to the natural sciences and to the humanities, which is to say that I assume that the natural sciences and the humanities can both be referred to as scientific disciplines of human intellectual activity. If there were no single concept of scientificity that covers both the humanities and the natural sciences, then questions concerning the scientificity of a particular discipline of human intellectual activity would be obsolete or each discipline would be free to define its own criteria of scientificity. In this case, however, not only the unity of science would be lost, it would be hard to exclude any discipline of human intellectual activity from the circle of scientific disciplines. The distinction between science and pseudo-science would collapse entirely.[63]

63 Cf. Maurer (2005: 27): 'The "exact" sciences ["*exakten*" *Wissenschaften*] are special cases just as much as the humanities [*Geisteswissenschaften*] are. The prevailing view in the theory of science is that senseless to lay down general structures of scientificity that are drawn largely from the technically (and economically) evaluable disciplines. This does not however change the fact that

On this presupposition I assume that a scientific discipline of research attempts to propositionally systematize a particular field of our pre-theoretically given experience of reality (a) based on certain presuppositions about the fundamental nature of reality, (b) with the help of particular methods and (c) for a certain purpose. However, there is neither unanimity in respect to the methods that one could rightfully call 'scientific' nor in respect to the very purpose of science, or its fundamental presuppositions. Since one's assumptions concerning the fundamental presuppositions of science, its proper methods, and its purpose are conceptually interwoven, it is no surprise that there is a whole variety of philosophies of science that come to different conclusions concerning what it really is that science is all about.[64] Despite this variety of philosophies of science, I argue that there are some features of science that belong to the core of any plausible conception of science.

First, I assume that the expression 'experience of pretheoretical reality' refers to the realm of phenomena that constitutes one's lived-world, i.e. 'the framework in terms of which man came to be aware of himself as man-in-the-world' (Scharp/Brandom 2007: 374) that is available before our theoretical investigation into the nature of reality. A *propositional systematization* of a particular field of our pre-theoretical experience of reality, then, is a system of propositions that are structured by relations that correspond to the methods used to investigate the corresponding field of study. For instance, a system of propositions that is established deploying the method of deduction will structure the propositions in question according to logical entailment, whereas the method of abduction will structure the propositions by way of showing that the truth of some of the propositions provides the best explanation of the truth of other propositions. Deploying different methods of research will therefore lead to different propositional systematizations of the same field of our pre-theoretical experience of reality.

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there are fundamental features of scientific work which are directed at the formation of theories. By this is meant that a network of claims is formed which may always be further deepened and which may always thereby enable sharper insights. How that happens depends on the domain of enquiry [*Gegenstandsbereich*]'.

64 Cf., for instance, Kuhn (1996), van Fraassen (1980), and Niiniluoto (1999).

Which method in fact is deployed for a particular field of study will depend in part on the questions that the scientist has about this field of study, where commonly these questions concern the origin of a particular phenomenon, its causes, its constitutive elements, its relations to other phenomena and the like. A propositional systematization of a particular field of experience that satisfies the condition of answering the questions which the scientist has about this field of study is a scientific theory. A scientific theory about a particular realm of reality therefore is a system of propositions that are structured by relations that emergence from the method used to investigate this realm of reality and provide answers to the questions the scientist has about this realm of reality.[65]

Second, I assume that the *fundamental presuppositions* concerning the nature of reality on which science is based are the necessary conditions for the possibility of science itself and can be addressed as the metatheoretical shaping principles of science. There are necessary conditions for the possibility of science in general and necessary conditions for the possibility of particular sciences. With regard to science in general, there are at least two necessary conditions.

First, since science intends to propositionally systematize our pretheoretical experience of reality it follows that reality has to be such that it is open to the respective systematization. Second, the possibility of science also presupposes that our epistemological constitution is such that a meaningful application of our methods of investigation is possible given our transcendental constitution. Science in general, therefore, is only possible based on the assumption that from an ontological point of view reality allows for a systematization using particular methods and based on the assumption that from an epistemological point of view we have the abilities to systematize reality in a meaningful way.[66]

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65 Cf. Weingartner (1971: 38): 'Under the heading "scientific activity" can be understood a mental and physical human activity, whose purpose is the discovery of an answer to one or several questions or problems, an answer structured in a certain way' (translation BPG).

66 Although at first sight these conditions appear to be trivially satisfied, it is a question of on-going philosophical debate whether the world and our epistemic situation are indeed mutually fitting and if so, whether there is need for explanation of this alleged fact. For instance, sceptical worldviews frequently deny

In addition to the conditions for the possibility of science in general, the possibility of a particular science presupposes that there is a well-defined object or field of study and that we have methods at our disposal that are adequate to investigate and analyse this object. Science is impossible if it does not have an object to study or fails to possess adequate methods to analyse the nature of its object. For instance, the necessary condition for the possibility of physics consists in the assumption that there is a natural world that can be studied deploying the methods of experimentation and abductive reasoning, while the assumption that phlogiston exists is a necessary condition for the possibility of chemical theories that explain the burning of substances in terms of dephlogistication.

I assume that the *purpose of science* is that what science wants to achieve, which, since science is engaged in by scientists, is that what the ideal scientist wants to achieve through his work.[67] There are two suggestions that are widely discussed: that the purpose of science is to discover true propositions about its field of study on the one hand, and that science does not intend to discover true propositions but only intends to provide a systematization that is useful to predict and explain the phenomena in question.[68]

On the first understanding, the purpose of science primarily is to use scientific methods to obtain knowledge of reality, where the corresponding

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both that we have the epistemic abilities needed for science to be possible and that the world is such that it is open to scientific exploration. Cf. Lowe (2002: 7–11) and Loux (2003: 1–19).

67 The ideal scientists at least satisfy the following condition: '[They] are of the highest possible intelligence and of the highest possible degree of philosophical and logical acumen, and they are intellectually honest in this sense: when they are considering an argument for some thesis, they do their best to understand the argument and to evaluate it dispassionately. [They] have unlimited time at their disposal and are patient to a preternatural degree […] and if their opponents think it necessary to undertake some lengthy digression into an area whose relevance to the debate is not immediately evident, they will cooperate' (van Inwagen 2006: 42).

68 Cf. Koperski (2015: 247–252): 'Realists take mature scientific theories to be true or at least approximately ture, where truth is understood as something like correspondence. […] There are many different versions of scientific antirealism. [On this position,] all we need from science is the ability to make successful predictions and technological advances. Whether a given law or theory is true in a correspondence sense is irrelevant; what we want is for it to work.'

methods are assumed to be truth-conductive and the established scientific theory is supposed to be a mirror of mind-independent reality. On the second understanding, the purpose of science is not primarily to discover true propositions about reality, but instead is a pragmatic one that enables us to predict and explain the phenomena in the corresponding field of research, irrespective of whether the propositions used to explain and predict the phenomena are true or false in the sense of mirroring reality. If the established theory can predict and explain the phenomena in question, it will count as a successful scientific theory. For instance, on the first understanding a physical theory that explains atomic processes in terms of the properties of electrons is committed to the existence of electrons, whereas on the second understanding electrons are only supposed to be theoretical entities introduced into the theory to be able to explain macroscopic phenomena in an efficient way, irrespectively of whether electrons actually exist. The two approaches to understand the purpose of science are not mutually exclusive since on the first understanding the true propositions science intends to discover are assumed to be the pragmatically most appealing constituents of a theory that enables us to explain and predict the phenomena in question. They only differ in respect to the ontological commitment of scientific theories.

However, the discussion concerning the scientificity of a particular discipline of human intellectual activity is only philosophically interesting if it is assumed that the purpose of science is to establish true theories about particular fields of our pre-theoretically given experience of reality. If the only purpose of science was to establish a propositional systematization of a particular field of research that has no claim of being a true systematization, then it would be hard to see how a discussion concerning the scientificity of a particular discipline could arise as long as the discipline would be able to provide some explanation of the phenomena in question. Therefore, in what follows I assume that the purpose of science is to establish true scientific theories about reality and that it is the truth of the theories in question that accounts for their ability to answer the questions the scientist is interested in.[69]

69 Cf. Schurz (2014: 23): 'The highest intellectual goal of science consists in the discovery of preferably true and contentful claims, laws or theories about a determinate field of enquiry [*Gegenstandsbereich*].' Cf. Werbick (1974: 332): 'If

Fourth, the most difficult question to answer is the question concerning the nature of *scientific methods*. The reasons are, on the one hand, that there is enormous discussion concerning both the proper understanding of the terms 'scientific' and 'method' and that, on the other hand, it is precisely the scientificity of its methods that is supposed to set aside science from pseudo-science. The problem is as follows: if our account of the characteristic features of scientific methods is too narrow, then we run the danger of excluding disciplines of human intellectual activity from the set of scientific disciplines that objectively should be included, and if our account of scientific methods is too unrestricted, then we run the danger of including human intellectual activities in the set of scientific disciplines, although they should be excluded. In the context of the discussion of the possibility of a scientific theology, then, it is important to avoid both the Scylla of methodological exclusivism and the Charybdis of methodological inclusivism. We therefore have to propose an account of scientific methods that does not entail the scientificity of confessional theology or its denial while it is still adequate to our intuitions concerning the essential features of scientific methods.

A method to achieve a certain goal is a set of rules that specifies what has to be done in theory or praxis to gain the desired result in a reliable way. Since science attempts to propositionally structure our pre-theoretical experience of reality with the intention to provide understanding and explanation of the phenomena in question in the form of scientific theories, it follows that a scientific method is a set of rules that specifies what has to be done in theory or praxis to establish scientific theories that are supposed to be true.

The methods of science, in general, are therefore the theoretical and practical means with the help of which the scientist wants to achieve the goal of providing a deeper understanding and explanation of reality. However, when it comes to the precise formulation of the theoretical and practical

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one understands "explanation" as the sensible ordering of the particularities of experience into a paradigm, to be implemented in a more or less encompassing totality of meaning, there is no sense in which explanation thus understood may be contraposed against an "art of understanding [*Verstehen*]" as a completely distinct scientific procedure; for this reason a division of humanistic and natural sciences [*Geists- und Naturwissenschaften*] based on a contraposition of understanding and explanation cannot be maintained.'

rules that the scientist has to obey, a problem emerges: since, from the point of view of the historian of science, different methods have been referred to as scientific throughout the ages, and since the different sciences today factually deploy different methods that correspond to their object of study, there is no such thing as *the* single scientific method that could be applied univocally to any object of study to provide insight into its nature. There is, in other words, no method which one could mindlessly apply to any object of study in the hope of gaining insight into its nature.[70] Therefore, instead of assuming that there is a single set of rules the scientist has to obey, it is more plausible to assume that there is a variety of methods that share a common methodological ground, but vary sufficiently to be able to adequately capture the differences between the different objects of study.

The common ground that all scientific methods share can be specified by a number of necessary conditions that a method has to satisfy to qualify as scientific. First, the corresponding method has to be explicitly reflected upon and has to be formulated *expressis verbis* in an intersubjectively intelligible way. The scientist has to specify what it is that he is doing and what he is presupposing in a way that enables other people to be aware of every step of the scientist's approach to reality. Second, the scientist has to justify why the particular method is assumed to be an adequate method to investigate the particular field of pretheoretical experience of reality which it is applied to. It has to be justified why the particular method is assumed to be a reliable method of investigation instead of another. Third, it needs to be clear what has to be done in case there is a mismatch between the theory and our pretheoretical experience of reality, which is to say that it has to be clear what counts as verifying and as falsifying evidence of the scientific theory in question.

70 Cf. Feyerabend (1986: 21): 'The idea of a method that contains secure, unchanging and binding theorems for the operation of science, and that makes it possible for us to provide the concept of "science" with modest, concrete content, encounters considerable difficulties when it is set against the results of historical research.' Cf. Harrison (2015: 168): 'In keeping with the indiscriminate uses of the term "science" in the first half of the nineteenth century, talk of a scientific method had initially meant simply a systematic plan of attack that could be applied to any number of activities, from physiology to fishing.'

Based on this common ground there is room for a methodological specification that respects the individual differences between the particular sciences and their approach to reality. For instance, while both physics and the study of history share the same methodological common ground, in physics, based on our perception of the world, the methods of induction and abduction lead to scientific theories that are tested in the laboratory, while the historian cannot confirm his theories in the laboratory in the same way but instead builds his theories concerning the history of the world on the available textual evidence and with the help of exegetical methods.

In sum, we can specify the scientificity of a discipline of human intellectual activity as follows: A discipline of human intellectual activity is a scientific discipline if it intends to establish a true scientific theory that answers the questions which the ideal scientist has about a particular field of our pretheoretical experience of reality in such a way that the methods used are intersubjectively intelligible, transparent, are shown to be reliable, and specify how the resulting theory deals with evidence and counter-evidence.[71]

12.2 The plausibility of Krause's concept of science

Krause's concept of science is in line with the developed concept of science, and therefore is up-to-date. First, the purpose of Krause's panentheistic philosophy of science is to develop a true scientific theory that answers the questions a philosopher is primarily interested in. According to Krause, his system of philosophy is designed to answer three questions: What is God? What is the world? *and* What is God's relation to the world? As Krause (1893: 59) says: 'We understand provisionally, in accordance with now widespread education, all objects of thought and perception in the three

71 One could object that there are sciences that deal with things that are not part of our pre-theoretical experience, for instance, particle physics or transfinite mathematics. However, although *prima facie* these sciences might be understood as not dealing with our pre-theoretical experience directly, they originate from sciences, physics and mathematics, that directly deal with the realm of pre-theoretical experience and therefore they indirectly deal with the reflection on what is pre-theoretically given to us in experience. They are reflections on the deep structure of the world of experience in so far as it is quantifiable or in so far as it is constituted by atomic particles.

thoughts: God, the world, and God's relationship to the world. God is thought of as the One, absolute, infinite being, the world first as the epitome of all finite beings; and because we are not able to think of anything except the unconditioned, the infinite and the contingent, finite, so only will be added the idea of the relationship between God and the world. Therefore, all that may be thought and realized, or even foreboded, will be included among these three objects.'

Since God is the infinite und unconditioned principle of science, and because the world is finite and conditioned through this principle, it follows that the question of the relation between God and the world, for Krause, is the question of the relation of the unconditional and infinite to the conditioned and finite. To establish his system of philosophy, as we have seen, Krause reflects on fundamental metaphysical, transcendental and epistemological questions and aims to establish an all-embracing and fundamental scientific theory of everything that explains the fundamental features of the world in terms of the fundamental features of the highest principle and thereby also accounts for the unity of science, the only genuine object of study of which is the highest principle of science and its relation to the world.

Second, in addition to the scientific ambition to develop an all-embracing theory of everything, Krause also is quite clear on the fact that the methods deployed to establish this kind of theory have to be reflected upon in order to count as scientific methods. As we have seen, to justify panentheism, Krause deploys two methods. One is the analytical-ascending method, which leads the human mind to the intellectual intuition of God as the highest principle of science. Deploying the analytical-ascending method of science, knowledge of God is retrieved in a transcendental reflection on the necessary conditions for the possibility of both our recognition of and the existence of finite entities that realize a unity of different categorical determinations. This is possible, according to Krause, because God is the highest principle of science that is the ultimate unity of unity and difference and in His being is not subordinated to the categories, but is recognized as being identical with each and everyone of these categories in a way beyond identity and difference.[72] The other method of science, according to

72 Because, in his view, Krause is able to show that, through the intuition of God, the ideas of reason turn out to denote, or even be, properties of the divine unity,

Krause, is the synthetical-descending method. Starting from the immediate, certain, fundamental Intuition of God, this method explicates the material and formal categories of science, by which everything is determined in its being, in its recognizing, and in its being recognized.

Third, according to Krause, these methods are not arbitrarily chosen, but of necessity are the only available methods to develop an all-embracing philosophical theory of everything that accounts for the fundamental features of the world and the corresponding unity of science in terms of a highest principle of fact and knowledge. The reason is that only transcendental reflections on the constitution of the ego, that is, on the material and formal categories the ego deploys fundamentally in its understanding of the world, is able to provide a starting point of science that is beyond doubt since these categories which *a priori* the ego is able to discern as the fundamental categories with which is recognizes the world, are the most fundamental tier of our recognition of the world and therefore have to be the starting point for a theory of everything, if that theory aspires to be adequate to our pretheoretical understanding of reality at all. Any other starting point, any other assumption that is not recognized as immediately certain, will embed an element of possible error into the theory of everything.

Furthermore, once the highest principle is recognized, the synthetical-descending method of science, according to Krause, can only continue by way of reading off or deducing further insights from this intuition of the highest principle of science by *a priori* reflection: a fundamental and all-embracing theory of everything cannot rely on *a posteriori* evidence because it is a theory that intends to establish the possibility of experience in the first place. That is to say, if it is adequate, there cannot be counterevidence provided by experience. In this respect, Krause's theory seems to be indeed adequate:

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he thinks he has achieved the most important task of philosophy as defined by Kant: '"Whether the ideas of reason behave towards the categories (his highest concepts of the understanding) as the categories to sensibility" […] I have now solved this problem raised by Kant, without my knowing, at the time, that Kant posed this problem; and it was by using Kant's critical method in a completely independent way, in the course of my own philosophical research. My lectures on the system of philosophy include the complete development of the doctrine [*Organismus*] of the categories as unconditional, and infinite, divine, essential properties [*Wesenheiten*], or as attributes of God' (Krause 1889: 312).

to provide a counterexample based on experience a finite entity had to be discovered the properties of which resist a description of this entity in terms of Krause's doctrine of categories. Since ordinary objects cannot be used for this purpose, as we can describe them in terms of Krause's categories, one might suggest that certain physical phenomena resist such a description. For instance, one might argue that the wave-particle duality of light provides a counterexample. However, it seems that Krause is able to account for this in the following way: the phenomenon in question, light, is a single phenomenon, as such. In itself, however, it is constituted by an opposition of wave and particle. Because light as such, however, is a single phenomenon, we know that there must be a principle of unity, a so far unknown physical principle, that is constitutive of the nature of light as such and is what constitutes the union of light as a single phenomenon as such. That, depending on how we look at light, light sometimes does behave like a wave and sometimes like a particle, could be explained by Krause by pointing out that also the way in which the Absolute is approached determines what is recognized: if we look at the Absolute as such, it is an infinite and unconditioned unity of essentialities. However, if we look at the Absolute in itself, we see that the world is part of the essentialities of God who in Himself is distinguished from Himself. Analogously, depending on how we look at light, that is, depending on the experimental setting, we discover different and opposing aspects of one and the same thing as such, of which we know that it is the unity of what can be distinguished in light.

In sum, Krause's panentheism satisfies all the conditions a scientific theory has to fulfil. It intends to establish a true scientific theory of everything that answers the question for the fundamental features constitutive of the world and their relation to the ultimate ground of the world in a way that transcendentally accounts for our pre-theoretical experience of reality in such a way that the methods used, the analytical-ascending and the synthetical-descending method, are intersubjectively intelligible, transparent, and are shown to be reliable in a way that specifies how the resulting all-embracing theory would deal with evidence and counter-evidence.

12.3 Reductionism, holism and the organic system of science

Apart from the fact that Krause's conception of science is a valuable position in the philosophy of science in general, there are two debates in which Krause's panentheistic system of science could be of particular interest: on the one hand, the debate between holism and reductionism and, on the other, the debate on the possibility of ultimate explanation and intellectual intuition as sources of insight.

The discussion between holism and reductionism concerns the question whether there is a fundamental science to which all the other sciences can be reduced either semantically or ontologically. The idea of reduction is that propositions of a special science A are accounted for in their meaning, that is, in their knowledge content, through semantic, epistemological or ontological bridge-principles, and construed as nothing more than propositions of the reduction base, that is, the special science B.[73] In other words, on reductionism, the system of science can be semantically or ontologically reduced to a fundamental science in the following way: the insights provided by the science that is going to be reduced, logically speaking, are shown, most often with the help of bridging principles, to be semantically or ontologically entailed by the insights of the scientific discipline to which it is reduced. To show the truth of reductionism it therefore must be shown that all sciences can be reduced to a particular scientific discipline by showing how, with the help of bridging principles, the putatively independent insights of the other sciences are either semantically entailed by insights of this particular science or by establishing that any object of investigation of the other sciences is ontologically constituted by the objects of the science that is supposed to be fundamental and can be fully described in terms of the alleged fundamental science. In most cases, the science to which all the other sciences putatively can be reduced, is physics. So, for example, according to this option, the knowledge of biology, chemistry and the social sciences is reduced to the knowledge of physics; it is argued either that physical facts are the only ontologically genuine facts and that all other facts logically supervene on the facts of physics, or that that the propositions of

73 See Nagel (1961) for a classic model of reductionism. See also Oppenheim and Putnam (1958). See also Jackson (1998)

biology, chemistry and the social sciences are, in principle, deducible from the propositions constitute of physical theories.

If Krause's conception of science were committed to reductionism, then it should be rejected because of its inadequacy. For not only has every attempt to show, through semantic, epistemological, or metaphysical arguments, that the statements of a single science, A, reduce to the statements of a single science, B, failed, but the ontologically necessary conditions for semantic reductionism are not met. Because, to reduce all knowledge of the individual sciences to the domain of a particular science, the facts would have to be mentioned in this particular science which, considered ontologically, would be the only genuine facts. Biological facts would have to be *nothing more than* facts of physics, if a reduction of biological statements to statements of physics were to be intelligible at all. This is not the case, because biological facts are logically independent of the facts of physics. For instance, it is consistent to imagine a possible world in which the biological facts known to us are the same, while the facts of physics differ from those in the actual world.

Krause's conception of science as an organic system of science, however, differs fundamentally from reductionism and, in fact, is a holistic position in the philosophy of science. On holism, no genuine science is reducible to another genuine science, although each and every of the sciences is related semantically and ontologically to any of the other sciences and together constitute science as a harmonious and unified system of science. The reason for this, according to Krause, is, of course, that, ultimately, all of the different scientific disciplines deal with one and the same genuine object of investigation – God as the highest reality – and investigate particular features of this reality that holds the world within. If the different sciences did not deal with the same object, then, according to Krause, it would be impossible that there is a unity of science at all. As Krause specified at the beginning of the analytical-ascending part of science: 'Every special science has a certain independence. For if the basic idea, the basic thought, is given to a special science, then it can be partly developed for itself. But the fundamental ideas of all the special sciences are united in the principle of science: all the special sciences are fundamentally contained in the one fundamental principle of the one science. And the highest perfection of every special science, to which humanity and mankind can attain, can only

be gained if every special science is formed as an inner, well-connected link in the one principle of science' (Krause 1829: 2). Furthermore: 'Now since all essences are a structure in God, all the individual sciences are also the inner structures of the one science, as the structure of the intuition of Essence. Thus, as essences, according to their nature and degree, and interrelationship, behave in themselves, and in and to God, so also all the individual sciences behave in themselves and in and to the one science. The structure of science is thus an unfolding of the structure of the basic ideas as about and in the idea of God' (Krause 1829: 230).

In Krause's system, science is *one*, so that, if not every science is completely independent of the other sciences, a relative autonomy is conceded to each and every single science, throughout the construction of the system of science as an organic system. Biology is not physics, even though the knowledge of biology and the knowledge of physics are closely related.

Krause is very up-to-date with his holism as an adequate theory about the unity of science. For the debate in the theory of science is beginning to move away from reductionism, for the reasons mentioned, and is intensified by questions about the inner connection between the sciences, in a manner which, as in Krause, considers the independence of individual sciences on the one hand, and their internal connection on the other. As Grantham (2004: 133) says: 'Scientists have often sought, and sometimes achieved, the integration or unification of scientific knowledge. Newton unified mechanics by arguing that the same laws apply to both terrestrial and celestial motion; Maxwell unified the theories of electro-magnetism and optics; Fischer and Wright synthesized Mendelism and Darwinism. Attempts at integration [and not reduction] remain prominent on the contemporary scene. Physicists discuss the possibility of a Grand Unified Theory, evolutionary psychologists attempt to integrate evolutionary biology and cognitive psychology.' And, one could add, philosophers of science attempt to provide an all-embracing theory of the unity of science that accounts for the very possibility of such unification of the different disciplines based on the assumption that the reality investigated is one and the same for all the sciences. That is to say, although, for the last few decades, it was often supposed that there is only one ontologically fundamental science, physics, and all sciences have to be ontologically reducible to physics, the situation now appears in a new light. Science is, again, being seen as a

harmonic system of disciplines that picture the world as an evolving and unified system of systems, in which there are relations of dependence and explanation between the branches (see, for instance, Esfeld 2010).

A recent example that shows Krause's idea of thinking of God as the infinite and unconditional principle of the system of science is highly topical, is found in the work of Arthur Peacocke. For Krause could easily agree with Peacocke when he says: 'A further pointer to the cogency of a panentheistic interpretation of God's relation to the world is the way the different sciences relate to each other and to the world they study – the hierarchy of sciences from particle physics to ecology and sociology. The more complex is constituted of the less complex, and all interact and interrelate in systems of systems. It is to this world discovered by the sciences that we have to think of God as relating. The "external" God of classical Western theism can be modelled only as acting upon such a world by intervening separately at the various discrete levels. But if God incorporates both the individual systems and the total system of systems within Godself, as in the panentheistic model, then it is more conceivable that God could interact with all the complex systems at their own holistic levels. God is present to the wholes as well as to the parts' (Peacocke 2004: 147ff).

A further example that shows the relevance of Krause's panentheistic philosophy of science and its account of the systematic-organic character of science as a system of relations that can be analysed as they are, as such, and in themselves, is found in Edwards (2004: 202): 'When science looks at anything at all – whether it be a proton, a galaxy, a cell, or the most complex thing we know, the human brain – it finds systems of relationships. Every entity seems to be constituted by at least two fundamental sets of relationships. First, there are the interrelationships between the components that make up an entity. Thus a carbon atom is constituted from subatomic particles (protons, neutrons, and electrons). Second, there is the relationship between the entity and its wider environment. So a carbon atom in my body is constituted as part of a molecule, which forms part of a cell, which belongs to an organ of my body. I am part of a family, a human society, and a community of interrelated living creatures on earth. The earth community depends upon and is interrelated with the sun, the Milky Way galaxy, and the whole universe.'

In addition, with his concepts of 'as such' and 'in itself', Krause stands very near to the current debate about metaphysical grounding. In today's philosophy of science we find the following: 'Individual entities are not only radically interconnected with others, but they also have their own identity and unique autonomy. Individual entities have a degree of self-intentionality – whether we think of human beings with their experience of being free agents, of birds with their glorious freedom in flight, or of particles like photons whose individual motion cannot be predetermined. Not everything we come across in nature has an identity of its own. Some things, such as the pile of papers on my desk, are simply collections of other things and do not form a new whole. [There is an] important distinction between things that are simply aggregates or collections of components. An example of such a new reality would be water, which has characteristics that are distinctive over and above its components of hydrogen and oxygen. Its functions and attributes cannot be reduced to the functions and attributes of its components. Its distinctive characteristics spring not only from its components but also from all its other constitutive relationships. It functions as a whole in a way that cannot be attributed simply to the way its component parts function' (Edwards 2004: 205).

In contrast with many panentheistic systems, which require that God be present in the whole system of science, but have no system at their disposal to show how this is possible, Krause has actually deduced the structure of the whole of science, with his panentheism, from the intuition of God as the ultimate principle of science. In Krause's panentheistic philosophy of science, we have an example of a well thought-out, but unfortunately unknown, example of such a theory of science, from which today's discussion could learn.

In sum, regarding the discussion between reductionism and holism, Krause's system of philosophy is a valuable source of insight: if reality is completely in God, as its single ultimate ground, and if this ultimate ground is dynamic and deeply involved in the fate of the universe, and if history is the one divine life of which we are part, then we should expect that science shows that, the universe is an evolving system of systems, in which every part harmonically relates to every other part. After all, on a panentheistic understanding, although *prima facie* there are different sciences, *secunda facie* all the sciences deal with different aspects of one and the same all-embracing reality.

12.4 Ultimate explanation and intellectual intuition

Let us turn to debate on ultimate explanation and the possibility of intellectual intuition as a means to establish a system of science. According to Müller (2008: 151) the concept of ultimate explanation was introduced by Husserl as follows: 'Philosophy, according to the idea, applied by me, is the universal, and in the radical sense, strict science. As such, it is science of the ultimate explanation, or, what is the same, of the final self-responsibility, in which therefore no predicative or pre-predicative self-understanding functions as an unquestioned ground of knowledge' (Husserl 1952: 139). What Husserl here specifies as ultimate explanation is, in effect, synonymous to Krause's understanding of what is achieved through the immediately certain fundamental intuitions of the ego and of God and describes Krause's method in the analytical-ascending and synthetical-descending part of science.

Ultimate explanation was not so much called into question, in philosophy in the last century, but simply ignored, or *ex cathedra* declared impossible or senseless. For example, Schönberger characterizes the situation as follows: 'Again, every statement admits of being thought of as a conclusion. For any statement, I can ask: what do I have to think, so that this statement is compelling? There are, however, hermeneutic presuppositions beyond all the thoughts, in addition to logical presuppositions. These have the drawback that they are not visible through logical analysis. Again and again, philosophy has, on these grounds, tried to arrive at a thought which does not presuppose anything further whatsoever, which is an absolutely primordial thought [*schlechthin erster Gedanke*] from which further ones are yielded, but which does not have any further prerequisites. This dream has, indeed, been dreamed out' (Schönberger 2007: 110).

From a systematic point of view, the claim that this dream has been dreamed up is astonishing, of course, because for its justification, if it wants to be more than a mere expression of opinion, it presupposes that there is ultimate justification of the claim that ultimate justification is not possible. It is, in other words, transcendentally self-refuting to assert that ultimate explanation, in principle, is impossible. Cramer is quite clear that this is the case and comments upon those whose think that ultimate explanation in philosophy is impossible as follows: 'Those who think they have to tell us what is no longer thinkable today should know that philosophy has to do

with fundamental questions, and therefore with arguments which cannot be refuted by trendy ways of thinking. Otherwise, we should hand over the solution of philosophical questions to the institutes of opinion research' (Cramer 1967: 9f.).

Philosophy must, in other words, adhere to argument, and because the denial of ultimate explanation is self-refuting, it is allowed to consider the possibility of ultimate explanation. There are, however, two features of ultimate explanation that need further clarification.

First, whatever is established by recourse to intellectual intuition is knowledge acquired through a purely subjective intuition. This intuition, fulfilled by the subject alone, cannot be mediated externally. There are, for instance, no arguments that could bring an interlocutor to actually fulfil the intuition of God. The only possibility, as Krause was aware, is to point to ways in which this intuition could be achieved. In this sense, talk of the intuition of the essence of God will always appear somewhat suspect to those who have not fulfilled it themselves. To overcome this suspicion, however, one might just understand the alleged intuition as an insight or stipulative definition that leads to a particular way to understand reality as a whole, and one should evaluate whether the system of philosophy that is established through the putative intellectual intuition is in fact a plausible system of philosophy that based on its assumptions and primitive concepts can explain what it intends to explain (in much the same way in which, say, in physics, Einstein in a way just stipulated that $E=mc^2$ to see where this would get him). The point here is how the overall image of reality, developed from the intuition of God, proves itself in scientific and human practice. In other words, if one does not believe in the possibility of intellectual intuition achieved by the ego, then one can circumvent it and still evaluate the plausibility of the corresponding system of philosophy in so far as one assumes that whatever is said to be intuited operates as a suggestion to see things in a certain way: if we assume that this and this is the case, then where do we get from there? And does it fit with our experience of reality?

Second, many philosophical assumptions are such that they are neither likely to be empirically verified nor of an intersubjectively compelling nature. They are such that, if they do not lead to contradiction, they can be freely adopted by an individual or a community as fundamental assumptions of a given system of philosophy. Consequently, they also can be freely

rejected by other individuals and communities. From the point of view of philosophy of science, the most important question in our context, then, is whether a scientific discipline is possible if it is based on metaphysical assumptions that are likely to transcend empirical verification, fail to be intersubjectively compelling, but do not lead to contradiction. Seen from the other side of the coin: are scientific theories only plausible if they are based on assumptions that are intersubjectively compelling and likely to be empirically verified? Some philosophers currently appear to suppose that we can indeed only speak of a scientific discipline or a scientific theory if it is based on intersubjectively binding assumptions that are empirically verifiable or on a concept of reason that is absolutely autonomous. They argue that a science cannot be based on assumptions that are neither empirically verifiable nor intersubjectively compelling and therefore reject the possibility of intellectual intuition. However, quite the contrary seems to be the case if looked upon from both the systematic and the empirical point of view.

First, from a systematic point of view, we have to be aware that our concept of science is itself a contingent cultural achievement that is based on particular ontological and epistemological presuppositions concerning the nature of reality and the nature of the different objects of study; presuppositions that are neither empirically verifiable nor intersubjectively compelling.[74] The function of these assumptions, in so far as they do not lead to contradiction, is precisely to constitute a particular perspective from which our pre-theoretical experience of reality is structured and made accessible to the mind in a propositional systematization for both theoretical and practical purposes. For instance, on the one hand, the assumption that *Orwesen* is the one infinite and unconditioned principle of science in virtue of which the world is what it is, is neither empirically verifiable nor

74 As Harrison (2015: 194) argues, 'science and religion are not natural kinds, they are neither universal propensities of human beings nor necessary features of human societies. Rather they are ways of conceptualizing certain human activities – ways that are peculiar to modern Western culture, and which have arisen as a consequence of unique historical circumstances.' Of course, the Chinese, Indians, and Arabs, for instance, also engaged themselves in activities that can be called scientific. However, today the expressions 'science' and 'the sciences' primarily seem to be related to those fields of study that have become immensely successful as disciplines of the European university.

intersubjectively compelling. However, it enables to account for the very possibility of a reliable scientific investigation into the nature of the world because it explains it by recurring to the reasonable essence of God. On the other hand, the physical assumption that there are genuine relations of causal efficacy regulating the behaviour of fundamental particles in the physical universe, or the assumption that mathematics is the language in which the fundamental structure of the physical universe can be expressed, function in the same way and constitute a particular perspective from which our pre-theoretical experience of reality can be structured, and in this sense these assumptions help constituting the very possibility of physics. They are, however, themselves beyond empirical verification, not intersubjectively compelling, and in part are even restricted by criteria like simplicity in the case of causation and beauty in the case of mathematics.

Since human beings are bound to a perspective interpretation of the world, and since there are different assumptions constitutive of the sciences that are neither intersubjectively compelling nor likely to be empirically verified, the best we can do to show the adequacy and plausibility of a particular all-embracing theory of everything, as in the case of Krause's panentheistic philosophy therefore, is to be clear, explicit, and reflective about our theoretical and meta-theoretical shaping principles and to show that on them a meaningful worldview is possible, both theoretically and practically.

Second, from the empirical point of view, a glimpse into the variety of theories discussed in the natural sciences and the humanities immediately reveals that there are many different theories that (a) both carry with them an undisputed claim for scientificity, (b) are accepted in the community as scientific theories, but (c) are based on assumptions that are likely to transcend empirical verification and are neither intersubjectively compelling; else they would not be there to be discussed. For instance, the assumption that our universe is part of a larger multiverse is neither likely to be empirically verified, nor is it an intersubjectively compelling assumption, not even amongst physicists. Although it is not clear whether the multiverse-theory could be empirically verified, and therefore whether it should be addressed as a metaphysical assumption on a level with the assumption that God exists, or as a yet unconfirmed empirical hypothesis, it is nevertheless discussed as a (part of a larger) scientific theory.

In fact, the longer one reflects on this, the harder it seems to find a scientific theory – be it philosophical, mathematical, physical, theological, chemical – that is not based on assumptions that transcend empirical verification and fail to be intersubjectively binding and in this sense can be understood as based on certain intuitions and decision to see the world from a particular point of view. Therefore, for both systematic and empirical reasons, a scientific discipline can legitimately be based on assumptions that are likely to transcend empirical verification and are neither intersubjectively compelling – as long as they do not lead to contradiction. Therefore, it seems that the fact that Krause's system of philosophy is based on intellectual intuition, and because of this is based on insights that are beyond empirical verification and that one can disagree with, does not entail that from the point of view of philosophy of science, it should be rejected as unscientific. Instead, what Krause provides is an all-embracing panentheistic theory of science that leads to a coherent and consistent plausible interpretation of the whole of reality.

12.5 Summary

Krause's panentheistic theory of science as an organic system of science is in line with currently deployed concepts of science. It entails that reductionism in the philosophy of science is implausible and it leads to a holistic interpretation of the unity of science that in recent debates is often argued to be adequate when it comes to the analysis of the different sciences and the relations amongst them. Furthermore, although the idea of intellectual intuition and ultimate explanation is often rejected in contemporary philosophy science, it could be shown that, in fact, assumptions that are neither intersubjectively compelling nor empirically verifiable, and in this way are structurally similar to conclusions drawn from intellectual intuition, belong to the very constitution of most of the scientific disciplines. Based on this background, Krause's panentheistic philosophy of science stands without counterargument regarding recent debates in the philosophy of science. In fact, it should be seen as a suggestion to perceive the world and our place in it from a particular point of view that is internally coherent, consistent, and has strong arguments in its favour. Krause's system of philosophy, in other words, provides a good candidate for an all-embracing theory of everything that accounts for the unity of reality and the unity of science in

a way consistent with recent developments in the philosophy of science. As Müller (2010a: 20) says: 'The both physically and philosophically, and theologically, manifestly ambitious idea of the all-in-one [*All-Einheit*], could be a discourse plateau on which science and theology could meet more unreservedly than elsewhere.'