INTERDISCIPLINARY COOPERATION: PROBLEMS AND METHODS

Friedrich G. WALLNER[1]

ABSTRACT. *In times of a growing splintering of disciplines in science we need an interdisciplinary cooperation. But there are at least three misleading types of interdisciplinary cooperation which have to be replaced by the concept of interdisciplinarity offered by the Viennese school of philosophy of science called Constructive Realism. The main goal of Constructive Realism is a proper (self-) understanding of science and thereby to achieve not only information but also knowledge in the sciences. The methodology Constructive Realism offers for that goal is the so-called "strangification". Apart from that the concepts of ontology, truth and interculturality are discussed from the point of view of Constructive Realism.*

KEYWORDS: *philosophy of science, isolation of disciplines, interdisciplinary cooperation, interdisciplinarity, instrumentalism, universalism, knowledge, self-understanding of scientists, strangification, Constructive Realism, truth, relativism, "relationalism", description or construction of reality, constructivism*

Contents

[1] University of Vienna, AUSTRIA

Introduction

We are in times of big crises. Environmental crisis, economical, political, social, educational… – you name it! How about science? Science seems to enjoy an ever growing progress, if you take a superficial look at it. Science is producing constant output, thus, it seems, more and more knowledge. Would not it sound malevolent to pretend that sciences are in a crisis? Yet – nobody will deny that the instrumentalization of today´s sciences is intimately linked to many crises. Apart from this rather superficial ascertainment, we can observe in academia a growing splintering of disciplines into subdisciplines. Today, we can count up to over a hundred different departments in physics, that work each in isolation without really knowing about the developments in the neighboring department. How to bridge this proliferation of gaps? More and more scientists call for „interdisciplinary cooperation", and on the face of it, this sounds promising. At least, nobody will deny, that cooperation is getting more and more necessary.

What I want to undertake in this article is to show, first, how divergent these kinds of „cooperations" are, even if appearing under the same, seemingly overarching label of „interdisciplinarity" or „interdisciplinary cooperation". I will try to roughly categorize these types of so-called „interdisciplinary cooperations" into three different types: instrumentalism, universalism, and reductionism. In each case, I want to show how these concepts fail to fulfill what they (seem to) promise.

I will propose a fourth concept, a concept of interdisciplinarity that fundamentally changes the understanding of scientific work. It not only avoids mere instrumentalism, universalism and reductionism, but even more, it is a new methodology at all. It differs from all the other concepts in that it does not set an absolute goal for sciences at the outset, but rather gives scientists a tool to think about their own scientific activities and effectively hold responsibility for their actions. The methodology is called „strangification" and will be discussed in the final part of Chapter 1. It will also be necessary to make the distinction of different realms of reality, that is, of that which exists.

In Chapter 2, I will deal with the more fundamental and common problems that are underlying the self-understanding of today´s scientists. These problems are not new, yet their historical, especially theologically and philosophically laden origins have been blurred and forgotten, thus one of my objectives is to trace back today´s ideology of science, starting from its historical origins and following the changes it has undergone over the course of time.

I think that we have to understand what science really is about, and what it had been about in the past. The solution of environmental problems will also depend on a proper (self-) understanding of science, since it is only from the standpoint of a proper understanding, that we can hope to make effective changes and permanent decisions towards environmental policies. The way scientific thinking is generally conceived of – namely as being separable and in fact separated from praxis – is reflected in politics. On the one hand you have scientists, who work, yet cannot really

explain what they do. The only thing useful to the laymen is the technological application of his scientific theories. On the other hand you have politicians, who make large scale decisions, using these results, without understanding neither the applications nor their scope of consequences for environments and societies.

In the final Chapter 3, we will look at the present, paradoxical situation of science, which for specific reasons seems to be eventually carrying itself to its own grave: its initial goal and commitment, knowledge, seems to be definitively at stake. Meanwhile, traditional philosophy of science still continues to consider science as still pursuing the ancient dream of pure knowledge. Yet the factual situation of today´s science is and has been different. Thus, the role of philosophy of science cannot be the legitimation of scientific activities anymore. Nevertheless, philosophy could still be useful to scientists. The movement of Constructive Realism proposes itself as a new philosophy, not of science, but for science.[1] It offers a tool (the methodology of „strangification"), that enables scientists to reflect, to understand and to articulate their own activities in a communicable way. Understanding is central to knowledge, the most important commitment of science: knowing means to understand what one is doing, that is, being able to make one´s actions understandable and explicit to oneself and to others. I will also discuss the problem of ontology, that is, the question, into what realms everything existing can be subdivided. It is important to relate the activities of science and culture to one another, in order to understand the scope of influence of both. Furthermore, we will shortly see how the concept of absolute truth is to be dismissed as meaningless and useless, yet how its appearance is linked to the historical origins of science and rationalism.

These origins can also be held responsible for the way in which Western culture has very often encountered other, foreign cultures and their sciences. If we gain a new understanding of science, we will discover that rationality is nothing unitary and peculiar to Western science alone. Each science has its own rationality. The problem of relativism is akin to the problem of tolerance. There is a false kind of tolerance, similar to scientific relativism which is only a false kind of relativism (false, because it leaves fundamental problems unsolved), and there is a good kind of tolerance, similar to a positive and different definition and understanding of relativism, one that I want to call „relationalism". This will be discussed in the final part of Chapter 3.

[1] For further developments in „Constructivism", see the publications of the „Konstanzer Schule"; relevant in this context are the works of P. JANICH, esp. *Konstruktivismus und Naturerkenntnis: auf dem Weg zum Kulturalismus*. Frankfurt am Main: Suhrkamp, 1996; and also those of S. J. SCHMIDT, *Kognition und Gesellschaft. Der Diskurs des Radikalen Konstruktivismus 2*. Frankfurt am Main: Suhrkamp, 1992; furthermore, regarding the methodology of Constructive Realism, see K. GREINER, *Therapie der Wissenschaft*. Eine Einführung in die Methodik des Konstruktiven Realismus. Berlin/Wien: Peter Lang, 2005.

I. FORMS OF INTERDISCIPLINARITY

I.1. Introduction

In the 20th century, much of the prevailing philosophy of science promulgated an understanding of science as an enterprise that is continuously striving towards a more and more accurate description of the whole nature, and eventually realizing the ideal of absolute knowledge. This erroneous attribution of tasks to science has helped to consolidate in the minds of many scientists a self-understanding of their own activity as one of describing nature – an opinion that turned out to be a self-misunderstanding. In this article, I will present the problems inherent to this self-misunderstanding of science, and I will try to suggest the necessity to replace it by a relatively new understanding of science. In order to do this though, we have to get a better idea of what science is generally considered like in our times.

In the past decades, there has been an increasing call for interdisciplinarity. Taken at face value, this call sounds very promising. Yet, in spite of this apparent progressive turn, certain understandings of interdisciplinarity have proven to be highly problematic, because they rely on problematic assumptions and lead to problematic consequences. Thus, what I want to do here is to discuss different – historically relevant or contemporary – understandings of "interdisciplinarity". Among these different concepts, I will have to dismiss some understandings, and I will offer a better concept of interdisciplinarity. In the course of this article, I want to show how certain understandings of interdisciplinarity are inadequate precisely insofar as they have not overcome the above-mentioned traditional self-(mis)understanding of science. Rather, they are – sometimes unconsciously – continuing to diffuse the traditional understanding of science in the guise of so-called "interdisciplinarity".

For reasons of comprehensibility, I want to present the different concepts of interdisciplinarity first. Probably you will be familiar with one or the other concept, and if not, you might possibly recognize one of them as an underlying presupposition of your own activities as natural scientists. I will try to show you the flaws of some prevailing concepts. As a consequence of proposing a new concept, I will try to clarify that concept by unearthing the more fundamental understanding of science presupposed therein.

I.2. Problems of Interdisciplinarity

I wish to distinguish four different forms of interdisciplinarity. The first one I consider as a form of pseudo-interdisciplinarity as it is erroneously called interdisciplinarity. Then I want to show an unreal form, which is only interdisciplinary in appearance, whereas it actually leads to consequences that eventually undermine a real understanding of interdisciplinary cooperation. Finally, I want to present two further alternatives, of which the first is very popular and tempting, but poses serious problems. The final concept, suggested by Constructive Realism, will try to solve the problems posed by all other forms of interdisciplinarity.

I.2.1. Instrumentalist Interdisciplinarity

In applied sciences, it happens that there is talk about "interdisciplinarity". The actual understanding behind this word is very often the following: an unreflected combination of knowledge with provenience from two or more different scientific disciplines, for instance a chemist using the results and methods of physics without any further concerns about the presuppositions of physics between different disciplines. This obviously has been a regular practice for decades in all kinds of fields where science is merely applied. What I want to criticize here is the ignorance towards the differences between different disciplines in terms of the methods used and the problems posed respectively. Not only is this kind of "practically oriented scientist" not aware of the presuppositions, namely the goals, methods and problems that govern the specific form of the science of which he adopts results, but at the same time he most certainly is not aware of the relativity of the goals, methods and problems of his own science. Here, another scientific discipline is only considered insofar as its results are of any direct interest and can be used for the solution of a problem, on which the scientist is working. He does not become aware neither of the problem, nor of the methods, that he uses to its solution. He does not see how his choice of information, in this case, information that does not originate from his own first-hand experience is determined by the methods and goals of his own science.

I see the real goal of interdisciplinarity not in the arbitrary use of results from this or that scientific discipline. Interdisciplinarity has to become a discourse in order to be able offer an insight into the nature of the specific scientific investigation one is pursuing. The instrumentalist understanding obscures the possibility of any such discourse from the outset.

Before we turn to the solution that I propose, we have to take into consideration another concept of interdisciplinarity, which is no less popular and, in a sense, more informative about the goal of science, even though it eventually pursues this goal in a traditional way of understanding that needs to be overcome.

I.2.2. Universalizing Interdisciplinarity

Ever since the early beginnings of philosophy and of science, there has been this motive to search for and find universal knowledge, that is, knowledge about everything. This motive was often deeply rooted in the belief, that there is a way enabling us to attain a certain type of knowledge that encompasses all possible knowledge – from all disciplines – at once. The type of interdisciplinarity based on this assumption I shall call "universalizing interdisciplinarity", because it has been expected to lead to a final "universal knowledge", encompassing all the scientific disciplines. Today one has accepted that neither religion, nor philosophy is able to provide a "unity of the whole", but the project has nevertheless not been abandoned. If we want to understand in what sense such a project is gigantic and in what sense it is highly arguable due to its problematic character, we have to fully understand the consequences and the premises involved therein. Since this project has been undertaken several times in the course of the history of philosophy, let us consider an

eminent example from which the full consequences become clearly visible: the case of the church against Galileo Galilei in the 17th century.

You have to consider a multitude of aspects, ranging from purely intellectual disputations over and against Galileo's project, up to the significance of the historical background into which it is embedded, in order to understand what was at stake in this case, which to us seems nowadays incomprehensible, if not exaggerated in its vehemence. Galileo's ambition was nothing short of giving a whole new system of explanation of the world. The point was not merely his defense of heliocentrism, since this point of view had already been taught by men before him, for instance Copernicus. If the question had been simply, whether heliocentrism or geocentrism is the right opinion, then this hardly could have been called a revolution. Yet, the very revolutionary aspect of his undertaking was the replacement of one model of explaining the world by another such model. It is insofar as the church of his time pretended to explain the world as a whole, that it felt threatened by Galilei. The process against Galilei cannot be dismissed by simply stating that the clerics were only unwilling to understand and accept Galileo's doctrine. In fact, what was at stake was much more than a simple astronomical point of view. Far from defending the clerical reaction, I want to simply point out how the church was enforcing this process against Galilei as a direct consequence of its own understanding of the world. The church was afraid to give up and sacrifice its own explanation of the world as a whole. Heliocentrism was incompatible with the theological model and method of explaining the world and it had seriously put these presuppositions into question. Much can be at stake, when questions are newly posed. In the history of philosophy and of science, the standpoint, that universal knowledge is something that is possible and can even be achieved, was practically held unanimously, even by philosophers of science in the 20th century. This idea was very prominent in the thoughts of famous philosopher Rudolf Carnap and the Vienna Circle, and it still continues to prevail in the contemporary, traditional philosophy of science.

Is a universalizing interdisciplinarity possible at all? In other words: is it possible to achieve an explanation of the world as a whole by means of a science, overarching and homogenizing the diversity of existing disciplines? And what are the consequences of such a conception of science? If we attempt to answer the question of the possibility of a universalizing interdisciplinarity, then the counter question has to be permitted: is there no other means of finding an explanation of the world as a whole? What was the method of a universalizing interdisciplinarity like, in the preceding centuries?

Each claim to a universal explanation goes along (at least implicitly) with the methodological question: what would be the general method to be applied in order to attempt and achieve an explanation which transcends the disciplinary boundaries? Each discipline has its own methods. Nevertheless, the question about which general method is to be used to attain universal knowledge has been ignored. In most cases, the question was not posed, and instead, the transcending of interdisciplinary boundaries was assumed, either consciously or unconsciously, to be done within the

methodical framework of the respective scientific discipline dominant at its time. In the Middle Ages, theology was the "Führungswissenschaft" (i.e. the "dominant", or "leading" science), in the 18th and 19th century it was physics, and today we are about to experience a change of paradigms, namely the progressive domination of all disciplines by biology and, eventually, by the computer sciences. Let us again look at the historical developments that took place, in order to understand what exactly is involved in the problem of looking for or stating a leading science.

Each form of a hierarchically organized interdisciplinarity determines the value of questions, and thereby decides which questions are "scientific", that is, legitimate be posed, and which are not. In the time when theology was dominant in European thought, it was considered as the leading science in relation to which the whole canon of disciplines was organized. Theology was mainly preoccupied with questions concerning teleology, that is, questions that cover the subject matter of the goal and purpose of each and every thing (notably of us human beings) and of the world as a whole. The central question was in other words: what is God's will?

By the 18th century, an important shift in the organization of the sciences had taken place: physics had become the new leading science, whereas theology definitely lost its modeling function for other scientific disciplines. Questions of theology were not anymore influential in other fields, at least not in their explicit form. Physics as the new leading science was, at that time, dominated by the mechanistic paradigm. Everything was conceived of as explainable and intelligible in terms of mechanistic processes, and these processes were basically guided by the principle of a contact causality, as the only type of causality, with a particular cause always preceding the effect (What we commonly call "causality" is therefore causality in a narrow sense, if we see it against the background of the Aristotelian distinctions). Within this framework of thought, there was no place and need anymore to assume that there was a Divine providence which guided all natural processes towards a predetermined goal, determining the events, as it were, from the future. As a consequence, objects which had until then belonged to other areas, e.g. the soul as subject matter of theology, underwent a shift and were suddenly posed in terms of concepts and questions, which had their provenience in physics (e.g. late 19th century Psychophysik). Medieval theology and modern physics were incompatible frameworks for posing problems. For instance, if we take a look at biology, we can distinguish different forms of biology, depending on the higher value that they attribute either to teleological, or to causal-mechanistic thinking. Depending on which question is asked, the science becomes a wholly new one. A teleologically oriented biology is a discipline very much different from a mechanistically oriented biology.

Generally speaking, a leading science determines the type of questions which can be posed, and thereby also determines the data that is to be taken into account and the data that is to be ignored. The history of science has shown that there has been a discontinuous evolution of leading sciences. No leading science has ever been able to guarantee its dominating position, because this position is always dependent from

external factors. The problem, which discipline is to be the leading science, is a problem that cannot be solved. Therefore the idea of universal knowledge, in the sense of a science that can transcend the disciplinary boundaries, has to be dismissed. The idea is indeed rather violent, if you think about it. It means that one science imposes its methodical approach towards certain objects onto other scientific disciplines, and functions as the model-science for these sciences. The very thing ignored is that the method itself determines the object. The method of one science cannot simply be applied to the object of another science.

At the roots of this misconception lies the confusion in which many scientists can be found. Scientists often have a false, idealizing image of their own activity. They don't see that, on the one hand the scientific activity and, on the other hand the talk about this activity, are two distinct activities. If a scientist talks about his own activity, he is no longer within the confines of his discipline, at least he cannot do so without transgressing the boundaries of his own scientific discipline. What he then does is something similar to philosophy. Especially scientists that have retired from an active career in research feel tempted to make general claims about what they do, and speak as if they were doing so from within their discipline, whereas they are actually making statements from without their area of research.

What I and, generally speaking, what Constructive Realism do, is offering scientists a tool that allows them to become aware of and eventually reflect for themselves on their own scientific activities. We think scientists should be enabled to ask themselves: *"what exactly am I doing, and how can I make myself understandable to others and to myself?"*

I.2.3. Explanatory Interdisciplinarity

We have not mentioned, though, another type of interdisciplinarity, which encounters the same unsolvable problem of determining a hierarchy of the sciences. The concept of explanatory interdisciplinarity, though, does not consider merely one science as the model- science for other disciplines, as we have just encountered it with the case of universalizing interdisciplinarity. It happens that some scientists apply their methods onto other disciplines, for instance, when sociologists try to explain the appearance of certain, say physical, theories, they might claim that the respective physical theory appeared under this or that social circumstance. However, scientists mistake themselves whenever they think that they can relativize the truth of a theory from another discipline by explaining the historical emergence of that theory. To relate this to the example given: if sociologists explain the appearance of a physical theory, they deal primarily with particularities: the particular activities of particular physicists that took place in a particular point in time. The validity of the theory of the respective physicists cannot be affected by the methods of explanation that are applied onto it by sociology. Although particular scientists bring about theories, the scientific method they use lies beyond their conscious reach, precisely because the use of a method presupposes that the method is taken as obliging. The sociologists cannot simply say that a physical theory can be reduced, by means of

sociological explanations, to a purely social phenomenon. Real interdisciplinarity is precisely not the mingling of methods, the relativization of one method by another method. This would be a bad understanding of interdisciplinarity.

In the case of explanatory interdisciplinarity, the question is not so much, which science is to be the model-science for all other sciences, but rather the question is that of relativization, that is, of sciences functioning as instances of adjudicating upon the legitimacy of another discipline. Whereas the universalizing form of interdisciplinarity poses the insolvable problem of the hierarchy of sciences the explanatory form of interdisciplinarity erroneously claims that some sciences are able to determine and even delimit the validity of other sciences.

We will look now at an understanding of interdisciplinarity, which differs very much from the above-mentioned conceptions. I call this type of interdisciplinarity *"strangifying interdisciplinarity"*. With the explanatory interdisciplinarity it shares the way of confronting different methodical contexts with each other, yet the purpose and the specific proceeding differs very much from the explanatory one.

I.2.4. Strangifying Interdisciplinarity

What distinguishes this type of interdisciplinarity from the aforementioned ones has to do with the claim, that we can no longer accept the imposition of methods of a science onto the objects or methods of another science. This can least be done by philosophers, but also scientists mistake their work, if they think that they can impose their methods on the methods of another discipline and thereby explain the methods of that other discipline. One important condition of strangifying interdisciplinarity is that the scientist of a certain discipline has to be ready to voluntarily understand his own discipline, because only he is really in the position to understand his discipline and to eventually modify it. This is how I came to realize the necessity for a new understanding of interdisciplinarity: many years ago, scientists approached me and complained about their lack of understanding what they were actually doing as scientists. In order to understand the full consequences of this new understanding of interdisciplinarity, we have to first understand wherein it actually consists in detail.

This type of interdisciplinarity is based on a methodological approach, that has been systematically put forward by the movement of Constructive Realism[1], of which I have been a part and whose ideas are in part influenced by Hermeneutics and also by philosopher Ludwig Wittgenstein. Strangification proceeds as follows:

The scientist transfers a proposition, or even a whole set of propositions, i.e. a theory, from its usual context into a foreign context, hence this interdisciplinary

[1] For a more detailed account, see: F. WALLNER, *Acht Vorlesungen über den Konstruktiven Realismus*. Wien: Wiener Universitätsverlag, 1991 (which is meanwhile also available in Spanish, Portuguese and Arabic translations); for further discussions, see: F. WALLNER, *How to deal with science, if you care for other cultures*. In: Philosophica 15, Wien: Braumüller, 1997; and T. SLUNECKO, *The Movement of Constructive Realism*: A Festschrift for Fritz G. Wallner. Wien: Braumüller, 1997.

methodology is termed *"strangification"* (the original, German term we used was *"Verfremdung"*). As a first consequence of this transfer, the propositions thus strangified might not make much sense in the new context into which they are placed, or they might even seem to be non-sense. The first expected effect of a strangification is that the scientist will feel the necessity to clarify his theory to himself and to others. Thus, in a further step, the scientist urges himself to make sense of the strangified propositions. This will lead him then to find and make explicit the presuppositions that can make sense of his propositions. In many cases, this task will ask for some patience on behalf of the scientist engaged in the process of strangification, but his effort can be rewarded with a deeper understanding of what he is actually doing when he or she is working as a scientist, and of what nature the object are is (I will treat this question later), that are brought about by the propositional system he uses. By strangifying the linguistic system of his own discipline, he grants himself the opportunity to look at it from a different perspective, and to eventually position the method of his discipline within a bigger, social context. Strangification can unearth the tacit knowledge that was for most of the time implicitly presupposed by a scientist or a group of scientists. Other than in the case of bad, for instance explanatory interdisciplinarity, the strangifying interdisciplinarity does not strive to make an assessment of one set of propositions against another set of propositions with the objective of preferring the one over the other. On the contrary, strangification is there to help both insiders and outsiders to understand a particular science better. After the process of strangification, a scientist should come back to his usual methods with a richer understanding of what he is actually doing as a scientist.

The key-concept here is *understanding*. What does it mean to understand? To understand means to be able to translate a set of coherent propositions into a common language. In a strangifying context, the presuppositions of a scientific language can become apparent to the scientist involved in the process of strangification. What he learns to discriminate are two aspects involved in the praxis of science, two aspects that must not be confused, since they otherwise lead to reductionism. By means of strangification a scientist learns to distinguish, on the one hand, that, which is irreducibly typical for and valid in his discipline only, and he also recognizes the limited scope of applicability of his propositional system. He realizes that what he claims holds only for the limited context in which it is expressed and understood. On the other hand, the scientist also discovers that his activity cannot be detached from the grounds on which his science has flourished. Despite the validity of his propositions being irreducible from without the disciplinary context, the praxis and the organization of that discipline are nevertheless rooted within the culture where it thrived, since the cultural aspect of science consists in that particular scientific activities nonetheless presuppose and take place within the realm of human (inter)actions. Therefore sciences must recognize how the cultural environment is indispensable to them. In fact, science is not uniquely rational, but rather a special manifestation of a more general, social rationality. Albert Einstein used to say that scientific knowledge is nothing but a refined version of the everyday life account. To

summarize this double revelatory aspect of strangification: strangification sheds light on both the cultural dependence of science, and on the specificity of a scientific discipline.[1] Thus the methodology of strangification manages to bridge the seeming gap between the mutually exclusive organizational concepts of relativism and universality. Strangification puts an end to universalistic claims and allows for a new concept of relativism, that more appropriately should be called *relationalism*, insofar as it is not the mere negation of universalism, but takes into account the typical flaws of usual relativism.

Scientists often realize that they don't know what the systems of propositions they yield really mean, whenever they have to explain it to lay people that are not acquainted with the specific language of the scientist. One cause for this is that disciplines (especially in physics) have grown more and more isolated from each other as a result of the degree of abstraction attained in the language they use. It is hard and it can be misleading to try to comprehend modern physics by means of the imagination. The apparent uselessness of our imaginatory force has certainly favored this tendency of scientists losing touch with the objects of their discipline. In fact, the design of physical experiments has attained a level of abstraction so high, that the concept of object was altogether lost in the process. Objects have been dissolved into pure data.

Another reason, that not only holds for physics, but for all sciences, is that the design of university curricula, as we have hitherto known it, is itself leading to this situation of isolation and lack of self-understanding: nowadays, the training of scientists takes place in such a disciplinary isolation, that after many years of research scientists are often even completely ignorant as to the activities of their colleagues from the neighboring disciplines.

I.2.4.1. Reality, Life-world and Actuality

The strangifying form of interdisciplinarity, as Constructive Realism has put forward, rests upon ontological clarifications, and these require an adequate understanding of science, as we have tried to give so far. It is not enough to say that scientists are not describing the world, but constructing realities. We have to give, and we can give a meaning to these programmatic claims.

We have claimed that each scientific discipline has a double aspect. On the one hand it is socially embedded insofar as it is a refinement of a social rationality, thus there is no fundamental difference between social and scientific rationality. Whenever scientists communicate with each other, this communication is only possible on the basis of the social embedding with its conventions, in which the

[1] This can be easily understood, if you consider an experience that probably most of you have already made, namely that when you have to translate from your language into a language which is foreign to you, you also become aware of the presuppositions of the language you normally use, the presuppositions common to both language as well as those that are typical for one´s own language alone.

scientists take part as individuals. This environment, considered in its totality, is a construct that we want to call *"life-world"*. This is the generative function of the life-world: within the world of everyday praxis, it allows for another type of praxis, the scientific praxis. In this sense, the methodology of strangification is nothing but a turn, a return towards the context, into which the scientific praxis is grounded. It is from this context, that a science can learn something about itself (reflexive function of the life-world). Since contexts are nowhere delimited, there is no limitation as to the scope of a context. A construct can be strangified in as many different ways as there are different kinds of contexts. On the other hand the theories that scientists produce are realities in their own right, irreducible to social factors. By saying this, we claim that there are at least two fundamental realms of reality. What we call *"reality"* is the result of a construction. Nevertheless, we have to distinguish two very different kinds of reality. On the one hand there are realities that we humans live in; on the other hand, there are realities that we describe / construct by means of concepts and data. Here we have to be careful not to make the mistake that has been made for so long throughout the history of philosophy and of science. What a science describes is not some kind of reality in itself (something we want to call *"actuality"*[1]). Science makes constructs, and what it constructs is what we want to call *"microworlds"*. What we understand by this word are reduced versions of the world, worlds construed with a set of selected data. The language used is part and parcel of that world, since it provides the concepts that, in their totality, determine and structure the selection of data. If these microworlds are reduced version of the world, they stand in a relation to actuality. Yet – what exactly is the nature of their relation? As living beings, i.e. organisms, we humans are rooted within actuality. As reflexive, knowing beings, our object is nevertheless not actuality, but the object is a microworld, a construct – and the moving, interactive totality of constructs is reality. Reality is not an autonomous realm, but it is the realm of human constructs. And how do these constructs come about? They are results of *"deformations"* (Maturana[2]), that we as living beings experience from actuality. Thus, actuality is of some help and stands in a certain relation to the constructs of science, although this relation is indirect.

We admit that there is a *world out there* (actuality), but we refuse to pretend that it can be described. This impossibility results not from any cognitive deficiency, but from the new conviction that the world out there is simply something, that cannot be known, or in any other way mirrored. The realm of actuality was always assigned the

[1] We have chosen the word *´actuality´*, since we have derived it from the original German term *´Wirklichkeit´* – a term that, in its verbal/predicative form *´wirken´*, suggests the exclusively processual, active and therefore self-sufficient character of this realm, whereas the term *´reality´* is derived from the Latin term *´realitas´*, which itself is derived from the Latin term *´res´* for thing or object. In other words: reality is the realm of objects, and objects, in our understanding, are nothing but constructs, that result from social and mental activities.

[2] See f. ex. H. R. MATURANA & F. J. VARELA, *Autopoiesis and Cognition*. The Realization of the Living. Dordrecht: Reidel, 1980.

wrong role, and this was so primarily due to a false understanding of the nature of science.

II. HOW TO PROTECT NATURE AGAINST SCIENCE?

II.1. The historical roots of Modern Science and its self-understanding

The aim of a philosophy of science has to be the creation of a philosophy for science. This has been the goal and self-understanding of what I and my colleagues did, when we initiated the movement of Constructive Realism. Philosophy (of science) does not need to say what science is. Yet, to make claims about the nature of science has been the implicit understanding of the task of most of philosophy of science in the 20th century.

Today's science is led by an ideology that is very problematic. This ideology will be discussed with the intention to replace it by a new ideology. Two different stances towards science can be taken: on the one hand one can say that science works perfectly well, so that there is no need for philosophy; on the other hand science has to be rightly seen as one of the main sources of dangers that more and more threaten to destroy nature and to eradicate cultural traditions. The new ideology that we propose has thus to be able to protect nature (and cultures) against science. To understand today's science and its functioning, we have to look back at its historical origins which date back to the 16th century, roughly speaking. In the course of the time, science has known a considerable development towards the 20th century. The crucial question to be asked here is: from which thinking has today's science evolved? We will try to understand this by looking at one, if not the major key figure of the scientific development, as it has taken place in Europe up from the 17th century onwards, namely at René Descartes.

His basic assumption about the world can be summed up as follows: Descartes assumed that nature could be subdivided into simple and clearly introspectible units, in other words, into simple particles. He thought of the totality as that of a mutual interaction of these particles, processes that can be described in terms of mechanical principles. An important basic assumption of this mechanistic view of Descartes is that at the origin of nature as a functioning totality stands God, who has created nature, a nature according to laws and structures that he himself has created out of his mind. Besides nature and its governing laws, God has created human minds. Based on this intimate link between the created human mind and God's mind, humans could legitimately claim to investigate and understand how nature works and how it is structured in its totality. It shouldn't be ignored, that in Descartes' philosophy the belief in the existence of God stands out of question. God's existence was the very fundament on which scientific investigation into nature could be conducted. It is only the existence of God's mind that guaranteed that nature is a structured and coherent totality, intelligible to the human mind. If there is a supreme intelligence who guarantees all this – and according to Descartes there is – then ethics is part and parcel of the scientific enterprise. If the assumption of God's existence was dropped, in other words, if both the connection between science and ethics or faith, and the

structural connection between the human mind and nature were disrupted, then nature would be in danger to become the prey of a ruthless exploitation. And even more, the idea of a structured world would not even exist, had there not been this constant reference to God, even though for us it is hard to believe this, since we usually speak about structures without ever referring to God and his mind as the author of these structures, not to speak of our ignorance concerning the necessity of the idea of God.

The 19th century has known radical changes. One important change was the continuing differentiation of the whole of science into particular scientific disciplines. What favored this stage of development of science was the separation of the idea of nature as a pure mechanism from the idea of God. Nature was decreasingly considered as the creation of one supreme creator. As a consequence of the absence of the idea of nature as divine creation with a purpose, science became reduced to the output of bare results. Thenceforth, the structure of nature was considered the object of scientists alone, and the negation of any purpose of nature was now an open invitation to consider nature as susceptible to arbitrary manipulations, regardless of any ethical considerations or responsibilities towards human societies.

This reduction of the originally Cartesian conception of science to the conception of science as manipulation of nature with the goal of mere outputs can be called *nihilistic*. What we mean here by nihilism is the ideological tendency to favour one aspect of a thing over all other aspects. This can be considered an attitude very much characteristic of much of European thought. In our precise and prominent case, today's ideology of science is nihilistic, and it became so in the 19th century, by leaving out all aspects of Cartesian science and retaining only the idea of nature as a pure mechanism, that can be understood, manipulated and governed by science alone. This finally amounted to the idea of science as having its sole fulfillment in the reproduction of nature.

In the 20th century, mechanism was considered as an ideology to be replaced, and sciences started conceiving of their own activity in purely instrumental terms. The former assumption of nature as a mechanism was replaced by the assumption that science cannot make definite statements about the objects of investigation. The scientific depiction of nature was considered to be adequate, if it was sufficient for science to function, *„as long as it works!"* The reasoning behind this was counterfactual: if the depiction of nature was inadequate, science would not work. Yet, since it worked, the depiction of nature was adequate. This kind of governance and control over nature is one-sided, because it is commanded by scientists alone, whereas the society has no say. If we take a look at the general global situation, namely socio-political and ecological crises, we are confronted with the necessity to integrate or even put into power the society, so that new rules to govern scientific research can be set. But how this can be done? Wouldn't this require a society, which is able to understand and govern science?!

II.2. Suggestions for a new environmental policy

Today, we are facing serious fundamental problems to find an effective environmental policy. First, science and its application in technology stand in a relation which is still not grasped by politicians. This problem can only be solved, if scientists have learnt to understand and explain what they are doing in a communicable way.

Secondly, we are confronted with an inherently political problem, namely today's problematic status of democracy. In our times, most politicians make decisions that are no longer based on personally worked out concepts. Rather, the decisions taken by our politicians are often dependent on the opinions of statistical majorities. As a consequence, democratic deficiencies also affect any possible civil right movements in a negative way and are thus another obstacle to tackling problems of environment in a more serious and effective way.

Thirdly, even ethical commissions have a problematic character. Instead of reflecting on ethics proper, they have adopted the habit to follow practical programs and goals, lead by political ideologies. Their status should be critical and reflexive, but instead, ethical commissions have come to be mere juridical consultants, telling scientists what is compatible and what is not compatible with the existing legislation, thereby not coming up to their ethical duty towards societies.

It is illusory to believe that a simple committee could be installed, reflecting on science and its activities from without, watching over these or giving the scientist a ready-made catalogue with rules of action, how to guide one´s scientific activities and how to set goals in a more ethical way.

Science, as we conceive it, cannot be organized and conceived in a hierarchical way anymore. A radical change of the inner organization of the universities has to take place. We have already said that strangification can make scientists become aware of the limitations of applicability of their discipline, that is, they can become themselves aware of the ethical problems entailed by the microworlds they have invented. While on the one hand to one discipline other disciplines are test-beds by which that discipline can learn something about itself, on the other hand the life-world – the social world we are embedded in, and where actions take place – is the touchstone for the acceptability of technologically applicable microworlds.

A bridge over the increasingly larger gulf between scientific praxis and social praxis can only be built, if both scientists and politicians give up this idea, that, either social life is subjected to the consultancy by scientific experts, or science has to be put under the survey of society. In both cases, certain human activities dominate over others, thus raising again the unsolvable problem of the hierarchy of sciences.

The (ethical) legitimation of science can only be done by scientists themselves, namely from exposing themselves to discussions with other scientists, and from reflecting then upon their own science and the ethical implications that they were not explicitly aware of before they entered the process of strangification. Strangification is thus a process of social learning. It´s only by learning about oneself from others, that the bonds of society can be held together.

III. A NEW VISION OF INTERDISCIPLINARITY AND INTERCULTURALITY

For the bigger part of the 20th century, philosophy of science set the goal to give a logical and epistemological legitimation of science and – in the case this seemed possible – to thereby discriminate between science and non-science. What seemed to have evaded those philosophers of science was the fact that their questions and tasks were more and more irrelevant to the factual situation of science. To an increasing extent scientists legitimized their science on their own. Philosophers of science that stand outside of this activity certainly cannot legitimize the activity of science from without. Still, science cannot be surrendered to itself. In the past few decades, scientists have lost touch with the object of their investigation. Even though they can perfectly well communicate with scientists of the same discipline, they do not really know what they are describing. In other words, they are unable to translate their formal language into some commonly shared and understandable everyday language.

What scientists actually produce are models. If a scientist produces something, and he cannot really say what he is describing, does not that sound very alarming? Thus, we come to the conclusion that science is in a paradoxical situation: despite constantly producing a large amount of output, scientists feel a growing inability to articulate this output, even to themselves. If one is unable to tell what one is doing as a scientist: How can one speak any longer of „knowledge“? The paradox is thus: science generates information, but, at the same time, it is increasingly lacking knowledge. The situation can be compared to that of my grandmother, though the situation of science is of course much more dramatic: my grandmother knew many household remedies, and she was able to use the right one for the respective disease to be cured. Still, it was more of a habit or an implicit know-how. As a matter of fact though, her remedies were at least as effective as those prescribed by a doctor. Nevertheless, I would not say, that she effectively had any knowledge. She was probably not able to tell what exactly she was doing and which processes those remedies induced in a body. Yet, her remedies worked. The situation in science has become very much the same: *„as long as it works“…* Knowledge, though, means precisely to not only be able to do something, but to be aware of and to be able to explain to one-self and to others what one is doing, in a way that transcends the linguistic confines of one´s activities without altogether dissolving the specificity of that discipline. In short, one could say that knowledge is insight plus a know-how about how to become aware of this insight and make it communicable. Knowledge is the process of *making* insights *explicit* and, thereby, making them susceptible to modification and improvement.

The irony of the Western intellectual history has been that the claim for total explanations and for reductions of diversities has led to the isolation of disciplines. Constructive Realism tried to solve this deficient situation of insular contexts by working out a methodological approach that can reconcile and thus transform the hitherto exclusive concepts of relativism on the one hand, and universalism or reductionism on the other hand. False instrumental (self-) understanding has lead to a considerable and threatening shift in the function of the scientists. A scientist is no

longer someone, who tries to acquire knowledge. One has to consider him rather as an engineer of data, an engineer of information management. What is at stake is nothing less than the ancient claim of European science, its commitment to achieve knowledge. Where did this tendency originate? We must first keep in mind that important distinction, which exists between various forms of science.

There is not only European science. There is Chinese science, Indian science, the science of Latin America, etc… This global fact has been overlooked. European science has been mostly considered in the West to be the only real science, because it was supposed to be the only absolutely rational scientific system. Why is it that we so easily share this belief? Apparently, if we look at today´s world, we notice that science seems to be very efficient, productive, and that it eventually found its way to the major cultural centres of our planet: you can study physics at New Delhi, at Peking, etc… At first, this sounds paradoxical: Westerners think of European science as being more rational than other sciences, in fact as being the only real science. Yet despite its global success and its recognition, European science has reached the crucial point, where it risks to definitely lose its main trait, its commitment to knowledge.

The reasons why science has approached this watershed can be found in the last one hundred years. For instance, the history of physics – and in general, the history of science – made the important point that the development of physics has never been a progressive and continuous development towards an ever increasing degree of rationality. In this sense, it has taught us that, for instance, Newtonian physics is in no way less rational than the Einsteinian Theory of Relativity. The opinion that science is moving throughout history towards more rationality is based on a misconception and misperception of science. Another important development in the past century has been the introduction of the observer-problematic into the field of physics, while in the *„Geisteswissenschaften"*(more or less equal to what you call the „humanities") the inclusion of the observer has been very common. Many scientists have been afraid of this, because they think that the introduction of the observer into a theory will entail the dissolution of the commitment of their science. As a consequence many of them are against any cooperation with scientists from the field of history or sociology, as they fear that the latter will proceed very much in the spirit of the above-mentioned explanatory interdisciplinarity, contesting the scientists´ claim of rationality.

This fear is probably not unjustified. There is an element that has to be present in each observation: love, love for the object of your investigation. This will sound scandalous to scientists, and they will object: „How can you ask for love in science! Science takes an objective, distant look at things, love is a subjective approach to a thing!" Why is this reaction so? According to the early 20th century sociologist Max Weber, we are convinced that we must structure in an arbitrary way in science, that is, we think we have to structure things in a way such as an absolute mind would structure them: absolutely, which means totally detached from any affection for the objects thus structured. This, I think, is really the core of European science: this idea

that to do science is to describe the world as if one was an absolute mind, as if one was the supreme Divine intelligence: God. As we have seen in the case of Descartes mentioned above, the influence of religion on science cannot be overemphasized.

This aspect can best be understood, if we consider the situation of Chinese science. The idea or concept of an absolute and pure mind, detached from any involvement into the matters of life, is not existent in Chinese culture. This fundamental aspect of science is excluded from, or rather ignored in the discourse of European science: that science is linked to human activity. It perfectly mirrors the Christian conception of the omniscient God who remains detached from what takes places in the world. God has been assumed to be a pure intelligence that does nothing else but simply watch and judge without „dirtying his hands". Description and the segregation of theory and praxis are just the two sides of the same coin.

Science invents models, but what do these models do? The question really is what we *do* with these models, not what these models depict. They don´t depict anything outside of themselves. They play a certain role in the context of human activity, they have an effective function. The function of these models or constructs is to replace something of the given world. These constructs, or microworlds, are often born in imagination, and they are used then to structure a selected set of data. Eventually they are applied technologically, thus generating new artificial realities, the sum of which is what we commonly call culture, or what we in Constructive Realism call *„Realität"* (as opposed to *„Wirklichkeit"*, the given world, or actuality, as we have seen above). This conception of science as the invention of constructs accommodates the fact that science modifies the world, whereas the traditional concept of science as description, mirroring the world, cannot bridge the gap that it itself has created by discriminating so-called pure theory and so-called pure praxis.

Are the false forms of interdisciplinarity not precisely such judgments from without? The meaning of love is thus very simple and is practiced by the very methodology of strangification: Who hasn't got love for the object of a scientific discipline and for the discipline itself, if not the practicing scientist himself! And is explanatory interdisciplinarity not sometimes maybe the result of a malevolent gaze through which a certain scientist perceives other disciplines?!

Another question that remains open in this context is that of what to make with the concept of truth. What is the place of „truth" in this new understanding of science as it is conceived by Constructive Realism? In traditional philosophy, truth has mostly been thought about in a general sense. This was based on the misconception of knowledge as image of the world: if thinking was the production of images of the world, then knowledge was the production of images that stand in a certain, definable relation to the given world. In scientific praxis, the question of truth is altogether futile. Working scientists rarely use the term „truth". Since we discard the traditional view on science, the concept of truth either becomes meaningless, or it is transformed. This is not easy to grasp, since traditionalists will object that truth can only make sense in an absolute sense, and that, for instance, an operational,

contextual understanding undermines the very meaning and function of truth as it was held by philosophers throughout the greater part of the European intellectual history.

Yet the concept of truth, if it is worth to be held – or rather, if it is to not be defused – can only be made sense of, if it is acknowledged as having a purely operational function, that varies with the specific context in which it is used. A proposition can only be called true with respect to the conditions under which it is used. As a matter of fact, this can be easily understood if we imagine the following thought experiment: I can say that it is true that if I add one thing and another thing, I get two things. Yet, this holds only if we make clear the circumstances under which this sentence is true, namely if we make explicit the presupposition that we are talking about things that are stable and impermeable. In the context of permeable things though, say two droplets, the same statement would not be true anymore: if I merge one drop of water to another drop of water, I will still have only one drop of water.

Now that we have claimed that science has to be conceived of as an activity rooted in the broader context of human activities within a culture from which it cannot be completely dissociated, we have to proceed to explain what exactly is the link between both the concept of interdisciplinarity and that of interculturality. What can we learn from strangification to have a better form of interculturality?

As we have seen already, interdisciplinarity was traditionally conceived of in the way that one leading science was influencing both the way problems were posed and the methods that were used in other scientific disciplines. This misconception of interdisciplinarity, which has not ceased to cause ravage in the scientific landscape has had its analogue in intercultural affairs. The link between both is not one of mere analogy though. Deficits in interdisciplinary and in intercultural realities are tied together, and the origins of this fatal link can probably be found in the intellectual colonization that was practiced ever since the time of the Jesuits up from the late 16th century. Since that time, the negative effects of false interdisciplinarity, notably the idea of a science dominating other sciences, have not ceased to permeate and influence the way interculturality was conceived of and practiced by Western politics. The problem of interculturality is the same: the relations between the European culture and other cultures have been dominated by the assumption, that European culture is the dominant and best culture, and thus the structuring framework within which other cultures can be judged.

Today's call for more tolerance has been a somewhat panic and weak solution to the problems posed by the violent domination of one, the Western, culture over so many different cultures. Real tolerance, though, is not a simple moral question of attitude. If we want to conserve the manifold and irreducible variety of cultures, we have to find a way how to preserve another culture and at the same time contain our own culture. A merely passive tolerance will not be able to stop the unified culture that we, as the totality of cultures, are moving towards right now. Here again, strangification might be the solution to this otherwise inescapable scenario. We have to become aware that we can strangify our own cultural beliefs by another culture and

thereby learn more about our own culture. Even more, the existence of foreign cultures is an indispensable condition for us to understand our own culture. While the call for tolerance often preaches only a negative form of relativism, strangification is a positive form of relativism (a relationalism, a „Vernetzung“), because strangification consists not in a spontaneous, unreflected self-limitation, but rather self-limitation itself is the effect of our learning from a cross-border experience. Other than with forms of negative relativism, where each culture is flagged down to lead an insular existence and to not communicate with his neighbor unless with an artificial folksy curiosity, the positive and strangified relativism of real interculturality consists in a self-experience in an alien land. If I go to China, I do not expect to be able to adopt and to understand the Chinese lifestyle. I would not learn it in my lifetime. Nevertheless, I can learn a lot more about myself, if I become aware of the presuppositions of my own culture that are thus revealed.

Conclusion

Interdisciplinarity is a need in times of more and more isolated disciplines of science. But there are three unsatisfying types of interdisciplinarity: The unreflected combination of results from different disciplines is purely instrumentalistic. To encompass all possible knowledge from all disciplines with the goal of a universal knowledge is the impossible idea of a universalizing interdisciplinarity and depends on a dominant discipline. And an explanatory interdisciplinarity, which applies methods of one discipline to other disciplines, leads to the relativization of one method by another method.

In contrast to that Constructive Realism does no longer accept the imposition of methods of one science onto the methods and objects of another science and offers a type of interdisciplinarity called strangifying interdisciplinarity. This kind of interdisciplinarity aims at the understanding of our own scientific discipline by the opposition to other disciplines. The methodology of this interdisciplinarity is “strangification” (German: “Verfremdung”), which means that some propositions are transferred from one discipline into another. Thereby the scientist gets to know the presuppositions of his propositions. This leads to the understanding of the meaning of the propositions of a science.

The strangifying form of interdisciplinarity offered by Constructive Realism rests upon several ontological and epistemological assumptions, most notably: Scientists are not describing the world but constructing realities. Science makes constructs. Knowledge is more than only information or data but a know-how about how to become aware of these data. Truth has to be understood as relational and not as absolute. There are different sciences based on different cultures.

Also a proper concept of interculturality can be based on the concept of interdisciplinarity offered by Constructive Realism. With the help of foreign cultures we are able to understand our own culture. Thus a negative relativism is overcome by a positive relationalism.

References

GREINER, K. (2005): Therapie der Wissenschaft. Eine Einführung in die Methodik des Konstruktiven Realismus. Berlin/Wien: Peter Lang.

JANICH, P. (1996): Konstruktivismus und Naturerkenntnis: auf dem Weg zum Kulturalismus. Frankfurt am Main: Suhrkamp.

MATURANA, H. R. / VARELA, F. J. (1980): Autopoiesis and Cognition. The Realization of the Living. Dordrecht: Reidel.

SCHMIDT, S. J. (1992): Kognition und Gesellschaft. Der Diskurs des Radikalen Konstruktivismus 2. Frankfurt am Main.: Suhrkamp.

SLUNECKO, T. (1997): The Movement of Constructive Realism: A Festschrift for Fritz G. Wallner. Wien: Braumüller.

WALLNER, F. (1991): Acht Vorlesungen über den Konstruktiven Realismus. Wien: Wiener Universitätsverlag.

WALLNER, F. (1997): How to deal with science, if you care for other cultures. In: Philosophica 15, Wien: Braumüller.

WALLNER, F. (2002): Die Verwandlung der Wissenschaft. Vorlesungen zur Jahrtausend-wende. Hamburg: Dr. Kovac.