Science and the Future of Mankind
Pontifical Academy of Sciences, *Scripta Varia* 99, Vatican City 2001
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SCIENCE AS UTOPIA

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Utopias are emigrated wishes; science is a way to recover them. What do we mean when we say that science has a utopian character and is a utopia? Is not science real? Is not science an essential part of our academic life and an essential part of the modern world? In this paper I shall propose four brief theses to describe the utopian element in science and its peculiar infinity.

1. *Uncompleted Science*

Science is never perfect; it is always something that is unfinished – not in the sense of a defect, but as something that belongs to the essence of science, to its peculiar infinite character. If science were something which could be completed, that is to say, if at some point everything that can be explained with scientific methods were to be explained; if at some point all questions that can be posed scientifically were to be answered; and if at some point everything that can be mastered with scientific methods were mastered, then science itself would be a mere means, an artefact, not a process – at least not in the sense that science constitutes precisely the future potential of a technical and rational culture such as ours. It would be as if one took rationality or reason to be something which could be completed, to be something that one could at some point have at one's disposal as a perfected good. But rationality and reason are, in opposite fashion, never completely fulfilled. They are demands upon thought and action that must be constantly aroused, at least in the wake of the European Enlightenment. They are demands whose sense lies not in their complete realisation but rather in their 'infinite' contribution to orientation.

This is the case, too, with science. In science we find expressed the 'infinite' will of man to comprehend his world – and himself – and even more

to make it his own work. That this, too, in turn, is an infinite task lies not in the fact that this task itself is utopian – we already live in a world which is to an ever increasing extent the product of scientific and technical understanding – but rather in the fact that there are no scientifically final answers to the question of how the world of man, insofar as it is (also) his product, should look in the end, and how mankind, even with scientific means, should understand itself. Furthermore, science is extremely inventive, not only in its results but also in its questions, and it is inexhaustible, just as understanding and reason are inexhaustible. 'Science as Utopia' is an expression of this 'infinity' of science or of a scientific culture, and it is the expression of the insight that science – again, like understanding and reason – always has its essence ahead of it, that is to say it always lives in the awareness that it is not what it is supposed to be, namely – in the words of the German Idealist Fichte – absolute knowledge. Such knowledge is indeed a pure utopia, but a useful one: it keeps the process of science and the process of knowledge in general in motion.

2. *Transdisciplinarity*

The scientific spirit is in motion – not only along the usual paths of research but also with regard to its own disciplines. Disciplinary orderings are increasingly replaced by transdisciplinary orientations. Transdisciplinarity means that research is to a great extent in motion out of its disciplinary limits, that it defines its problems independently of disciplines and solves them by passing beyond these boundaries. The institutional expressions of transdisciplinary orientations – which are effective wherever a strictly disciplinary definition of problem situations and problem solutions no longer fits – are the new scientific centres that are being founded or have already been launched, such as the Harvard Center for Imaging and Mesoscale Structures or the Stanford Bio-X Center. These centres are no longer organised along the traditional lines of physics, chemistry and biology institutes or faculties but rather from a problem oriented perspective, which in this case follows the actual development of science. Transdisciplinarity proves to be a promising new research principle. Where it is in place, the old institutional structures begin to look pale. Research is looking for a new order.

The development of science in a transdisciplinary direction may even reawaken the notion of a *unity of science*, which during the development of modernity replaced the older notion of the unity of nature. But this notion of a unity of nature seems also to have gained ground once again (in sci-

ence and philosophy), at first as the conception of a unified physical theory – if there is only one nature, then all natural laws must also be part of a unified theory of nature – then in the form of increasingly transdisciplinarily-oriented scientific research. If nature does not distinguish between physics, chemistry, and biology, why should the sciences that study nature do so in a rigid, disciplinary manner?

The unity of science and the unity of nature may well be philosophical dreams, but their basis – ever more strongly integrative, indeed, transdisciplinary research – is real. Some examples are: (1) nanotechnology, in which physicists, chemists and biologists work hand in hand in the production and investigation of nanostructures; and (2) foundational questions of quantum mechanics, which are worked on in cooperation by physicists with very differing backgrounds, especially mathematical physicists and researchers in the field of theoretical and experimental quantum optics, and by information scientists and philosophers; but also (3) monistic and dualistic explanatory conceptions within the framework of solving the so-called mind-body problem, in which originally purely philosophical approaches are connected with research in neurophysiology and neuropsychology into the empirical connections and mutual dependencies of physical and psychical states and processes. Transdisciplinarity is constantly reinventing science – and in this way it remains close to science's 'infinite', and thus also always utopian, essence.

3. *The Limits of Science*

There is scarcely a place where the unfinished, 'infinite' or utopian character of knowledge and of science is made more clear than in the question of the *limits of knowledge and science*. It is all the same whether *practical* limits are meant, that is, limits presented by our comprehension and the means it has at its disposal; *moral* limits, that is, limits that place knowledge acquisition and science under ethical categories; or *theoretical* limits, that is, limits that cannot be overcome – independently of practical and moral limits. Here we are concerned with the question of a *de facto* finitude, which would connect the utopian with knowledge and science, this time in a negative sense.

The philosophy of science discusses this question, usually with reference to the natural sciences, in the form of two theses. (1) The thesis of the complete or asymptotic *exhaustion of nature*. According to this thesis, the history of scientific discovery is either absolutely finite or at some point

goes over into an asymptotic approximation to what can be known. The place of innovations would be taken by filling-out and mopping-up operations, the calculation of additional decimal points, and the classification of additional cases, which tell us nothing that is essentially new. (2) The thesis of the complete or asymptotic *exhaustion of information capacities*. According to this thesis, the scientific information possibilities are either again absolutely finite or at some point go over into an asymptotic approximation to absolute limits of information. Here, too, filling-out and mopping-up operations would take the place of innovations. Science would have exhausted its own research and articulation possibilities; between it and a possibly unexhausted nature there would rise an insurmountable information barrier. The crucial question – whether scientific progress still has a future – would only be apparently paradoxical. However, within the boundaries of the two theses presented, this question is unanswerable, and this, too, speaks in favour of the infinite and the utopian in the affairs of science.

One reason for this is that *questions*, and in particular scientific questions, know no bounds – what would be the sense of saying that all questions are answered? (At best, saints could talk like this). And the *goals*, in this case goals pursued by scientific knowledge, are similar. If research is not determined only by the respective state of research already reached (for instance with regard to answering scientific questions), but also by the (internal and external) goals tied to it, then the notion of an end to scientific progress would not only include the assertion that we know everything (that we can know), but also the assertion that we know all goals (that we can have). The number of these goals, however, is unlimited even if we accept the limits ascribed to the scientific permeation of the world and of mankind. But this means that in order to be able to answer the question – whether scientific progress has a future – we would in a certain way already have to know what we do not know now, that which only scientific progress or its failure could show. In this sense there are no limits to science.

4. *The Phoenix*

What I have said about transdisciplinarity applies to scientific thinking in general: scientific thinking, so to speak, constantly invents itself anew, realises itself in its constructions and destroys itself with its constructions. The phoenix is the symbol of science just as the owl is the symbol of philosophy. Science creates itself just as philosophy constantly looks at itself and what it has seen. Science lives from the mortality of knowledge, phi-

losophy from the immortality – or better, from the infinity – of reflection, which also constantly meets itself, while science forgets and discovers. Only the concept of construction holds the two together. For philosophical reflection, too, – as long as it does not just reproduce itself hermeneutically in a state of infertility – constructs, designs new worlds and fills them again with its grown-old experiences.

Returning once again to the beginning: if science knew everything that it could know, it would in a certain sense be perfect in its limitation and finitude, that is to say, everything that could be explained according to its own questions would be explained; everything predictable according to its cognitive base would be explicated; everything cognitively demanded according to its own epistemic intentions would be available as an instrument; and what is given with the above mentioned perfections would leave no room for other things to be explained. But this notion suffers from the above mentioned circumstances connected to the infinitude of our questions and our goals. Scientific progress is thus limited neither by an attainable perfection of knowledge nor by absolute theoretical limits of knowledge – however, there are practical limits. For the limits of science are either *limits of error* (the scientific intellect is stymied by its own insufficiencies) or *economic limits* (scientific progress becomes unaffordable) or *moral limits* that are always given whenever scientific progress turns against mankind itself. Whatever the case, every measure of science that puts limits to its progress is a practical measure and thus a self-given measure. And this, too, means that science is always essentially something unfinished: uncompleted limits and uncompleted limitlessness – the concrete utopia of science.