

Chap 12, in Habib, S. Irfan and Raina, Dhruv (eds.), *Situating the history of science : Dialogues with Joseph Needham*, Oxford University Press (New Delhi), 1999, p. 303-324 (Oxford India Paperbacks, 2001). (Trad. en anglais, par M.P. Original français : 1997f, 1999c).

Universality of Science : Historical Validation of a Philosophical Idea ^A

by

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SUMMARY.-

The question of the universality of science is considered, in contemporary debates, under the most varied and opposed positions depending whether one is sharing the point of view of an "ideal science" or that of a "social production of science". In the first case, science is conceived as the "hard core" of its statements and results at the period under consideration, and its supposed universality ignores factors that relativize its contents of knowledge, and which can be of a conceptual as well as a social nature. Conversely, an exclusive focalization on the social aspects of the production of scientific knowledge ignores the objective character of these knowledge contents, be they either thought objects such as mathematical ones, or phenomena of the real, physico-biological as well as human and social, world. These two extreme positions, although caricatural, are shared by many. They illustrate the absence or ignorance of interdisciplinary analyse between philosophy, the various sciences, history of sciences and general history.

We shall first evoke very briefly elements of the critique set against the universality of science as they stand nowadays from inquiries of philosophy of knowledge, sociology of knowledge, history of science, history and anthropology. Then we shall try to set philosophically the problem of the universality of science as a philosophical idea, strongly linked to science and to philosophy since their genesis. We shall see, by following the idea at various stages of the history of thought, that the philosophical statement of universality of science has to be confronted with the historical reality of the production, diffusion and assimilation or appropriation of scientific knowledge, always specifying the various dimensions of that one (which include its applications and its links to

^a Paper presented at the *International Conference Science the Refreshing River. On the History of Science and Civilization*, New Delhi, 2th-4th sept. 1996.

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techniques and to technology).

1

THE NEED FOR A HISTORICAL ANALYSIS.´

The problem of universality of science is considered, in contemporary debates, under the most varied and opposed positions depending whether one is sharing the point of view of an "ideal science" or that of a "social production of science". In the first case, science is conceived as the "hard core" of its statements and results at the period under consideration, and its supposed universality ignores factors that relativize its contents of knowledge, and which can be of a conceptual as well as a social nature. Conversely, an exclusive focalization on the social aspects of the production of scientific knowledge ignores the objective character of these knowledge contents, be they either thought objects such as mathematical ones, or phenomena of the real, physico-biological as well as human and social, world. These two extreme positions, although caricatural, are shared by many. They illustrate the absence or ignorance of interdisciplinary analyse between philosophy, the various sciences, history of sciences and general history.

It is true to say, as we all are conscious, that science is not only a set of knowledge, ruled by the judgements of reason and of experience. Science is also involved in a cultural and axiological context, and stands on values that are commonly accepted by the culture in which it takes place. But science is also an activity and includes, as such, its practices, that are socialized ones or even directly social practices. Science contains also its applications which have consequences on the transformations of society, and these transformations have a direct retro-effect on science itself. Science, technology and society are closely related, and contemporary science is often considered as "technoscience", a concept invented to express this complexity.

To-day science is inseparably the system of science and technology, in which the two dimensions I mentioned previously also take part, science as content of knowledge and science as practice. The fact that, when we speak of science, a system is at stake means that we are compelled to consider that the very notion of science means indissociation between knowledge as content and the concrete situations in which it is embedded. This means that, even if we would consider only the epistemological dimension of science, that is science as a type of thinking, we would have to consider the possibility of these effects or consequences as virtual properties of such a type of thinking. This expresses nothing else than the following evidence : human thinking, whatever be the form under which we consider it, carries with itself the virtuality of man's practices, actions and sociality.

At every period of history, and in every cultural area, science, or its equivalent, is embedded in a cultural totality of an organic nature and constituting by itself a system. This systemic character makes difficult to conceive the possibility of transmission of a state of science and of culture to another one, be such transmission considered either in space at a given period, or in time along the flow of history : out of their systems, the elements that constitute these systems undergo a shift of meaning. Hence the difficulty of the question of transmission, which, as I shall try to show, is at the heart of the question of universality.

This state of affairs is eventually taken as an excuse by those who consider that the debate on the universality of science is closed, because it is strictly related with the claim of universality made by the "western-positive-technological" conception of science. Those who share this conception consider that to-day science, "world science", is the only universal science, and they would deny any other and further consideration. One could however object that "universality" meant in that way is not necessarily a feature of this science, but has been imposed by an economical mode of domination related systemically with the power of technology.

On the contrary, radical opponents to this "imperialist" conception of science would deny any value to the notion of universality of science, precisely because of this systemic solidarity between science and domination. But they ignore that systems evolve and that elements taken from within a structure can be transferred to another structure without disappearing. In such a case, it will be interesting to inquire ourselves about the changes of meaning these elements suffer, or, eventually, about some permanencies that can be observed through the process of transmission. And, indeed, if translation is treachery, it might well, for this very reason, endow some creative effects.

With this in mind, we can wonder whether there is not, in the case of "universality of science", something that resists the strong criticisms that have been opposed to it. I am sure that Joseph Needham - who wrote an admirable meditation on the historian of science as an œcumenical man¹ - would not have liked to leave up the idea of universality of science, for it would mean at the same time to leave up the idea that science is value, and deprive us from one of our means - tools or arms -, to act in favour of the enlightenment and accomplishment of mankind. And it thus would make us leave the place for the benefit of growing obscurantisms and fundamentalisms. But, for sure, we have to question science and the idea of its universality, in order to understand better what kind of reality and effectiveness these notions have.

I shall take as my point of departure, in this intended critical analysis and reconstruction, the state of criticism, now rather known, corresponding essentially to : 1) reflections on the insertion of science in the industrial and capitalistic society (see, for instance, the works of Max Weber, of Jurgen

¹ Needham [1993].

Habermas, of Jacques Ellul, among many other); and 2) reflections on the link between science and imperialism, which have been growing during the last two decades and of which the studies on "Science and Empires" are a part.

Admitting these analyse and criticisms as known, I shall try, in what follows, to develop some elements of argumentation which are more a call for further thematical investigations than mere statements or conclusions. For, I think, the question of universality of science is primarily a question about the nature of science, science as we consider it nowadays, but also science as it has been in the past. And, about this, our knowledge is far from being close : we discover new dimensions and aspects of science that shed more light on the question of its universality.

For all these reasons, we can see that this question is twofold : on one side it is, undoubtedly, a philosophical question, and it must be considered with a philosophical mind. But we cannot, as closed philosophical systems would do, consider that philosophy by itself can give the answer. For science is - besides any attempt of definition - a reality, a historical, intellectual and social, reality, and only by historical investigation can we hope to grasp something of its reality - through its evolutions. The same can be said about the idea of its universality, the meaning of which has evolved through the centuries.

At this stage, we would propose that universality of science is a philosophical question submitted to the proof of history.

We shall dedicate now some time to the philosophical point of view ; then, we shall adopt a historical point of view, which will be centered around two considerations : history and anthropology on one hand, history of science as a history of transmissions on the other hand.

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THE POINT OF VIEW OF PHILOSOPHICAL ANALYSIS

The program I propose to consider is the following : look for the founding concepts of the idea of universality concerning science, to see whether our criticisms let us in the end some sound elements that fit with our intelligibility requirements. Then, inquire into history - general, cultural and anthropological history -, and into history of science, to see whether a concept of universality can be reconstructed from such elements that would be better suited with real and living science.

I shall restrict myself, for this investigation, to the philosophical

tradition of Mediterranean and Western world that is usually considered to begin with ancient Greeks. In doing so, I let aside other origins of our modern science, thus calling for complementations about the foundations of science and philosophical ideas in other cultures that have been influent on the constitution of present modern science. For Greek culture is only one of the origins of our present conception of science.

Our notion of science, and modern science itself, have one of their main roots in the founding moment of the birth of science and philosophy, in old Greece, when the ideas about the world, that is cosmology, underwent a crucial transformation from *mythos* to *physis*, from mythological descriptions about the creation of the world and the order of nature to natural ones, organized through reasoning². A new form of thinking was thus appearing : it would develop from these “positive” thinking of the old Ionians and from another current of abstract thinking thus appearing with Parmenide and the Eleates and which, from Socrate to Plato, asked about the deep truth and the real being that hide themselves under mere appearance and change of nature. They established the *logos* as the principle of rational thought, together with the requirement of intelligibility, which refers to the idea of *being*³. Aristotle would explicitate the role of the *Logos* as the series, endowed with a meaning, of the words having a meaning, which led him to emphasize the idea of demonstration. It is this *logos* that makes the difference, according to him, between man and animal⁴.

In the conception of the *Logos* as developed by Greek philosophy - although not so much in Aristotle, who favoured logics-, the role of mathematical thinking is emphasized, due to the mathematical method of reasoning that overcomes the approximations of discourse in ordinary language and to its ability to serve as a model, because of its ideal objects that make possible to relate, through rigourous logical reasoning, the one and the multiple, the identical and the varied, by referring one to each other the elements of geometrical figures.

The *logos* verifies permanently the validity of established meanings : in other words, any uttering asks for its own criticism. This function of the *logos* is, at the same time, and for this very reason, claim of universality, whose idea was being born with it.

The conception of science inherited from Greeks, even if it has been modified - in particular through the adjunction of the notion of experience and the experimentation procedure -, is hencefore closely linked to the ideas of universality, of reason, of philosophy.

The close link between the coming up of the philosopher and the advent of the citizen⁵ is worth to be emphasized, for these ideas arose, as a matter

² Cornford [1912, 1952], quoted and discussed by Vernant [1965].

³ Vernant [1965], 1985 ed., p. 383.

⁴ Aristotle, *Politics*, Book I, chapter 2. Cf. Labarrière (1994).

⁵ Vernant [1965], 1985 ed., p. 392.

of fact, together with the rational mode of arguing that dialogue is, in this peculiar society ruled by democracy - in a way, these ideas are an emanation of this society. Rational dialogue is, in this sense, a formalization of that social invention of the Greek city, democracy. But, should we add, it not only formalizes it but transcends it, for its further fecundity would overpass the limits inherent to this first form of democracy towards a more "universal" widening which will go along with the idea of humanity (or mankind) - still a very restrictive idea at Greeks' time.

Because of this "social origin", the idea of universality, together with those of reason, of science and of wisdom (*sophia*), all pretending to transcend, through the notions of being and of truth, the circumstances that gave birth to them, these ideas cannot, indeed, escape criticism.

But we are aware that the contingency of circumstances does not forbid - on the contrary it can possibly make it manifest - the universality of some human dispositions such as art, symbolisation, ability to make objects and to technics, religious feeling and metaphysics, the demand for meaning, and the capacity of rationality is one of such dispositions. It remains hencefore our task to question this rationality, its content, its evolution and its effects, under the point of view, precisely, of universality.

Let us keep, from all that, that the idea of universality, as well as the ideas of reason and of demonstrative (and even objective) science, with which it has a constitutive link, carries with it the requirement of its own criticism. In this, it would show particularly adequate, in its principle, when one would aim at overcoming the limitations of a local culture, or at making possible a communication between cultures.

This idea was enrooting and, so to speak, "universalizing" itself still more with regards to the conditions of its origin. The story would be long to tell : there were numerous centuries of maturation where philosophy, religion and theology, sciences, and social transformations as well, were in close interaction.

I shall only mention the affirmation of universality of the faculty of judgement, that seems to be well established between European Renaissance and eighteenth century. It is well expressed by Descartes' words in the opening of his *Discourse of the Method* : "*The power of judging well and of distinguishing the true from the wrong, that is poperly what we call good sense or reason, is by nature equal in all men*". Worth of emphasis is also the strong ties it holds with the possibility of a universal doubt⁶. With Descartes, doubt is founding of a knowledge that is to be, at the same time, and for this very reason, universal. Here something quite new sprang up : the only true knowledge is that knowledge that, for every thinking subject, overcomes the obstacles opposed by doubt.

The great lesson from Descartes' *Regulae ad directionem ingenii - Rules for the guiding of the mind* -, a lesson that was to be somehow

⁶ Descartes [1637a], first part (my emphasis, M.P.).

underestimated by positive science that would develop after his time, is that there is no knowledge and science if not through subjectivity, which is the proper place of intelligibility. Every mind, every subjectivity finds in itself its understanding and its judgements, and keeps in itself the ability of getting at truth without any need to refer to any authority.

I said that posterior science was to silence somehow this lesson, and to prefer keeping the one of man's power on nature. But philosophies would generally maintain something of the idea. Kant's philosophy, for instance, re-established against the critiques of empirism the demand of reason by gifting the transcendental subject with sensibility and understanding, that make knowledge possible by allowing him to organize rationally his experience of phenomena. It took, however, science as it was given, aiming at justifying it but without considering as a possibility an eventual future recasting.

As to Descartes's project to found a science that is certain, if it has been effective only with geometrie, and mainly failed for the rest, its inspiration is to be found in his philosophy, notably in his *Meditations*, where he proposed to look back to the *ego cogito* as the first evidence, eventually able to provide an absolute foundation to knowledge⁷. Edmund Husserl was to see in it the instauration of "a new type of philosophy", in which "naïve objectivism is replaced by transcendental subjectivism" (see Husserl's *Cartesian Meditations*⁸). This universal science was, for Husserl, philosophy itself, such as it is considered by phenomenology. To found knowledge, the philosopher must take everything again to his own account : "Philosophy, he said, is a personal affair of the philosopher", "it must be constituted as his *own*, be *his* wisdom, his knowledge that, although its tends towards universal, is acquired by himself and that he must be able to justify since the start and at each of its stages"⁹.

Let us forget this particular philosophy, Husserl's phenomenology : I only wanted to mention the resonance of this perspective with the question of the criticism and of the eventual refoundation of the universality of science. Its claim begins with a radical questioning on everything that we believe to be evident or certain, and this questioning is done in a decidedly fundamental way, as a coming back to thought as such¹⁰, to the subject as being the place and the condition of thought, actor and warrant of any possible knowledge : this subject of knowledge, that is truly at the heart of the question of its universality.

⁷ Descartes [1641].

⁸ Husserl [1934], 1992 ed., p. 21.

⁹ See also Husserl [1954].

¹⁰ See Groethuysen [1995], pp. 127-134.

3

THE LESSONS OF HISTORY
AND OF ANTHROPOLOGY

The notion of universality that, from the point of view of philosophy, we have seen going along with that of reason, goes along, from the point of view of history, with the notion of mankind, "the coming of which is very recent and limited in expansion", as Claude Lévi-Strauss recalls us in his admirable small book *Race and history*¹¹.

The idea of mankind, overtaking the narrow frontiers of the tribe or of the city so as to embrace the whole of human beings, have been formed progressively, in the Mediterranean and Western world, from Greek philosophy and monotheist religions - not without episodic backward steps, the recent forms of retrogradation being racism and the various ethnocentrism in present time. The notion of mankind, of universality of the humane, owes undoubtedly much to Judaism and to Christianity. I am too much ignorant about non-western philosophies, but I remind that Joseph Needham asked for the need to investigate what form the idea of mankind and of its unity had for instance in Confucian thought¹². The same should also be done with the teachings of Buddhism.

Something was still missing however, in the cultural area of Western Europe in the finishing Middle Age, to this notion of mankind: the sense of its exact relationship with nature, of its situation in the Universe. It was required, to acquire it, to challenge the divinity insofar as this last stood as a closed thinking, and this came with the opening of the skies, with the foreseen possibility of man's freedom. It might not have been by mere chance that the last restrictions against universality of the humane fell at the same time as the rigid spheres of the old cosmos did break out.

Let us jump, in our evocation, from the humanism of European Renaissance and from the new vision of the world symbolized by the names of Nicolas Copernic, Giordano Bruno et Galileo Galilei, up to eighteenth century, with its great travellers, whose relations speak of the encounter of man with man, and with its blossoming of thinkers of Enlightenment - from Giambattista Vico to Charles Secondat de Montesquieu and to Giambattista Beccaria, from Jean-Jacques Rousseau to Denis Diderot and M.J. Nicolas Caritat de Condorcet -, elaborating anthropological, philosophical and juridical conceptions that proclaim the equality in right of all men on the Earth. The first article of the *Universal Declaration of Human Rights* of the 1789 French Revolution acknowledges this

¹¹ Lévi-Strauss [1952], p. 21.

¹² Needham [1993].

irreversible acquisition of human thinking, beginning with : “All men are born free and equal in right...”.

At the same time mankind was admitted as a conscious reality, and maybe as an effect of it, people became aware of the great variety of human cultures, incomparably more varied than races or ethnies.¹³ Levi-Strauss observes that cultures - and languages as well - which have a same origin tend to diversify one from the others, while, on the contrary, those which have different origins develop common characters by which they seem to converge. He underlines also that any human people and culture, be it a known or an ignored one, be it considered as an evolved or a “primitive” one, lets behind it a history that is as long as the others ones. Some of these histories are cumulatives, for complex, always circumstantial, reasons; there happened to be interactions, influences and borrowings between them, that we cannot simplify according to a linear course decided in fonction of the progress of a single one.

On the long duration that extends from prehistory up to us, we register the marks of neolithic revolution, which shows all the characteristics of universalization by its contagion to all the peoples on the Earth, and also the marks of further important transformations of which the most recent are the scientific and the industrial revolutions, whose propagation seems akin to something universal from the facts although, it has been suggested, possibly more through effects of coercion than of free choice. Through these transformations, anyhow, progress neither appears to be a necessary occurrence, neither is it a continuous change. As we look at it, progress seems to proceed through jumps and mutations, through changes of orientation. We could possibly apply to its jerky and aleatory but in any case unavoidable motions, the metaphor of the transforming breaks of plate tectonics : in the end, some displacement lets be shown, visible upon the duration of time, that we call progress. Yet we would have to discuss from which variables this judgement is stated. Anyhow, the fact remains: from a given point of view, that depends on variables and of values pertaining to our culture, progress of scientific and technical knowledge lets itself be stated.

The idea of progress, stemming from the accumulation or summing up of knowledges, is inherent to our conception of science, and it is tied with the critical function of reason, constitutive of science. However, the cumulative aspect of knowledges that underlies this stated progress, notwithstanding its objective character, is relative : it has to do, so to speak, if we look at it closely, with the projection on one axis only of the various components of a culture. “Modern culture” gives privilege to the axis that measures scientific development. Other cultures give privilege to other, different, axes.

What makes the originality of each of these cultures sits “in its particular way to solve problems, to put values in perspective, problems and

¹³ Lévi-Strauss [1959].

values that are approximately the same for all men : for all men without exception possess language, techniques, art, knowledges of scientific type, religious beliefs, social, economical and political organization”¹⁴. These characters can also manifest themselves in predispositions to some genuine assimilation of elements originated in a different culture, through the development of particular abilities that may eventually create new forms of thinking or new practices. All cultures proceed with the inheritance from passed generations and through communications with other cultures ; a part of common patrimony may eventually be rediscovered through a process of differentiation-unification that is characteristic, generally, of the relations between cultures.

One of these cultures, the so-called “western culture” (in fact, a bunch of cultures, the origin of which is not only western), has generated industrial revolution and also contemporary science with its particular meaning, its own cultural value. It has spread over the world, a situation not unprecedented if we think of prehistory with neolithic revolution, and of the beginning of history with the invention and the diffusion of writing.

Downstream the centuries which follow these instauration, the question of knowing where exactly they have appeared is of a secondary and even anecdotic interest, when compared with the fundamental fact that all cultures caught these rather quickly for their own sake and assimilated them - through transformations from their original forms. The place where neolithic revolution took place is finally of little importance as all human cultures have been able to make it their own. Similarly, what importance, Levi-Strauss observed, to know in which culture industrial and scientific revolution began ? The simultaneous coming out of the same technological overthrow followed by social upheaval in societies having accepted it show that these modifications did not hold to the peculiarity of the genius of a culture, but “to conditions that are so general that they are located outside the consciousness of men”¹⁵. Such “revolutions” are not limited to the modalities of their coming out : they are got to take new forms, to which all cultures on the inhabited Earth will take part, whatever the conditions.

Given this background panel, we would have to evoke the circumstances by which, in history, modern science has constituted itself in correlation with the idea of its universality. In the gross lines this history is known. The essential idea I shall retain from it is that the representations given by science appear to us more and more explicitly as constructions.

To admit that science and, up to a certain point, reason itself, is built - beyond a more immediate *function of rationality* -, does not affect its universality in right, that is its potentiality to expand. In a given cultural environment, these rational elements have been progressively elaborated, woven by the threads endlessly intertwined of experience and of understanding, molding and filling

¹⁴ Lévi-Strauss [1959].

¹⁵ Lévi-Strauss [1959], p. 50.

with substance the frame in which they are taken. But their universality might still be only a partial and a restricted one, relative to this culture where they were born. Their universality will be in a position to be safely stated only if these elements resist confrontation - on the level of knowledge, and not as resulting from coercitions at other levels that would make them took over, usurpated - with other elements originated in other cultures : or, if they feed themselves with these other elements, getting at a larger universality.

4

SCIENCE : A HISTORY
OF TRANSMISSIONS

In their variety (variety of their objects and of their methods), and in their diachrony, sciences never ceased to feed one another, ensuing subsequent changes in their nature and renewing themselves. It is a lesson of history that when a “science” becomes rigid and closed in itself, it is doomed to disappear from the field of knowledge. It fossilizes, such as astrology and alchemy, living sciences yesterday, cultural reliefs today.

History of sciences shows also scientific traditions in formation, in a given time and in a given place, characterized by given types of problems, of approaches of their objects, and of practices. Filiations in works at successive periods assess the existence of these traditions, of these schools¹⁶. Eventually, these last extend to a whole culture : in that sense one speaks of the chinese scientific tradition¹⁷, of the scientific (mathematical, astronomical, etc.) tradition in Arabic language or of Islamic countries¹⁸... Transmissions from a tradition to another one are observed : from Greeks to Arabs¹⁹, from Arabs to Mediterranean Europe...

Contemporaneous science has resulted from these transfers, from these modifications. In particular, if science in the sense we mean today is eminently the heir of Greek thinking, of its notions of *phusis* and of *logos*, it has borrowed also one of its fundamental constitutive components to a different source : I mean technics and experimentation, that seem to have been foreign to Greek thought of science, notwithstanding the remarkable inventions of Greek

¹⁶ Paty [1990], chap. 4.

¹⁷ Needham [1974, 1993].

¹⁸ Rashed [1984, 1986, 1992, 1994].

¹⁹ Rashed [1993], chapter 1.

engineers, mostly developed in the alexandrine period²⁰. And notwithstanding also the mechanical works of Archimedes which bear on statics only and which still witness the absence, in this culture, of a relationship between theoretical thought and practical knowledges, these knowledges being considered as belonging to empiria and escaping pure rationality.

In the long run, new currents have been formed from various preceding traditions, from which they borrow elements which they integrate in an original construction, giving birth to new traditions that reveal to be fruitful.

Modern science, as it has developed in Europe since Renaissance in the sixteenth and seventeenth centuries, has inherited from science of Greek Antiquity, from science in Arabic language and from science of European Middle Age, all these scientific traditions being themselves in filiation one to the other, although in a non linear manner. And being also indebted to other traditions, such as those from the East, through the complex and innumerate exchanges that never ceased from Antiquity and Middle Ages to European Renaissance, between East and Mediterranean shores and from there to Western Europe, about which too little is still known. We know about caravans and trades, about military and political conquests, and for sure exchanges of ideas and of knowledges have gone along with them : but on these, history is still wanting. In such exchanges, openness to difference and novelty from inside a tradition towards other ones is indeed a factor that benefits the first and makes it gain in universality.

Modern science itself began with an italian period, that culminated, with respect to the science of nature, with Galileo ; its second period is referred, by the well-known nineteenth-century German historian of physics J. C. Poggendorf, to one “where the other peoples of Europe took an always more active part”, with British and French sharing the first rank (this second period began, according to him, with the foundation of the London Royal Society in 1662 and the Academie des sciences of Paris in 1666)²¹. Henceafter the flame divided and multiplied, being passed to numerous European countries, and the development of the different branches of knowledge occured in the most varied directions, science itself taking a new form.

One may evoke, in a more “local” manner, a more specific example which deserves detailed study, the case of “mathematical physics”, that was established in eighteenth century, from its start in the 1730's to its culminating point, Joseph Louis Lagrange’s *Analytical Mechanics* published in 1788²². Mathematical physics has been formed in the confluence of two directions of matematical and physical thought. The first direction was that of the transmission and of the developpement of Gottfried Wilhelm Leibniz’ differential and integral

²⁰ See the argumentation of George Thomson against Benjamin Farrington's claim in favour of a tight link between the outcoming of reason and a supposed technical progress among Ionian people (Farrington [1944], Thomson [1955]). See also Vernant [1965], 1985 ed., pp. 261-322).

²¹ Poggendorf [1878], french transl. , p. xii-xiii.

²² Paty [1994].

calculus, occurred around 1700-1720, thanks to Leibniz himself, the Bernoulli brothers Johann I and Jacob in Basel, and to people among the mathematical milieu of Paris Academy of Sciences such as Pierre Varignon and Alexis Fontaine²³. The second direction was that of the transmission of Newtonian physics on the continent, among the heirs of the first ones such as Alexis Clairaut, Leonhard Euler, Jean d'Alembert, followed in turn by their own successors, Lagrange, already named, and Pierre Simon Laplace²⁴.

A new so to speak "school" was formed, in a place and in an intellectual milieu that differ from those where the initial elaborations took place, and this new school happened to open a new branch of science the fecundity of which would last nearly one century, after which the flame dispersed and lightened again, in other and new places. It is in that sense that theoreticians in physics from Germany and North Europe of the second part of nineteenth century, that were active in electrodynamics and in thermodynamics, considered themselves to be the successors of mathematical and theoretical physics coined by Lagrange and Laplace as well as by Jean Baptiste Biot, Joseph Fourier, Siméon Denis Poisson, Augustin Fresnel, André Marie Ampère...

History of sciences is only made with such examples: it is a history of transmissions. The problem of the universality of science might be enlightened, in this respect, from a somewhat similar but more general consideration with respect of cultures. Transmissions of a scientific current to another one are indeed concerned by cultural factors, even if the effects of these factors are less important inside a given culture considered on a large scale - as it is the case of western Europe.

This particular form of culture, in which science has such a large part, that had been constituted in the context of the Christian civilization of Middle Age, results indeed, in turn, from the confluence of two cultures : "the science of the Greeks" and the "Wisdom of the Jews". Of them, Jean Bottéro reminds us, in his book *Birth of God*, that they represent two millenary traditions oriented in two very distinct directions. "The science of the Greeks", he writes, "is the fruit of one millenary of progress, of struggles, of refinements and discoveries about intellectual reflection. The wisdom of the Jews is the fruit of one millenary of progress, of struggles, of refinements and discoveries about religious feeling"²⁵.

Let us mention indeed, upstream of both, Babylonian writing that allowed both "Greek science" and "Jewish wisdom" to be moulded in their respective forms. (And we shall not forget "the admirable achievements of Babylonian culture as well as the cultures of the other peoples of Mesopotamy that have preceded the Greeks"²⁶ which impregnated them directly). Undeniably

²³ Blay [1992], Greenberg [1995].

²⁴ Greenberg [1986].

²⁵ Bottéro [1992], pp. 31-32.

²⁶ Needham [1991], pp. 342.

writing has contributed to endow science with genuine properties by which it differs from writingless cultures. Consider Mayas' civilization in Central America : it developed well elaborated scientific knowledges in mathematics (they knew the zero even before the mathematicians of India, it seems), in astronomy, and extremely sophisticated techniques (architecture and town urbanisation, water supply in regions distant from rivers and with irregular precipitations...).

Let us remind, finally, that the great cultural filiations mentioned above, through which scientific traditions that gave rise to nowadays science have emerged and developed, are in no way exclusive of other influences, underestimated up to know and still often poorly known, but which might well have had a fundamental and decisive character. According to Joseph Needham, the openness of the skies claimed by Giordano Bruno and William Gilbert as a corollary of Copernican vision, would have benefitted of the knowledge which had recently reached in Europe, of Chinese astronomers' representation of celestial bodies, floating inside an infinite space²⁷.

For the great historian of Chinese science, the civilizations of China and of India play a paper in the emergence of modern science in Europe : he saw the ancient scientific currents of the various civilizations as rivers flowing into the ocean of modern science"²⁸. In his beautiful meditation entitled "The historian of sciences : œcumenical man"²⁹, Joseph Needham expresses his conviction that it is necessary to get rid of the europeocentric feeling of supremacy that is still effective in history of science under the pretext that scientific revolution first occurred in Europe. The origins of science are multiple, he reminds us, evoking the contributions of the various civilizations to the common patrimony of scientific knowledges : "By thousands of capillaries, as veins that converge to form a major trunk, a big cave vein, influences came from the whole world." **Find orig. quotation**

Collaboration of cultures requires, to be richer, the existence of differences between them : monolithism entails frailty, as Claude Lévi-Strauss advises us in *Race and history*. "It is", he writes, "the holy duty of mankind" to beware of blind particularism and "also to never forget that no fraction of mankind holds from itself formulas that could be applied to the whole, and that mankind merged into a unique way of life is just unconceivable, because it would be an ossified mankind"³⁰.

Therefore universality means to take into account difference from the other, and it implies exchange. Needless to say that - considering also the construction of the concept that we tried to get back at - universality is not to be confused with uniformity and monolithism. We are left henceforth with the

²⁷ Needham [1954-], vol. 3, p. 438 sq.; Needham [1993], p. 132.

²⁸ Needham [1991], p. 271.

²⁹ In Needham [1991], pp. 340-348.

³⁰ Lévi-Strauss [1952], pp. 76-83.

problem of communication and exchange, and these are in no way to be taken from the model offered to us by present “world civilization” through the media business, that is a monologue with loudspeakers. Universality calls for the other and requires dialogue. In dialogue, two or more entities exist (human or cultural), each with its own system of reference.

Let us say, concerning what we can learn from achievements observed through history of sciences, as well as concerning communication of a given culture with another one, that a sympathy, and even some kind of “empathy”, is needed to enter in the intelligence of another thought, or of another type of thought, different from one’s own. The remark is valid for systems of thought distant in time as well as for contemporaneous ones as studied by anthropologists. In both cases, what is required is to decentre oneself in order to get in communication and recognize the *other* as he stands in its own system of thought. The universal, if it corresponds to something possible and meaningful, contains among its conditions of possibility, *recognition*. As a corollary, the choice of a point of view is not only unavoidable but necessary and demands, for universality to be built, the acceptance of difference: it demands to admit the existence of other cultures and of other values even of those which one cannot assimilate because they are too alien to us or too much in opposition with the values we consider essential. Such is the spirit of tolerance. This spirit appears to be a genuine feature of a science of a peculiar nature, history, in its approach of its object³¹.

I would like, incidentally, to make a remark about the variety of scientific traditions and their bonds to culture, a historical reality which should not be confused with extremist ideological considerations completely antagonistic to the claim for universality. Recent history taught us to which aberrations has led the idea that there would exist - with irreducible opposition between them - a Jewish science and another one, so-called Aryan science (actually, a Nazi one), or a “bourgeois science” as opposed to a “proletarian” one. To believe in something like a “imperialistic-capitalistic science” and, on the other side, a “third-world science”, eventually an “Islamist science”, is nothing but obscurantism, it must be stated clearly, and the same holds with respect to reason. Once again, we need not exclusion but dialogue, because we are aware that nothing living and progressing is closed and isolated from the rest of the world.

What is true is that history - and in particular history of sciences - teaches us that there was, in the development of human civilizations, a Chinese science, an Indian science, a Greek science, a science in Arabic language or of Islamic countries, a science of European Christian Middle Age, a science of European Renaissance, and henceafter a science called “modern” or “classical”, followed by a “contemporary science”. And also other sciences conceived by other peoples, in particular those of the ancient civilizations of America. None of

³¹ It is also a feature of anthropology.

these sciences was or is universal - even that one in which we are situated, that is “contemporaneous science” -, but, to the extent to which they expressed the dimension of man's knowledge - knowledge of nature and of himself -, they all aimed at something that does not differ from what we have called universality.

I shall not develop here about the eventuality of comparing between the claims to universality from various sciences - related, indeed, with epistemological features of these sciences that would make them wider in scope and more unified, or not. What I want to retain at this stage is that there is, from one science to another, some kind of a current of universality, which corresponds to a widening of universality when something has passed - assimilated, transformed, recreated, whatever be the case - from one to the other. That means that a communication - at least some kind of communication - has been established. And this is related to a question at stake in the debates of contemporary philosophy of science, that of "incommensurability", that is, actually, of "incommunicability". Let us stand, anyhow, with the recognition of an inherent tendency to universality of all sciences and all knowledges.

If such is the case, as we must be convinced, it means that a communication must be possible between these various forms of knowledge, between these various sciences and these various conceptions of science, notwithstanding their systemic character into their respective cultures. And, indeed, such a communication has been effective, along the flow of history, from some of them to other ones, for these last would be incomprehensible without the first ones, either linearly either through partial borrowings, even if we do not always know how to fully evaluate such exchanges.

For those who situate themselves in the system of “contemporary science” - it would be improper to call it “western science” for it has been constituted from the most varied contributions -, it entails the requirement, if this science is wanted to tend towards more universality, to know and to understand these other endeavours, parallel or in filiation. We must, to this aim, get over the “ignorabimus” of sociological or structural relativisms, and invent the means of comprehension, that set bridges from a science and from a culture to another one, taking in account the difficulties inherent to any translation.

We can well take our starting point from our own perspective, from present science and our own cultures, to build universality of science : it is not necessary, nor is it wishable, to convert oneself to another point of view - in this, indeed, we would never fully succeed. But we can measure precise and detailed knowledge of these other conceptions would allow us to understand to which extent present science is universal and, as well, what is still missing in it to pretend to universality. Such is, eventually, from the point of view of ethics and of rationality as well, the stake of historical study of these cultural forms sciences are.

I let aside today problem of integration - and first of compatibility - of science, or of what we think in science is universal, with the various cultures that

are the true wealth of present mankind. Cultures are not fixed and rigid. They themselves can be transformed in part by their confrontation with science and, in turn, we can expect that, far from uniformization, each of these cultures is able to enrich our conceptions of the science and culture problem and to reequilibrate their relationship by offering more genuine ways of acculturating science.

The idea of universality goes with that of unclosed representation - or system. The vision of the world that goes along with the idea of "universal science" is that of a world still in its building stage, a world in elaboration. A science aiming at this qualification is at the same time content and research ; permanently pointing at its own reform, looking for its improvement, it is critical and knows that it remains unachieved. There is an obvious link between universality and truth, both being incitative and regulative requirements for the constitution of knowledge, and both escaping eternally any full achievement and possession. As the young mathematician Evariste Galois wrote it, the night before his death in a duel : "Science is the work of human mind, that is more fated to study than to know, to search the truth than to find it"³².

5.

TO CONCLUDE

There is, actually, no conclusion, but still questions. But these questions no more have the initial simplicity of the crude sketch of two opposed and mutually exclusive positions, from which we had started : having given our notions the flesh of reality they endow as having been lived through, the questions themselves have henceforth suffered transformations. They have evolved from purely abstract ones about something like mere ideological symbols to actual problems to explore, not endowed a priori with any impossibility and, above all, meaningful.

Considering methodology, the questions raised by the idea of universality of science and its criticism show the need to consider them from both points of view of philosophy and of history. Only in that way can these questions get their real content or flesh and their deep meaning. From both points of view, they become apparent as questions of fact and as questions of right. The questions of fact bear on the nature of science and on its relationships with society through history up to the present. The questions of right, informed by the lessons of criticisms, lead to no other question than the following ones : *is the idea of a universality of science thinkable ? is a universality of science possible ?* Having

³² Evariste Galois, letter to Gabriel Chevalier, june 1832, in Galois [1962].

been able to state them, with the grounded intuition that they have some meaning, we have to go deeper inside them, in order to detail the true nature of their contents, and to make alive the science we recognize and the kind of universality we think right and valuable. This means that we have to continue to think, and study, and exchange.

Fundamentally, indeed, these questions invite to a renewed dialogue between philosophy and history about sciences (and about the history of sciences), due to the necessary imbrication of each of these two types of questioning if we want to continue to be able to doubt and to inquire with the view of getting at some kind of true knowledge, while at the same time establish what kind of truth this knowledge has.

I would like to acknowledge the discussions I had with participants of the Conference during the session or privately, as well as the precious dialogue with the unknown referee. They have helped me to improve the present text, and they are exactly in the spirit in which it has been written : not to present a closed account but to stimulate reflexions and exchanges from the various point of views and the various cultural origins.

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RESUME L'IDEE D'UNIVERSALITE DE LA SCIENCE

L'idée de l' "universalité de la science" est l'objet, dans les débats actuels, des positions les plus opposées selon que l'on se situe du point de vue d'une "science idéale" ou de celui d'une "production sociale des sciences". Dans le premier cas, la science est conçue comme le "noyau dur " de ses propositions et de ses résultats à l'époque considérée, et son universalité supposée ignore les facteurs qui relativisent ses contenus de connaissance et qui peuvent être aussi bien de nature conceptuelle que sociale. A l'inverse, une attention exclusive aux aspects sociaux de la production des connaissances ignore le caractère objectif de ces contenus de connaissance, qui ont trait aussi bien à des objets de pensée comme ceux des mathématiques qu'à des phénomènes du monde réel, tant physico-biologique qu'humain et social. Ces deux positions extrêmes, caricaturales et cependant fréquemment rencontrées, illustrent l'absence ou la méconnaissance d'analyses interdisciplinaires entre la philosophie, les sciences et l'histoire des sciences.

Nous rappellerons tout d'abord quelques éléments des critiques qui sont faites contre l'universalité de la science telle que nous la connaissons aujourd'hui, et provenant de la philosophie de la connaissance, de l'histoire des sciences, de l'histoire et de l'anthropologie. Nous nous proposons ensuite, après avoir posé philosophiquement le problème de l'universalité de la science, de confronter cette idée, telle qu'elle se présente aux différents étapes de l'histoire de la pensée, et en particulier de nos jours dans les discussions philosophiques et scientifiques, avec la réalité historique de la production, de la diffusion et de l'assimilation de la connaissance scientifique conçue selon ses différentes dimensions (incluant ses applications et ses liens aux techniques et à la technologie).