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The Human and Historical Dimensions of Certainty

*Arrête, misérable veuve malabare! Ne crois point ce fou qui te persuade que
tu seras réunie à ton mari dans le délices d'un autre monde si tu te brûles
sur son bucher. – Non, je me brûlerai; je suis certaine de vivre dans les
délices avec mon époux; mon brame me l'a dit.*
Voltaire¹

*Such 'thoughts' grow up unconsciously. They are picked up – we know not
how. From obscure sources and by unnoticed channels they insinuate
themselves into the mind and become unconsciously a part of our mental
furniture. Tradition, instruction, imitation – all of which depend upon
authority in some form, or appeal to our own advantage, or fall in with a
strong passion – are responsible for them. Such thoughts are prejudices; that
is, prejudgements, not conclusions reached as the result of personal mental
activity, such as observing, collecting, and examining evidence. Even when
they happen to be correct, their correctness is a matter of accident as far as
the person who entertains them is concerned.*
John Dewey²

I. The end of certainty, or its modification?

Even though the modern world may – in some ways – be more secure than it was in the past, at the theoretical level one notices a profound crisis of certainty, involving every field of life and culture³.

¹ François-Marie Arouet de Voltaire, *Dictionnaire philosophique*, in *Œuvres complètes de Voltaire*, Chez Antoine – Augustin Renouard, Paris 1819, tomes I-VI, tome II, »Certain, Certitude«, pp. 347-353, pp. 350-351.

² John Dewey, *How We Think. A Restatement of the Relation of Reflective Thinking to the Educative Process* (1910), Heath and Co., Lexington, Massachusetts 1933, p. 7.

³ Obviously one cannot speak of a complete rupture between the vision of the past replete with certainty and that of the present all a prey to uncertainty, in that there has always been this contrast between those who claimed to be in possession of absolute certainties and those who, on the other hand, argued their precarious and provisional nature. However, we hold that, today especially, the world of the so-called absolute

In physics, for example, the certainties of Galileo regarding a universe created by God and written in a mathematical language, and those of Newton, for whom the elegant compages of the Sun, the planets and the comets was guided by a single divine design, are countered in our century by the indeterminacy of quantum physics and the principle of uncertainty or indeterminacy of Werner Heisenberg.

In geometry, the certainty and evidence of the Euclidean axioms, as existent geometrical entities which are the result of our intuition, are undermined, especially following the discovery of non-Euclidean geometry, by their arbitrariness and conventionality, reducing them to primitive concepts or mere operative postulates.

In biology⁴ and in organic chemistry⁵, the certainties of a world in which God has ordered all things according to size, number and weight contrast with the strange intertwining of chance and necessity that one finds at the origin of life and biological evolution, these too invested, on a microscopic level, with a source of indetermination, deriving from the same quantic structure of matter, that is, from mutation.

In sociology, the scientific certainties of a *physique sociale*, foretold by Comte and understood as the study of social phenomena, obeying invariable laws just like natural phenomena and thus subject to prediction, are opposed in our century by the opposite tendency which rejects all kinds of historical determinism whether idealistic or naturalistic, and in consequence any kind of historical prediction.

In the philosophy of history, the certainty of a divine plan outlined by Hegel is countered by various forms of critical ontologism, which see the individual or social group as the authors of historical events, whose meaning depends on them alone. One sees a parallel process in the opposing camp of Marxian materialism: the idea of history as an ineluctable course of events, subject to the same laws that govern other natural phenomena, has met with similar anti-determinist arguments⁶.

and definitive certainties is gradually disintegrating. See the reflections of a group of Italian thinkers on the 'myth of certainty': Marcello Pera, (Ed.) *Il mondo incerto*, Laterza, Bari 1994.

⁴ Cf. Claude Bernard, *Leçons sur les phénomènes de la vie communs aux animaux et aux végétaux*, Vrin, Paris 1878, 2 vol., vol. I, p. 62: »Le déterminisme n'est donc que l'affirmation de la loi, partout, toujours... c'est l'affirmation que, suivant le mot connu de l'antiquité: 'Tous est fait avec ordre, poids et mesure'«.

⁵ In the laboratory of Justus von Liebig the same biblical saying of Bible, cited by Bernard, was written: »God has ordered all things according to size, number and weight«.

⁶ Cf. Popper, »The Poverty of Historicism«, *Economica*, vol. 11, 1944, n. 42 (pp. 86-103) and n. 43 (pp. 119-137), 1945; *The Open Society and Its Enemies*, Routledge, London 1945, 2 vol.

In philosophy, the highest point of crisis, perhaps, was reached by Ludwig Wittgenstein and the logical positivists. Not only is it incapable of providing any certainty, being merely a method of linguistic clarification, but it has lost even its traditional functions, i.e. the search for wisdom and critical discussion, traditional issues and certainties now held to be pure and simple pseudo-problems.

We do not believe, however, that the situation is as alarming as it sounds, even though there have been radical changes in thought, especially with respect to the last century. Indeed, if we look at history, there has always been a constant stream of new customs and ideas, and if we focus on the history of philosophy or science, even the strangest and most extravagant theories and ideas, although they have nearly always disturbed the well-educated of the time, in the long run have been accepted and have become part of the traditional heritage as certainties to be counted on. Often the greatest dissenters and *provocateurs* of the past have been later considered to be perfectly trustworthy, their thoughts in accord with the common sense of the epoch. Moses, Socrates, Jesus, Saint Francis of Assisi, Erasmus, Luther, Giordano Bruno, Machiavelli, Campanella, Galileo, Voltaire, Montesquieu, Descartes, Kant, Marx, B. Russell, Gandhi, Einstein, etc. were all non-conformists whose thought and action went against the mainstream, and whose defiance of the social system of their day in some cases cost them their lives⁷.

We hold therefore that we should face the alteration of certainties with greater serenity, without any form of philosophical or scientific panic, and that it is not necessary to take the road that leads to scepticism, irrationalism, or nihilism. We must try instead to understand the nature of our certainties and their healthy modification.

In this paper, we will try to show that every certainty has a human and historic character, and therefore these apparent crises are none other than differing ways of looking at certainty; or rather, it is precisely these events which often determine the progress of knowledge, since the abandonment of certain convictions is usually followed by the acquisition of better and more fruitful forms of knowledge, and all this seems to us to be a normal human and historic process. Our critical objective therefore, will be to refute every absolute, static and definitive form of certainty, while trying to reveal the various obstacles which prevent man from achieving this.

⁷ See Domenico Porzio (Ed.), *La provocazione*, Ferro, Milano 1972.

II. Fallibilism and the construction of certainties

A fundamental assumption of our thesis is the intrinsic fallibility of man, which involves in various ways all sectors of life and culture, such as to completely extinguish any kind of absolute and definitive certainty.

This conception of fallibilism has deep and variegated roots in the history of thought. We find it especially in Charles Peirce, who opposes it to 'infallibilism' and considers it innate to the activity of the researcher, who is aware of the errors to which scientific inquiry is prone. We find this vision in ancient thought, including eastern. Confucius, Xenophanes and Jesus Christ all stress, in different ways, the intrinsic weakness and fragility of human nature.

In our century, fallibilism seems to be an assumption accepted in various fields of knowledge and by various authors. Apart from in Karl Popper, where it is linked to his method for conjecture and refutation and to the falsificationist attitude⁸, we find it in Bertrand Russell, linked to the empirical, uncertain, inexact and partial nature of human knowledge, and in John Dewey, associated with the transient and relative nature of facts in a world in continuous evolution and with the correspondingly hypothetical nature of the conceptions and theories used to act on them and explain them.

The assumption of fallibilism obviously has immediate repercussions for both philosophy and epistemology. Above all, we hold that its acceptance and therefore, the rejection of an absolute knowledge open the way to inquiry and truth. Indeed, the continuous emergence of new problematic situations makes it necessary at all times to seek provisional and approximate forms of certainty. The creation and resolution of problems are in a state of continuous change and certainties are part of this permanent situation. Heraclitus, Bergson⁹, Lavelle, Merleau-Ponty¹⁰, Dewey¹¹, Piaget¹² Popper¹³, yet

⁸ Cf. Francesco Nuzzaci, *Karl Popper. Un epistemologo fallibilista*, Glauco, Napoli 1975.

⁹ Henry Bergson, *Évolution créatrice*, Alcan, Paris 1907.

¹⁰ Maurice Merleau-Ponty, *Éloge de la philosophie*, Gallimard, Paris 1953.

¹¹ When we try, through inquiry, to re-establish the disturbed relationship of the organism to the environment, we bring about new environmental conditions which in their turn are the cause of new problems (Cfr. Dewey, *Logic: The Theory of Inquiry*, Holt, New York 1938, chap. II).

¹² Jean Piaget, *L'équilibration des structures cognitives. Problème central du développement*, Puf, Paris 1975. «Toute connaissance consiste à soulever de nouveaux problèmes au fur et à mesure qu'elle résout les précédents». *Ibid.*, p. 36.

¹³ Life itself is the creation of new problems. «I conjecture that the origin of *life* and the origin of *problems* coincide» (Popper, «Autobiography of Karl Popper», in Paul A. Schilpp (Ed.), *The Philosophy of Karl Popper*, Open Court, La Salle, Illinois 1974, 2 vol., vol. I, p. 142). «Thus life proceeds, like scientific discovery, from old problems to the

from completely different philosophical points of view, agree in maintaining a similar thesis, which stresses this changing and transient condition of the world and of life, including our knowledge.

The fact that one cannot establish absolute certainties, therefore, is not so much indicative of the weakness of man's cognitive powers, as of a real difficulty in knowing and living in an unstable and uncertain world in continuous evolution.

Our very cognitive structures modify and adapt themselves continuously in relation to the environment in which every organism happens to live. Thus the impact of the emergence of new discoveries or forms of knowledge can often cause a profound modification or revolution. For example, Kant's synthetic *a priori* disintegrated following the discovery of non-Euclidean geometry and the philosophical implications of quantum mechanics¹⁴.

Piaget, Popper and Lorenz, following in the epistemological wake of Kant, also reject, for various motives, the synthetic *a priori* and favour a dynamic approach to the problem of knowledge. The genetic epistemology of Piaget, impregnated with a form of »kantisme dynamique«¹⁵, and the evolutionistic epistemology of Popper¹⁶ and Lorenz¹⁷, the former underlining the selective pressures to which scientific theories are subject and the other two the biological and evolutive roots of cognitive forms, distance themselves from Kant's synthetic *a priori*.

discovery of new undreamt-of problems« (Popper, »Epistemology Without a Knowing Subject« (1968), *Objective Knowledge. An Evolutionary Approach*, Clarendon Press, Oxford 1972, chap. 3, p. 146.

¹⁴ We refer the reader here to Hans Reichenbach, *Relativitätstheorie und Erkenntnis a priori*, Univ. of California Press, Berkeley – Los Angeles 1920; Hans Reichenbach, *The Rise of Scientific Philosophy*, Univ. Of California Press, Berkeley – Los Angeles 1951, chap. VIII; Rudolf Carnap, *Philosophical Foundations of Physics*, Dover, New York 1965, chap. XVIII.

¹⁵ Cf. Piaget, »L'épistémologie des régulations«, in AA. VV., *L'idée de régulation dans les sciences*, Avant-propos de F. Perroux, Intr. de J. Piaget, Maloine, Paris 1977, p. X. According to Piaget, it is a question of »de renoncer à l'*a priori* ainsi conçu, ou si l'on préfère, de substituer à l'apriorisme un kantisme dynamique où l'innéité épistémique serait à remplacer par une succession de constructions formatrices« (*Ibid.*).

¹⁶ Karl Popper, *Logik der Forschung*, Verlag, Vienna, 1935; English translation, *The Logic of Scientific Discovery* (1959), Harper & Row, New York 1968, paragraphs 6, 30, 85, pp. 42, 108, 251, 278-279; »Science: Conjectures and Refutations«, *Conjectures and Refutations. The Growth of Scientific Knowledge* (1963), K. Paul, London 1972, chap. 1, pp. 46, 51-52; »Truth, Rationality, and the Growth of Scientific Knowledge«, *Conjectures and Refutations*, *op. cit.*, chap. 10, pp. 216-217; Popper, *Objective Knowledge. An Evolutionary Approach*, *op. cit.*, chap. 1, pp. 16-20, 24; chap. 2, pp. 66 ff.; chap. 3, p. 121; chap. 6, pp. 242 ff.; chap. 7, pp. 261, 266-267.

¹⁷ Konrad Lorenz, *Die Rückseite des Spiegels: Versuch einer Naturgeschichte menschlichen Erkennens*, Verlag, München 1973.

The assumption of fallibilism also leads us to accept a critical or falsificationist methodology. The justificationist or inductive method, in the classical sense up to the logical positivism of the Vienna Circle, is insufficient in that it is based on confirmation and not on critical testing of theories.

Bernard and Popper especially have shown with great vigour the dangers of this method, proposing how it may be rectified. Bernard observes: »... je cherche autant à détruire mon hypothèse qu'à la vérifier«¹⁸. Popper holds that one can never provide definitive justifications on the validity of a theory, and thus the true scientific attitude is one which is critical, founded on the criterion of refutability or falsifiability.

Fallibilism also puts us on our guard against every form of absolute certainty regarding scientific theories, in that they are always partial and provisional, representing only the current state of our knowledge¹⁹. In this way they are located between idealism and realism. They are our intellectual instruments, but are also true representations of reality, though they be approximate and provisional²⁰.

Not only our knowledge but the very methods of research of certainties are subject to change and evolution, inasmuch as they derive not only from epistemological sources, but above all from the same scientific practice that is changing continuously²¹.

III. Roots, forms and varying degrees of certainty; their human character

Given that the acceptance of certainties, in general, derives from a serious critical research, yet the various necessities of life often oblige us to act on immediate certainties that come from instinct, society, or culture.

The ancient sceptics and even Hume held that it was unthinkable that one could live without relying on anything certain, whether this be *belief*, *custom* or *habit*²². However, if it is necessary to live trusting to certainties of

¹⁸ Bernard, *Principes de Médecine expérimentale*, Puf, Paris 1947, p. XXV; also *Ibid.*, pp. 220, 251.

¹⁹ Bernard, *Introduction à l'étude de la médecine expérimentale*, Baillière, Paris 1865, p. 63.

²⁰ Cf. *Ibid.*, p. 63; Popper, »Three Views Concerning Human Knowledge« (1956), *Conjectures and Refutations*, *op. cit.*, chap. 3, p. 117.

²¹ See especially Dewey, *Logic: The Theory of Inquiry*, *op. cit.*, »Preface 24 August 1938«, also chaps. I, XIX.

²² Cf. David Hume, *Enquiries*, Clarendon Press, Oxford 1777, sect. V, part. I, pp. 43-47. »As an agent, I am quite satisfied in the point; but as a philosopher, who has some share of curiosity, I will not say scepticism, I want to learn the foundation of this inference« (*Ibid.*, sect. IV, part II, p. 38).

this nature, it is also true that many other certainties, in order to be considered such, must be the fruit of our careful and continuous critical examination. However it may be, as Russell notes, we are obliged to learn to live without absolute certainty yet without being paralysed by doubt and hesitation²³.

All this leads inevitably to the problem of the nature and the validity of these certainties. The quest for certainty is rooted in the very existence of human beings and constitutes one of their fundamental needs. Man lives in a hazardous and risky world and is obliged to look for security, as Dewey acutely states²⁴. The search for certainty is thus the objective correlate of the riskiness of the world and of life, in other words of their instability and uncertainty²⁵.

There exist various forms and degrees of certainty. There are the certainties of the common man, different from those of the philosopher or of the scientist, and generally impregnated with a naïve realism and many prejudices, in that he is not accustomed to critical reflection on his acquired beliefs. There are the certainties of the logical-mathematical sciences, that seem at first acquaintance to be absolute and definitive types of certainty. There are also the certainties of the natural sciences, among which physics especially excels. There are, finally, the certainties of the so-called social sciences, which are the most debatable and the most prone to social, cultural and economic conditioning.

A. Biological and cultural roots

These various forms of certainty, have, in our opinion, a common origin, in that they seem to be particularly rooted in the organic structures and in the cultural heritage of a given individual.

From a biological point of view, the search for certainty corresponds to the need to re-establish the organic equilibrium, that is to say, the conditions that allow us to continue to live. In any case, this search represents an attempt to escape momentarily from the constant problematic situation in which every organism in the world finds itself.

²³ Cf. Bertrand Russell, *A History of Western Philosophy*, Unwin, London 1945, »Introduction«; Bertrand Russell, *The Problems of Philosophy* (1912), Oxford Univ. Press, Oxford 1974, chap. 15.

²⁴ Cf. Dewey, *The Quest of Certainty. A Study of the Relation of Knowledge and Action*, Minton, Balch & Co., New York 1929, p. 3.

²⁵ Dewey holds that people live their lives in an uncertain, precarious and dangerous world, whose existence involves hazards, in that it is the theatre of risk, uncertainty and instability (Cfr. Dewey, *Experience and Nature*, Open Court, Chicago, London 1925, chap. II).

All living things, including animals and plants, make use of an enormous and helpful – yet always precarious – baggage of certain knowledge. Throughout the long history of evolution, every organism has innumerable certainties stored in its genome and in its nerve structures, by which we mean types of knowledge which have functioned in the environment in which it has lived and have allowed it to survive.

These biological structures, while they have guaranteed a high level of survival to every organism, man included, on the other hand have often shown themselves to be unfit and insufficient for their own survival, since the environmental situations are highly varied and changeable and at times even unpredictable. For this reason it is necessary to face these situations by inventing new strategies – experimenting, that is, with new forms of certainty. From a biological point of view therefore, humans, animals and plants go through life via a process of trial and error; strategies that correspond to successful situations are incorporated in the organism's behaviour and are held to be valid forms of certainty.

The life of organisms on the Earth therefore, oscillates between acquired certainties, more or less valid, and certainties that must be looked for; the former may be considered to be forms of life already crowned with success and thus likely to be successful in the future, and the latter as attempts or tests to find the solution to our existential problems.

Apart from these certainties, we possess a large store of knowledge and beliefs that come to us from the society and the cultural world in which we live. It is precisely these certainties which are the most controversial and problematic, and we notice this especially when we compare with other kinds of certainty belonging to other societies of our own time or of the past²⁶.

The certainties which come to us from culture and society are thus the most exposed to error and often are accepted only because they are the fruit of socio-cultural conditioning²⁷.

In the following pages, we proceed to a critical analysis of the various forms of certainty, highlighting their human and historic character.

B. The certainties of the common man, the philosopher and the scientist

First of all we may make a distinction between the certainties of the common man, the philosopher and the scientist. The common man is generally satisfied with his certainties, which have been transmitted to him from

²⁶ Descartes refers to this kind of certainty in the *Discours de la Méthode*, De l'Imprimerie de IAN MAIRE, Leyde 1637, Sec. partie, pp. 17-18.

²⁷ Cf. Blaise Pascal, *Pensées*, Garnier, Paris 1964, Article IV, »Des moyens de croire«, p. 142.

infancy and which belong roughly to the predominant form of knowledge in a given society in a specific period. Thus whether he be communist, liberal, democratic, Catholic, Protestant, Moslem, Hindu or Buddhist, he possesses a given system of beliefs which for him are synonymous with certainties. In the same way, each nation may boast a high percentage of members of particular political parties or believers in a particular religion, of which the individuals often know only a few marginal or superficial aspects, since their acceptance is not the result of a detailed methodical examination, but merely a hurried, superficial and conditioned knowledge of a particular philosophical, political or religious doctrine, often even deliberately imposed. Indeed history, right up to our own times, shows us that an individual may even sacrifice his own life – believing himself to be truly convinced – for this kind of certainty, which is not actually *his*, not being the fruit of his critical or conscious appraisal. The sociology of knowledge has tried to throw light on the various mechanisms, be they economic (K. Marx), religious (M. Weber), social (K. Mannheim) or economic and cultural (Lenin, Mao, A. Labriola)²⁸, which lie at the base of this social production of thought. Studies on cultural anthropology and the various forms of physiological and psychological conditioning are equally illuminating from this point of view²⁹.

The philosopher too inevitably starts from these same cognitive conditions, but rather than accepting passively this knowledge, considering them to be untouchable and definitive truths, establishes with them a relationship of critical awareness. In other words, the certainties which we find deposited and silent in the mind of the common man are questioned by the philosopher, on whose shoulders the responsibility for judgement and choice comes to rest.

The scientist also receives from a young age an education founded on the dominant knowledge of a certain epoch, that is he becomes a specialist in 'normal science', as Thomas Kuhn would say. Yet even here, as with the philosopher, considering above all the progressive character of scientific knowledge, he must remain open to the acquisition of new certainties and, at the same time, he must have the courage, when the occasion presents itself, to abandon the old certainties or 'paradigms' of normal science. Even though the scientist's process of critical revision of certainties is in one sense analogous to that of the philosopher³⁰, this process of critical testing is car-

²⁸ These authors recognise an interaction between structure (economy) and super-structure (culture or Marxist criticism).

²⁹ One thinks, for example, of the classical conditioning of I. Pavlov and the instrumental or operant conditioning of B. F. Skinner.

³⁰ Here too the starting point is the dogmatic acceptance of a dominant form of knowledge, moving then to a critical and problematic examination of it.

ried out on a more solid basis, in that it is normally characterized by rational and experimental procedures.

C. The certainties of the natural and moral sciences are different in kind

One other important distinction which we believe is necessary to make concerns the certainties of the natural and moral sciences. Socrates³¹ was perhaps the first to consider moral virtue as being on the same level as science, thus establishing that ethics is a form of knowledge. Spinoza, in *Ethics*, using the geometric method of Euclid and trusting to the same conception of the intuitive evidence of axioms, made a further attempt to reinforce and present in a more modern way this same construct of ethical-cognitive parallelism. Albert Einstein seems to have moved in the same direction when he held that one can derive a moral starting from premisses having the same function as the axioms in mathematics. He attributes the 'discovery' of these in the field of ethics to 'inspired individuals'³² (alas, how many such individuals have caused enormous damage to humanity!), and these same axioms are indicated in both the Jewish and Christian traditions³³. In this way 'the laws of science and ethics' might be considered together in that they are both axiomatic systems.

Now without wishing to draw a rigid boundary between these two types of knowledge, since the exchange of concepts between the two is very frequent and fruitful, we do however believe that it will be useful to maintain a general philosophical distinction in this sense.

In the modern period, Kant especially has maintained that the categories of knowledge concerning logic and mathematics and the empirical sciences on the one hand, and moral questions on the other, are of different kinds and thus even their epistemological bases are different. Before Kant, it was Hume who maintained, at the end of his *Enquiries*, that one must distinguish between questions of quantity or numbers or empirical matters, and all the others, which he held to be only »sophistry and illusion«. In our century, Russell,³⁴ Wittgenstein³⁵ and the logical positivists, among whom especially R. Carnap and H. Reichenbach³⁶, have, with differing emphasis, main-

³¹ *Protagoras*, 361ab.

³² Cf. Einstein, *Out of My Later Years*, Philosophical Library, New York 1950, »Year 1950«.

³³ Cf. *Ibid.*, »Year 1939«.

³⁴ Cf. Russell, *A History of Western Philosophy*, *op. cit.*, chap. 31.

³⁵ Cf. Ludwig Wittgenstein, *Tractatus Logico-Philosophicus* (1922), The German text of L. Wittgenstein's *Logisch-Philosophische Abhandlung* (1921), Introduction by B. Russell, Routledge and K. Paul, London 1972, prop. 6.4 – 6.421. »Es ist klar, daß sich die Ethik nicht aussprechen läßt... Ethik und Ästhetik sind Eins« (*Ibid.*, prop. 6.421)

³⁶ He maintains that moral axioms are not principles of knowledge. Cf. Reichenbach, *The Rise of Scientific Philosophy*, *op. cit.*, chap. IV.

tained – in our view correctly – this same thesis regarding the inadmissibility of gnoseological reduction of moral assertions.

D. The certainties of the logical-mathematical and natural sciences

As well as this distinction between the certainties of the natural and moral sciences, it is also necessary to stress the autonomy and the independence of logical and mathematical certainties from empirical ones and to uncouple the former from their supposedly intuitive or evident character, which in the past has conferred on them a kind of absolute status.

Today, in general, it is held that the certainties of the logical-mathematical sciences have a tautological, arbitrary and conventional character, and that as such, they are the product of man and do not impose themselves on him in an absolute manner. These truths may be considered to be empirically certain only insofar as they refer to reality. As a matter of fact, the problem of the human and conventional character of these constructs and their applicability to reality was resolved by A. Einstein, who stated: »As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality«³⁷.

The certainties of the natural sciences are of a completely different nature to those of the logical and mathematical sciences, in that they are subject to rigorous empirical testing. Indeed, it is sufficient to consider the history of science to realize that no scientific theory has stood the test of time. Bernard, Russell, Bachelard, Lenin and Popper especially have stressed this progressive and approximate character of scientific knowledge, in the sense that every theory generally constitutes a step forward with respect to a previous theory, and a deeper understanding.

Some authors, especially Bernard, Bachelard and Popper, have added to these two natures of progression and approximation that of rectification or correction. Since the theories are in any case exposed to error, scientific progress is achieved above all by continuously rectifying them, where possible, until one is obliged to abandon the theory in question altogether, opening up a completely new and different path of inquiry, as in the case of a scientific revolution.

E. The certainties regarding the human sciences: the example of equality

The certainties regarding the human sciences, while of a different character to those of the natural sciences, are not absolute either, but depend on the feeling of humanity of the men of a given historical epoch. Indeed, a rapid glance at any particular issue or episode in the history of philoso-

³⁷ Cf. Einstein, *Sidelights of Relativity*, Dutton, New York 1923, pp. 27-45, p. 27.

phy, politics, law or some other humanist discipline, is enough to realize that such knowledge is characterized by relativism, which is linked in turn to the sense of humanity of the individual thinkers or people, and to the very historical conditions in which they lived. These certainties are not progressive, unlike those of the logical-mathematical and natural sciences, which generally are. We shall take as an example the concept of equality³⁸ in its moral, political and juridical senses.

Plato and Aristotle argued for the equality of all free citizens, but this conception of theirs was rather limited. Plato affirmed the political equality of the sexes but in his opinion only a tiny few could aspire to knowledge. Aristotle limited his equality to free citizens alone, excluding the slaves, whom he believed to be such by nature. The Athenian Pericles preached the political equality of all Athenians, excluding however slaves and foreigners.

The first to support equality for all men were the stoics, for whom its roots lay in reason and virtue. In the Christian tradition there has been strong support for the religious equality of all before God, since they were one in Jesus Christ and brothers in that they were all sons of God.

Until the Middle Ages the western monarchical regimes strongly limited individual liberties and thus curtailed considerably the moral and juridical equality of the citizens. Strong pressures towards this only began to be felt by the time of the Renaissance; in the eighteenth century especially, political equality was to make great strides, particularly with the French Revolution, which made it a fundamental principle: *égalité, fraternité et liberté* were the mutually supporting foundations of a new social reconstruction. In the nineteenth century the socialist and communist movements propounded the new concept of economic equality, based on the equal distribution of wealth. Christian communism gave way to economic communism, and for this reason these two concepts of equality, although philosophically opposed, sometimes found common ground. Today, in nearly every country in the world, there are efforts to apply the Universal Declaration of Human Rights (1948), which holds all men to be free and equal in dignity and rights.

These few observations serve to show how diverse people's conceptions concerning one moral, political or juridical notion may be, and how far this may be linked to other general conceptions of a philosophical, religious, political, or economic kind, and to a historical situation.

³⁸ Cf. Stanley I. Benn, »Equality«, *Encyclopedia of Philosophy, (The)*, Macmillan, London 1972, 8 vol., volume 3, pp. 38-42.

The same situation of relativism may be noticed for other philosophical, moral or juridical concepts.

IV. The scientific attitude and the acquisition of certainties

After this brief critical examination of the diverse forms of certainty, we would like to consider, as far as is possible in this context, the way in which we may come into contact with them.

In the human sciences, in our opinion the best way to arrive at some acceptable form of certainty consists in trusting to a sincere, human and disinterested desire for truth. Therefore, the only method which to us appears acceptable is that of free research and critical discussion, even if in this field there are no fixed points of reference or secure criteria of truth.

The reflections of Russell, Dewey and Popper are of great help in this sense. We agree in general with Dewey, when he asserts that even here one may use the scientific method, by which we mean an attitude rather than a collection of rules. From a negative point of view, this means freedom from the slavery of habit, from prejudice, from dogma and from every passively accepted tradition; from a positive point of view, this means a desire for research, for examination on the basis of solid facts and sufficiently gathered data, with a view to the resolution of our doubts and problems³⁹. Similar advice, in our view valid, is given by Russell, when he considers the principal aim of philosophy to be knowledge, in particular that kind of knowledge »which results from a critical examination of the grounds of our convictions, prejudices, and beliefs«⁴⁰. A similar scientific methodology is also propounded by Popper, who associates the method used in science for conjectures and refutations with the critical method, used in the field of human sciences and based on rational discussion. Essentially this consists of formulating »one's problem clearly and of examining its various proposed solutions critically«⁴¹.

However, if the characteristics of the method of free research and rational discussion are imprecise and without closely defined limits, those of the empirical sciences are more determined and one may discuss them with greater profit and using more convincing arguments.

³⁹ Cf. Dewey, »Unity of Science as a Social Problem«, *International Encyclopedia of Unified Science*, Ed. by Neurath and others, Univ. of Chicago Press, Chicago 1938.

⁴⁰ Russell, *The problems of Philosophy*, *op. cit.*, p. 90.

⁴¹ Popper, *The Logic of Scientific Discovery*, *op. cit.* (1968); »Preface to the first English edition, 1959«, p. 16.

We do not have space here to discuss the problems of method in the empirical sciences. We will limit ourselves to declaring our support for the scientific methodology of Bernard and Popper regarding the insistence on the necessity for testing and refutability or falsifiability (Popper) of scientific theories. Both of these authors rightly stress the dangers of confirmation and the necessity of a strict critical analysis of scientific theories.

V. Certainties and prejudices

The search for truth or certainty has always gone hand in hand with the attempt to identify the errors and obstacles that stand in its way. We remember here F. Bacon's theory of the *idola* and the more modern theory of the *obstacles épistémologique* of Gaston Bachelard⁴². The obstacles have been of various kinds and so have the methods to try and eliminate them. Here we will examine this problem and put forward our own thesis for its resolution.

We wish to underline here that the abdication of an attentive and impartial scrutiny of our own knowledge or certainties constitutes one of the biggest cognitive obstacles; whereas on the other hand, an attitude founded on doubt, on free research and on rigorous critical appraisal can protect us from a facile or naïve acceptance of certainties. An attitude of this kind, which sees in the binomial »doubt-research« the engine of knowledge, leads us back especially to Aristotle, Descartes, Bernard, Russell, Peirce⁴³, Dewey and Popper, who all stressed with greater vigour than others the value of doubt and inquiry for the establishment of our own knowledge or certainties.

Among the biggest obstacles to the achievement of truth and certainty is prejudice, which, as the etymology of the word suggests (*prae-iudicium*), is a judgement that anticipates or precedes knowledge obtained directly, based on critical examination of the evidence or arguments. As Voltaire states: »Le préjugé est une opinion sans jugement. Ainsi dans toute la terre, on inspire aux enfants toutes les opinions qu'on veut, avant qu'ils puissent juger«⁴⁴.

Prejudices are often linked to superstition or to various forms of belief. These may be seen as acquired or unconscious certainties, rooted in our

⁴² Gaston Bachelard, *La formation de l'esprit scientifique. Contribution à une psychanalyse de la connaissance objective*, Vrin, Paris 1938.

⁴³ See *The Fixation of Belief* (1877) and *How to Make our Ideas Clear* (1878).

⁴⁴ Voltaire, *Dictionnaire philosophique*, in *Les œuvres complètes de Voltaire; The Complete Works of Voltaire*, Voltaire Foundation, Oxford 1994, volumes 35 and 36, vol. 36, p. 456.

very behaviour and ways of thinking. We may also include in this category the taboos of certain indigenous tribes, seen as a rigid code of rules to be observed, imposed by tradition, whose magical explanation lies beyond human control⁴⁵. Besides being associated with heavy forms of social and cultural conditioning, prejudices are also encouraged by our own mental laziness, and thus by a lack of responsibility in subjecting these kinds of knowledge to a careful critical analysis. The quote from J. Dewey at the beginning of this discussion provides an eloquent interpretation of them and also shows us how, through rigorous inquiry, we may free ourselves from them.

Prejudices may be of various kinds, they all have in common the fact that they are premature judgements and sometimes simple habits of mind. In sum, they are accepted passively and in any case before any conscious and critical research⁴⁶. The greater part of them are nurtured – as B. Russell tells us – by the strength of tradition and our passions, but what makes us free from these two *vincula* is not so much a question of any particular convictions we may have, as the way in which we have formed them, that is, how we have come to have them.

It is extremely easy therefore, for political or religious authorities to inculcate, via the acquisition of certain habits, similar beliefs in young individuals. Such a technique has been already noted by Pascal, who writes in the *Pensées*:

«... Car il ne faut pas se méconnaître: nous sommes automate autant qu'esprit; et de là vient que l'instrument par lequel la persuasion se fait n'est pas la seule démonstration. Combien y a-t-il peu de choses démontrées! Les preuves ne convainquent que l'esprit. La coutume fait nos preuves les plus fortes et les plus crues; elle incline l'automate, qui entraîne l'esprit sans qu'il y pense. Qui a démontré qu'il sera demain jour, et que nous mourrons? Et qu'y a-t-il de plus cru? c'est donc la coutume qui nous en persuade; c'est elle qui fait tant de chrétiens c'est elle qui fait les Turcs, les païens, les métiers, les soldats, etc. (Il y a la foi reçue dans le baptême aux Chrétiens de plus qu'aux Turcs.)».⁴⁷

Being thus able to create beliefs and certainties, habits can also serve to eradicate them, if used in the opposite way: as Laplace⁴⁸ observes, we may use Pascal's method to remove prejudices.

⁴⁵ See James G. Frazer, *The Golden Bough. A Study in Magic and Religion* (12 vol., 1907-15), Oxford Un. Press, London, 1994.

⁴⁶ As is known, above all F. Bacon (*Novum Organum*, 1620) and Descartes (*Principia Philosophiae*, 1644; *Regulae ad directionem ingenii*, [1629] 1701; *Discours de la Méthode*, 1637) placed great value on this critical re-examination of our certainties and prejudices.

⁴⁷ Pascal, *op. cit.*, p. 142.

⁴⁸ *Essai philosophique sur les probabilités* (1814), Gauthier-Villars, Paris 1921.

It is now clear that appropriate techniques of physical and psychological conditioning or deconditioning can lead to the same results⁴⁹. Shakespeare was right then when he said: »For use almost can change the stamp of nature«⁵⁰.

It is necessary to add immediately however, that while habit and various forms of deconditioning may be used to remove prejudices, we would like to stress that this can also be achieved by appealing to reason. With this, we can destroy the various emotions or thoughts that assail our minds, as Descartes⁵¹ and before him Buddha⁵² and Chuang-tzu taught. In the field of children's education, John Locke⁵³ advised us to appeal to reason as soon as the child understands language, so as to eliminate unwanted tendencies and bad habits and allow the child to be corrected and guided.

VI. Obstacles and certainties

A. Against absolute, immediate and a priori knowledge

Perhaps the biggest obstacle of a philosophical nature is that of confusing 'our' truths for absolute and eternal knowledge. This sort of obstacle can hinder the progress of knowledge considerably.

A single example concerning the discovery of non-Euclidean geometries will suffice to demonstrate the difficulties which can obstruct scientific discoveries, thanks to a few philosophical prejudices. Ludovico Geymonat observes that A. M. Legendre »while getting very close to a resolution of the debate [on non-Euclidean geometries], did not manage to achieve this, above all because he was held back by a serious philosophical prejudice: that of conceiving the postulate of parallels as an absolutely certain truth, and of asserting therefore, that the only task of mathematics in this regard was to discover a satisfactory logical demonstration. It was precisely this philosophical error which prevented the French school from introducing non-Euclidean geometries to the world, thus adding to the many other merits acquired in the period we are dealing with here. Instead the credit for this important discovery goes to Gauss, Lobacevskij and Bolyai«⁵⁴.

⁴⁹ See Encyclopædia Britannica, Inc. *Britannica CD 98, 1994-1997*: »Conditioning«, »Physical conditioning«; see also Konrad Lorenz, *Die Rückseite des Spiegels: Versuch einer Naturgeschichte menschlichen Erkennens*, Verlag, München 1973, chap. VI, par. 7.

⁵⁰ *Hamlet*, Act. III, sc. 4, 168.

⁵¹ *Les passions de l'âme*, Guinard, Paris, 1650, Articles 41, 43 and especially 45-50.

⁵² K. E. Neumann e G. De Lorenzo (Eds.), *I discorsi di Gotamo Buddho*, Laterza, Bari 1969, 3 vol. See especially »Ogni mania«, Part I, II; »Spavento e terrore«, *Ibid*.

⁵³ *Some Thoughts Concerning Education* (1693), Clay, London 1895, par. 81.

⁵⁴ Geymonat, *Storia della matematica*, in Nicola Abbagnano, *Storia delle scienze*, Utet, Torino 1962, 3 vol., vol. I, pp. 305-662, p. 575.

Another obstacle for the formation of our certainties or knowledge is an unquestioning faith in immediate knowledge, originating from both sensations and intuition.

As regards immediate knowledge deriving from sensations, empiricists and materialists especially have often fallen into this kind ofgnoseological trap; without wishing to detract from the merits of these sources of knowledge, one must however take the necessary precautions with respect to such cognitive positions. In the first decades of this century, following the influx of Russell's logical atomism and Mach's doctrine of sensations, Wittgenstein and the members of the Vienna Circle traced the sources of knowledge to our sensations. R. Carnap⁵⁵ in this regard elaborated a 'theory of the constitution' based on the reduction of all forms of knowledge to the data provided by our senses. This is not the place for an adequate critical discussion of this neopositivist programme, but the inextricable difficulties into which this kind of reductionism leads have by now been amply noted: in thegnoseological field the result was a subjectivist idealism⁵⁶, and in the methodological field, the proposed criterion of verifiability or empirical significance had the effect of making philosophy itself redundant, along with all theoretical elements, including epistemology and the very laws of science, none of these being verifiable by, or reducible to, sensory data.

Immediate knowledge based on intuition also has its risks. In fact these are even greater in that while knowledge deriving from sensations has more or less reliable foundations, intuitive knowledge is founded in the final analysis on thegnoseological presumption that we ourselves, perhaps illuminated by God, are the only sources of knowledge. This form of knowledge, therefore, is subject to neither empirical nor rational evaluation.

A priori certainties constitute another kind of obstacle, of a purely philosophical nature. When we refer to these certainties we do not mean, obviously, the analytic or *a priori* propositions of logic and pure mathematics, which possess this certainty solely in virtue of their form. We refer rather to all other propositions which claim to be certain by appealing to absolute and self-evident principles or premisses, in conformity with purely rational or intuitive guarantees. The appeal of Aristotle and Descartes to such intuitive principles is characteristic in this regard. Throughout the course of the idealistic and rationalistic tradition, analogous appeals and guarantees have assumed different forms, but the cognitive basis has remained the same, and is lacking in any critical testing of an empirical nature.

⁵⁵ *Der logische Aufbau der Welt*, Verlag, Berlin 1928.

⁵⁶ See the critique *ante litteram* by V. I. Lenin (*Materializm i Empirio-krititsizm*, Moscow 1909) of Mach's doctrine of sensations and therefore of logical positivism.

B. Political ideologies and mechanisms of social control

Another form of obstacle concerns political ideologies. Like other prejudices, these are often determined by the social and cultural environment or by economic interests, veiled by sophisticated forms of rationalisation.

According to Marx, as is known, these ideological forms (*ideologischen Formen*), like all other theoretical creations or forms of knowledge (*theoretischen Erzeugnisse und Formen des Bewußtseins*)⁵⁷, are determined by existing social relations and thus no intellectual critique can eradicate these interest-linked prejudices of the ruling classes (*interessierten Vorurteilen der herrschenden Klassen*)⁵⁸. Now, while crediting this thesis with a certain validity, we do not accept that any form of political certainty must necessarily be an interest-based ideology. The dialectical materialists are wrong to consider this assertion absolutely valid, to consider it, in other words, an absolute certainty. Such an assertion in fact, in order to gain a certain philosophical dignity, would have to deny, at least for itself, that it is merely the fruit or the necessary result of a social condition. To consider certainties as none other than ideologies produced by social conditions of life, even if this analysis is largely true, cannot however be accepted in an absolute sense. Indeed, in this way, all the assertions and theories Marx and Engels themselves would collapse or lose meaning, precisely because they are merely social productions.

There exist therefore, certainties which are just ideologies, that is the result of political and social situations and conditioning; however, not all certainties of this kind are really so. Here too, it is necessary to examine them critically, without neglecting Marx's own methodology, in order to see clearly their intrinsic validity.

Another category of obstacle, which hinders a careful and conscious formation of certainty, is represented by certain social mechanisms of control or certain procedures that serve to protect special forms of knowledge or social and political norms. Michel Foucault⁵⁹ has clarified these diverse mechanisms and forms of exclusion of speech. Essentially, he asserts – wisely in our view – that in any society the production of discourse is at once monitored, selected, organized and distributed via a certain number of procedures, which are imposed and maintained by a complex of institutions, with the aim of controlling it. Furthermore, these procedures are not imposed without the use of force, or without at least an element of violence.

⁵⁷ Cf. K. Marx, F. Engels, *Die Deutsche Ideologie*, »I., Feuerbach«, in *Werke*, Verlag, Berlin 1964, Band 3, 1845-46, pp. 37-8.

⁵⁸ Cf. Marx, *Zur Kritik der Politischen Ökonomie*, »Worwort« 1859, in Marx, Engels, *Werke*, *op. cit.*, Band 13, 1859-60, esp. p. 11.

⁵⁹ *L'ordre du discours*, Gallimard, Paris 1971.

Obviously we must not forget that above all the mass media, especially television, newspapers and often even the big publishing houses, being held usually by political parties or industrial or financial magnates, often carry out this rôle of social control to perfection.

VII. Epistemological obstacles

A. Scientific ignorance and Weltanschauungen

Hamlet says to Horatio: »There are more things in heaven and earth, Horatio, / than are dreamt of in your philosophy«⁶⁰. There is more philosophy in life than in the books of philosophy. Philosophical problems, in other words, have their roots in real life, and this has numerous aspects, one of which, extremely important, concerns the natural sciences. To take an interest in philosophy, therefore, without some kind of scientific preparation is an undertaking that may be doomed to failure. It is superfluous to recall here that the greatest philosophers have often also been eminent scientists, from Aristotle to Galileo, Descartes, Pascal, Leibniz, Einstein and Heisenberg.

For example, how can we hope to resolve the problem of the relationship between body and mind, without some knowledge of physiology and the pathology of the brain? How can we tackle the problem of the place of man in the universe, without studying, from a scientific point of view, the origin of life or Darwin's theory of evolution? Again, how can we examine the problem of knowledge, without the rudiments of the physiology of perception, or of quantum physics and the theory of relativity?

Even the various visions of the world can act as epistemological obstacles. Although every one of us, often unconsciously, has their own vision of the world and life, and although this may function as a guide and a means of orientation even in many of our practical actions, yet these visions cannot be held to be absolutely certain. Not always do they help us to live, nor are they useful from a scientific point of view. On the contrary, often they can become real obstacles, in both a practical and a scientific sense.

Bachelard, Popper, Koyré and Kuhn, from different points of view, have tried to throw some light on the various psychological, philosophical and sociological mechanisms responsible for this sort of brake or inhibition of thought.

⁶⁰ Shakespeare, *Hamlet*, Act. I, sc. 5, 166-7.

Gaston Bachelard, who sees in *orthopsychisme* the fundamental problem of epistemology⁶¹, holds that it is often necessary to try to rectify or reject the various *Weltanschauungen* which from time to time obstruct the progress of knowledge⁶².

Karl Popper, while on the one hand attributing an important propellant function to these visions, comparing them to great metaphysical hypotheses or research programmes, on the other, sees in their refutation one of the best moments of scientific growth⁶³.

In the same way Alexandre Koyré⁶⁴ has demonstrated, in his work on the history of science, the inhibiting or stimulating function of these differing visions of the world.

Thomas Kuhn⁶⁵ has shown us the quantity and the nature of the forms of psychological and sociological resistance on which the growth of science is founded. He focuses on the interplay of the various *Gestalten* and visions of the world in the advancement of scientific knowledge.

B. Justificationism

Another important obstacle in the path of science is represented by a kind of justificationist attitude or tendency to confirmation. F. Bacon, Bernard and Popper are perhaps the authors who have particularly, and better than the others⁶⁶, highlighted such a danger, and while Bacon – in our view – did not succeed in loosing these intellectual bonds⁶⁷, Bernard and Popper did.

Bernard, within the framework of a determinist methodology based on counterproof (*modus tollens*)⁶⁸, has stressed the risks that derive from an

⁶¹ Cf. Bachelard, *Le rationalisme appliqué*, Vrin, Paris 1949, p. 66.

⁶² Bachelard, *La formation de l'esprit scientifique*, op. cit.; *La philosophie du non*, Puf, Paris 1940.

⁶³ Popper, *The Logic of Scientific Discovery*, op. cit., paragraphes 4, 79, and esp. 85; *Realism and the Aim of Science*, From the *Postscript to the Logic of Scientific Discovery*, Rowman, Totowa, New Jersey 1982, esp. »Introduction 1982«, pp. XIX-XXXIX.

⁶⁴ *Du monde de l'à-peu-près à l'univers de la précision*, Colin, Paris 1961; *La révolution astronomique*, Hermann, Paris 1961.

⁶⁵ *The Structure of Scientific Revolutions*, International Encyclopedia of Unified Science, vol. 2, n. 2, Chicago, London, 1962.

⁶⁶ These psychological mechanisms tending to confirmation, due to feelings of fear, melancholy, jealousy, candour, etc, had been highlighted in the literary field by Giovanni Boccaccio (*Decameròn*) and by William Shakespeare (*Julius Caesar*, *Othello*). See Nuzzaci, *K. Popper*, op. cit., pp. 73-4.

⁶⁷ See Nuzzaci, op. cit., pp. 73-7.

⁶⁸ The counterproof, which is an *experimentum crucis*, is a highly critical moment, and puts our theories to the hardest test (cfr. Bernard, *Introduction*, op. cit., pp. 97-100).

approach linked to the verification or justification of one's own theories⁶⁹. He also observes, with great psychological subtlety, that our very desire or anxiousness to confirm the hoped-for results of an experiment are serious obstacles to scientific discovery⁷⁰.

Popper especially dedicated a large part of his intellectual efforts to placing us on our guard against this justificationist attitude, so dangerous for scientific research. We will do no more here than mention the great methodological importance of the criterion of falsifiability, proposed by Popper and on which much of his thought hinges⁷¹. This falsificationist attitude, based on philosophical fallibilism⁷², is sharply opposed to the justificationist attitude.

C. Absolute belief in 'facts' and in theories or systems

Absolute belief in facts or data also constitutes a large obstacle to the formation of scientific knowledge.

The old form of positivism especially assigned to these a decisive rôle for the knowledge of truth; but Claude Bernard⁷³, around the middle of the nineteenth century, had already noted with great clarity that every fact must be interpreted, and that there is no such thing as a pure fact exempt from theory.

However, while a blind belief in facts is a serious obstacle to scientific knowledge, it is also true that one must use them as a basis on which to construct laws and theories. Indeed, science is based on a correct and balanced interaction between facts and theories: the former are the building-blocks of science; the theories are like the buildings that are designed and constructed starting from these. This interaction between facts and theories was lucidly illustrated by Bernard⁷⁴ himself, but Comte before him had also noted that a »stérile accumulation de faits incohérents« does not in itself constitute the science, which is rather founded »dans les lois des phénomènes... à laquelle les faits proprement dits... ne fournissent d'indispensables matériaux«⁷⁵. In our century Dewey⁷⁶ and Popper⁷⁷ especially have lucidly illustrated this same interaction of facts and theories.

⁶⁹ Bernard, *Principes*, *op. cit.*, pp. 251, 220.

⁷⁰ Bernard, *Ibid.*, pp. 220-221.

⁷¹ Cf. Nuzzaci, *K. Popper*, pp. 41 ff.

⁷² Cf. *Ibid.* »It so happens that the real linch-pin of my thought about human knowledge is fallibilism and the critical approach«; Popper, *Realism and The Aim of Science*, *op. cit.*, par. IV, p. XXXV.

⁷³ Cf. *Introduction*, *op. cit.*, p. 93.

⁷⁴ Cf. *Principes*, *op. cit.*, pp. 226, 229.

⁷⁵ Cf. Comte, *Discours sur l'esprit positif* (1844), Vrin, Paris 1974, par. 15, p. 24.

⁷⁶ *How We Think*, *op. cit.*, chap. VII; *Logic: The Theory of Inquiry*, *op. cit.*, chap. VI.

⁷⁷ Cf. Popper, »Science: Conjectures and Refutations«, *Conjectures and Refutations*, *op. cit.*, chap. 1; »The Bucket and the Searchlight. Two Theories of Knowledge«, *Objective Knowledge. An Evolutionary Approach*, *op. cit.*, pp. 341-361.

In the wake of the old positivism came the philosophers of the Vienna Circle and of logical positivism, reformulating these 'facts' in various ways. For Wittgenstein, one of the greatest inspirational figures of neopositivism, they are the existence of states of affairs (*das Bestehen von Sachverhalten*)⁷⁸ and we can create for ourselves images of these states of affairs that correspond to reality with the construction of elementary propositions (*Elementarsätze*)⁷⁹, which are thus images of reality⁸⁰.

This gnoseological approach, which we also find in the logical atomism of Russell and the scientific philosophy of the Vienna Circle, has had important philosophical and epistemological consequences. First and foremost, it has provided the pretext for closing the doors to every philosophical debate, philosophy not being able to constitute itself from elementary or atomic propositions, being no more than a means of linguistic clarification⁸¹; secondly, this conception has expunged from science, as being insignificant, scientific laws and hypotheses, since these cannot be constituted from such propositions either⁸².

If a blind belief in facts, without their interpretation or theoretical explanation, can be a source of great difficulty, an excessive faith in theories or in pure reasoning can have the same effect. In this sense, theories are identical to systems, in that they are pure constructions of thought.

Absolute faith in pure or *a priori* theories and in systems constitutes a serious obstacle to the growth of scientific knowledge, and here too the epistemological warnings of Bernard, together with those of Hermann von Helmholtz, should be considered highly useful.

In sum, the flaws of systems lie in their purely deductive or logical construction, confusing coherent truths with truths that correspond in some way with reality. Freed from this relationship with reality, their constructions may become fantastic and unreal. Systems have something in common with hypotheses, which, if they are sanctioned by experiment may become laws or theories; if, on the other hand, they are regulated only by logic, they become systems⁸³. Scientific theories are actual interpretations of reality, despite being always provisional and approximate⁸⁴.

⁷⁸ Wittgenstein, *Tractatus*, *op. cit.*, prop. 2.

⁷⁹ *Ibid.*, propp. 4.26, 4.21.

⁸⁰ Cf. *Ibid.*, prop. 2.141: »Das Bild ist eine Tatsache«.

⁸¹ Cf. *Ibid.*, prop. 4.112 »Der Zweck der Philosophie ist die logische Klärung der Gedanken. Die Philosophie ist keine Lehre, sondern eine Tätigkeit«; M. Schlick, »Die Wende der Philosophie«, *Erkenntnis*, I, 1930, pp. 4-11.

⁸² For a critique in this sense, see Popper, *The Logic of Scientific Discovery*, *op. cit.*, par. 4.

⁸³ Cf. Bernard, *Introduction*, *op. cit.*, pp. 385-386.

⁸⁴ *Ibid.*, p. 63.

Helmholtz rightly holds that it is a grave mistake to believe that thought can base itself on logical consequentiality and the completeness of the system alone, irrespective of its natural foundation, i.e. observation and perception, thus taking flight in the world of metaphysical reasoning⁸⁵.

VIII. For a human construction of certainty

Let us try to sum up briefly the principal conclusions to which we have come.

Above all, it appears to us that the very fact, amply shown by history, of the diversity and plurality of the so-called absolute certainties, shows that they cannot be so, and that, in consequence they must be seen rather as certainties of man's own making and historically conditioned.

Moreover, we are of the opinion that it is essential to distinguish between various forms and degrees of certainty. There are the certainties of logic and mathematics that have a high degree of reliability and there are the certainties of the empirical or natural sciences which are also highly probable. There are, finally, moral and religious certainties, which are of a completely different character from logical-mathematical and empirical ones. It is here that the most dangerous deceptions lie, since often – as we have seen – they are only the fruit of socio-cultural conditioning, unlike *our* certainties, by which we mean the result of *our* conscious and responsible research. Continuous and rigorous research, centred on man's intelligence and capacity for inquiry, seems to us one of the best ways to avoid being carried away by the irrational and impetuous wind of various political, moral and religious fanaticisms.

Their common assumption, in any case, while admitting their diversity and reliability, seems to us to be fallibilism, and it is for this motive that we have opted, in the field of the empirical sciences for a tougher form of scientific testing than that of verifiability, i.e. falsifiability, latent in the work of Bernard more than a century ago, and set out explicitly with refined logical techniques by Popper. As far as the acceptance of human and social certainties is concerned, however, it seems to us more appropriate to trust to the method of research and free discussion, centred on the sense of humanity of every man and on a sincere and disinterested desire for truth, while accepting that in these fields of knowledge it is difficult to achieve objective certainty, and in many cases – in our opinion – not even desirable. The

⁸⁵ Cf. Hermann von Helmholtz, *Das Denken in der Medizin*, Berlin 1877; in Helmholtz, *Vorträge und Reden*, fourth edition, Braunschweig, II, pp. 165-190.

important thing is to try to create a world where each may live, in respect and love for the others, with his own opinions and lifestyle, tolerating as far as is possible those of other people. In this way democracy, tolerance, liberty, equality, love, justice, happiness and other noble sentiments may become mutually supporting.

Above all in the social and human field, therefore, tolerance, so dear to Voltaire, is still today, precious and indispensable.