

INTELLECTUALS AND THE REAL

All the languages of the world, I believe, have words to distinguish, among men, between intellectuals and manual workers: the former use their brains more than their hands; the latter use their hands more than their brains. Since the beginning of time, many men could easily be classified in one or the other of these groups (and certainly many others could fall into the intermediate zones between the two poles). For example, “*intellectuel*” and “*manoeuvre*” are very old words in the French language, direct heirs of Latin words designating the brain and the hand.

Throughout history, manual labor has had a primary role in the subsistence of the social group. Humanity has never been able for a single minute to do without manual labor, whether that of the hunter, the farmer, the miner... today of the worker. Nevertheless, if physical work is necessary in the short term, it is without doubt mental work which has been and remains primary in the long term. It is in the nature of physical work to be repetitive and periodical; it is by the work of the mind that through meditation, reflection, the scientific approach can formulate new procedures, new approaches to the action of man on nature. It is the engineer who increases the efficiency of labor. Here, as in many other areas, the values which make

Translated by Susan Scott Cesaritti.

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humanity progress are not the same as those which help it endure.

Not long ago, intellectuals were rare, because the productivity of manual work was low and because the physical strength of 99% of the adults was necessary for the nourishment of the species. Of the one (or two or three) per cent of the privileged ones who could live without working manually, the major part did not work at all even mentally, so that they deserved only very exceptionally the name of intellectuals. Nevertheless, intellectuals existed already in the most ancient times and played a role as driving forces of humanity: Elijah, Enoch, Aristotle, Plato... were unarguably intellectuals, like Marx, Einstein and Mao; and there were around them other intellectuals, less creative, but capable of understanding, discussing and thus encouraging their work.

Today, the number, both relative and absolute, of intellectuals increases prodigiously: the increase in productivity of manual labor, due to the application to work of methods invented by intellectuals, permits manual labor to become unceasingly less. Already in the most progressive nations, 50% or more of the active population is employed in the tertiary sector, where in general physical effort counts little; and especially, in the primary and secondary sectors themselves, jobs where the brain counts more than the hand are becoming more and more numerous. On the other hand, economic progress, brought about by technical progress, obliges the average man to enter more into the intellectual zone. And pure or nearly pure intellectuals, those whose *professional* activity is predominantly mental (professors, research scientists, the upper echelons of politics, industrial enterprises, and administration, men of letters and artists) reach, in the most progressive countries, a number in the order of 10% of the active population. Intellectuals number therefore in the tens of millions in the present day world, and their long term influence on other men remains more decisive than ever.

The word "real" can be taken in many different senses in literary languages, even though its etymology seems to me rather clear (the French word "*réel*" and the English "real" come evidently from the Latin "res", a concrete word, which means

" thing ", " object ".) Nevertheless, it is necessary to define the sense which I give to the word " real " in the present article.

I take " real " here to mean the opposite of " imaginary ". The real is that which the human brain perceives through a *stimulus to the senses*; the imaginary is that which the human brain conceives by its *internal functioning*. All objects, all things, all being, all phenomena (from the atom to the galaxy), whoever or whatever emanates *signals* perceptible to man (whether these signals are directly perceived by the senses or are amplified or detected by instruments or machines) belong to the real.

The great domain of the imaginary is, on the contrary, elaborated, formed, " imagined ", " invented " by the *human brain*. Its origin lies in information (whether real or not) stored in the brain and combined, " treated " by cerebral activity itself. I propose to distinguish four registers in the domain of the imaginary: *free imaginary*, result of the spontaneous activity of the brain (from the dream to utopia); the *rational conceptual*, which tends to arrange spontaneous invention, to make it exact and eliminate its contradictions, to facilitate remembering of it and its transmission from one brain to another; the *experimental conceptual* or experimental scientific thought, which tends to know the real through a comparison between the rational conceptual and perceptible stimuli issuing from the real itself; the *surreal conceptual*, finally, which tends, beyond the observed and the experimented, to elaborate and to retain the cerebral invention necessary to our knowledge of the real as a whole, and to permit us to understand and to explain this real.

I have no doubt about the fact that these distinctions and classifications of cerebral activity, which are not in any way classical, will seem strange to many readers and will call forth a host of comments and criticisms. They are however only marginal to our proposition; I beg the reader therefore to consider them merely as simple conventions of terminology, intended only to facilitate the reading of what follows.

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The proposition put forth by the present article is that, at the three-quarters point of the twentieth century, the dominating thought among intellectuals has remained largely a tributary

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of the past, and has not been influenced at all by the methods nor by the results of experimental science.

Let it be understood that this thesis is much less true for the Anglo-Saxon countries than for the Eastern European and Mediterranean countries, but it is true above all for the developing countries. And this is not a refutation of the thesis, but on the contrary an argument in favor of it, since it tends to explain the delays, slowdowns, and difficulties in the economic, social and political development of these nations due to the delays, slowdowns and difficulties of assimilation, for the peoples of these nations, of the spirit and the results of experimental science. The reader can judge for himself, as he goes along in his reading, if whole sections of archaisms do not still subsist in the thought even of North American intellectuals (if, for example, "econometric economic science," which is currently prevalent in these countries, and because of them throughout the world, is not a characteristic manifestation of it).

It should be well understood that I am writing this article with my own country, France, in mind, and that in writing it I am thinking of those intellectuals which I know best, French intellectuals of the years 1975-76. But they seem to me good examples since they are without doubt in the same situation as others throughout the world, or barely above the average. In France the contrasts are apparent between a strong industrialization, a rapid activation of technical progress, and the very evident persistence of a traditional mentality. On the whole, each reader can judge how he himself and his country stand in regard to the attitudes and behavior mentioned here.

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RATIONALITY AND EXPERIMENTAL SCIENCE

The major fact is that the great majority, if not the near totality of French intellectuals distinguish badly or not at all between what, in experimental scientific method, is in the order of rationality and what is experimental.¹

¹ It is enough to read the articles on the "Sciences" in contemporary encyclopedias to become aware of the confusion of mind on these crucial

The prevalent opinion in this regard is that science is *at the same time* rational and experimental. This is not wrong, but it is still not clear. The average intellectual is not capable of distinguishing the respective roles of rationality and experimentalism. These thinkers conceive of rationality and experimentalism in practice as tied together by links which are self-evident. The result then is that they think and act as though everything that is rational is also necessarily experimental and everything that is experimental is also necessarily rational. The reader of this journal must know that such is not the case; if not, his training will have to be re-done and he will place himself, in the meantime, in the dominant category of average (French) intellectuals.

In fact, invention is rational; discovery is experimental; the teaching and expression of the discovery are rational. Thus it is quite true that science is *at the same time* rational and experimental, but it is necessary to explain the ambiguous meaning of the term *at the same time*. One must distinguish clearly the three fundamental phases of the acquisition of science: hypothesis or invention, discovery, the expression of the discovery.

1) *Hypothesis*. Man perceives only what he expects to perceive: to perceive a signal issuing from the real, the brain must be endowed with a structure of reception;² it must have imagined, *invented*, a series of events, a cerebral rational "pattern" (that is, conforming to the habitual procedures of coherent treatment of information by the brain); this is the invention of the hypothesis, necessary preliminary to all discovery.

2) *Discover*. But, of the innumerable inventions, of the innumerable hypotheses which the brain forms, *the almost totality is not in accord with the real*; for example, because the factors present in the real were unknown or considered badly in the hypothesis, in the premisses of rational reasoning which formed the hypothesis' foundation. The test of the comparison of the

problems. One finds there in effect inextricably tangled texts which insist on the complexity of the problems posed. These very unclear texts do not help the researcher at all and send him thus back to the current returns from his own laboratory. The great philosopher Gaston Bachelard, whose work is in other respects remarkable, has only added to this dark disorder.

² I take the liberty of referring the reader to my book *Comment mon cerveau s'informe*, Paris, Robert Laffont, 1974.

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hypothesis to the real, a test which crumbles 99% of hypotheses and which is therefore crucial, can only come from the observation of the real, from experimentation with the real. Far from being self-evident, natural and automatic, this test demands from man a great humility before the real, a patience, perseverance, competence, honesty, all qualities exceptionally rare in the human species. It requires, for example, the courage to verify that the invention which was done with such enthusiasm, that the hypothesis which was elaborated with such great effort, is found to be contradicted by signals issuing from the real: that these signals are different from those predicted by the hypothesis; that the signals announced by the invention did not keep their appointment.

Such is the essential phase of the acquisition of scientific knowledge. It is completely original in relation to what precedes and what follows it, and it is by far the most difficult for man, because it implies a submission of pretentious cerebral rationality to an exterior restraint: the real.

3) *The expression of the results of the discovery.* In those cases, very rare in a man's life, when the researcher *finds* what he was searching, where the discovery confirms the invention, where observation, the signals issuing from the real coincide with those announced by the hypothesis, the scientific knowledge thus constituted must be communicated to other men, taught. This teaching of the results of the discovery can only be effected correctly and efficiently in a precise, coherent language, the rational language, the mathematics used by specialists on the subject.

It must be understood that this scheme is valid for the physical sciences as well as for the human sciences, with the difference that everyone knows but whose banality cannot cause us to forget its importance: in the physical sciences, one can in general observe and experiment at the same time; in the human sciences, one can only observe. The phase of discovery, always very arduous, is therefore even more difficult in the human sciences than in the physical sciences. In the human sciences, the researcher can *neither make nor find* identical " systems ";³

³ Astronomy cannot experiment, that is create at its pleasure identical systems. It can only observe. But nature furnishes identical systems for its

he therefore cannot test his hypothetical “ model ” except by more or less precise analogies. This represents a dramatic handicap, which makes the task of the researcher in the human sciences even harder than that of the researcher in the physical sciences but which, one can be sure today, does not prevent complete success.

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The day in which the intellectuals of the entire world will have understood well, assimilated in their brains, experienced in their flesh, the above scheme (laid out since 1620 by Francis Bacon, elaborated since 1290 by Rober Bacon), one will be able to say that the spirit of experimental science has begun to penetrate throughout humanity. Up until then, one will have to write: *nothing is less experimental than the thought of men, in this century in which economy, society, culture and the style of life have been transformed by experimental science.*

* * *

And not only have (French) intellectuals not (in general) perceived the spirit of the experimental method, but they have not yet even perceived the *results*, the acquisitions, the major contributions to knowledge that this method has given, in the course of the last two or three centuries, to mankind. To tell the truth, our intellectuals know many details; I don't think anyone is ignorant of the fact that light travels 300,000 km. per second, that the universe holds billions of galaxies, that the hydrogen atom is made up of an electron and a nucleus, etc. ... *But no synthesis has been born in their brains from these disparate and sporadic pieces of information. The daily behavior, the political, moral and philosophical concepts of these thinkers have not been modified: they remain those of the last century.*

The case of Jean Paul Sartre and Simone de Beauvoir, two model intellectuals, of great intelligence, great sensibility, great heart, and immense illumination, is particularly representative.

observation. Its situation is thus the same as the experimental sciences although experiments cannot be done.

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I was particularly astonished by Mme. de Beauvoir's attitude, her refusal to consider biological factors in her study of the feminine condition. Claude Tresmontant has written on Sartre's attitude concerning the results of experimental science: ⁴ "A magnificent example of this attitude, a model, an archetype of the French philosopher, is furnished us by Jean-Paul Sartre and Simone de Beauvoir. Read their *Mémoires*, their *Autobiographies*. One will see what formation they have received: the Sorbonne before the war, the Faculté des lettres. Their ignorance of the sciences of the universe and of nature is without a break. When Sartre and Simone de Beauvoir were studying at the Sorbonne, the great adventure of modern physics was taking place, and there were in 1927-28 the great cosmological discoveries of Lemaître, Friedmann, Hubble, Humason. Read through the *Mémoires* of Sartre and Simone de Beauvoir: you will find no trace of, no allusion to these great discoveries, these great revolutions in science. Neither astrophysics, nor physics, nor biology ever interested them in the least. This is what explains their a-cosmic philosophy, this is why at the end of her life Madame de Beauvoir could set forth as seriously as could be that one is not 'born' woman, that one is not woman by birth or nature. One becomes woman by choice, education, culture! The detestation of nature, *the detestation of objective reality*, the detestation of physiology, is one of the most characteristic traits of modern French philosophy, with Sartre and Simone de Beauvoir certainly, but also with the philosophers of the following generation."

In effect, the phenomenon is far from being limited to the faithful of Sartrian existentialism. To quote Tresmontant again: "It is enough (to judge their attitude with regard to science) to observe how the modern-day disciples of Descartes and of Kant receive the notions of the age of the universe and the stars: *they do not listen at all*. It does not interest them." ⁵

The basic fact is simple, certain, although absolutely incredible: *our intellectuals have remained rationalists*. They have remained insensible to the triumph of the experimental method.

⁴ Claude Tresmontant, *Sciences de l'univers et problèmes métaphysiques*, Paris, Editions du Seuil, 1976, p. 9.

⁵ *Ibid.*, p. 17.

Or more exactly (without doubt) they have only been affected physically, superficially (and not intellectually, conceptually) by the concrete changes in the environment, the standard of living, in the life-style, by the information, the knowledge, that nevertheless science has brought us in a torrent in the past 50 or 100 years. Our intellectuals are still living in the first two—traditional—registers of cerebral activity, the spontaneous imaginary and rational conceptual: they have not assimilated either the experimental or the surreal.

With them, as with Plato, as with Descartes, the idea of “ truth ” hides that of “ reality ”; they believe spontaneously that reason, at least “ rational ” reason, permits the discovery of the true; and consequently they consider observation and experimentation only as an auxiliary, secondary, sporadic, anecdotal... tainted with the idea of servitude traditionally attached to manual work. They look for a rationality that is “ pure ” enough to render experiments useless.

The prestige remains with the philosopher or mathematician who elaborates and links together abstract concepts, “ beings of reason ”, and is limited for the practician who confronts these concepts with the real. For example, the prestige of Sartre greatly exceeds that of Louis Néel or Alfred Kastler, Nobel Prize winners in physics and members of the Académie des sciences; André Lwoff, Nobel Prize in medicine and director of the Institut Pasteur, wrote that he esteems himself more for having *invented* the RNA messenger than for having *discovered* it. Without doubt, this is more consonant with the spontaneous processes of the brain system; the joy of invention (when the brain creates according to its inner content and its own laws) is greater than the joy of discovery (which is the submission of the brain to a foreign signal, coming from outside). Contact with the real, except in the cases programmed by the genetic code, is a trauma for the living creature, not a pleasure.

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Generally, the intellectual of today, remaining fundamentally a rationalist, lives in a world which is more and more artificial, which resembles less and less the natural world in which mankind

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has lived for hundreds of thousands of years, the natural world in which rationality was formed by the effect of natural selection and of which consequently this rationality took honorable account. He is therefore "out of his element", having for the perception and understanding of the countries of today only the concepts, the intellectual instruments pertaining to the countries of yesterday. This must, if not suffice to explain the confusion and inquietude of the intellectuals of today, at least contribute to explaining the major characteristics of their behavior. In the field of his professional specialty, if he is engineer or executive and, in the domain of his private life, to the extent to which he uses modern machines (automobiles, elevators, household appliances, air transport), the intellectual is confronted with the *experimental* usage of a real which is highly technical, organized, efficient, constraining. In all the other areas of his thought (social, moral, philosophical, political, artistic, spiritual, religious) he becomes cerebral again, that is to say creator of the imaginary and of traditional rationality.

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In the pages which follow, we shall envisage two notable aspects of this crisis of contemporary intellectuality, of this lag between the mentality of today's intellectuals and the concrete problems which they must discern, study, resolve. In a first section, we shall speak of the information issuing from the human sciences which is unknown or minimized. In a second section, we shall speak of the information coming from the physical and biological sciences which intellectuals should have made the basis of their culture (and which in fact they ignore or consider only as anecdotes).

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I. INTELLECTUALS AND THE HUMAN CONDITION

The human sciences are practically absent from secondary school teaching, not only in France, but also, except for cases scattered here and there, in all the nations of today's world. It is from

this angle that we will allude to the lack of culture dominating intellectuals today in the whole world with regard to... the human condition. This I will do by following the text of a report which I recently presented to the (French) Minister of Education.

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The secondary school, coming from the *lycée*, dedicated traditionally to the "verbal-conceptual" formation of a restricted "élite" which was itself the product of the directing classes limited to 2 or 3% of the population, has not found the new way necessary to carry the *majority of the children of the nation* to high intellectual levels. Teaching remains exaggeratedly abstract and cerebral; it is characterized by exaggeratedly ambitious programs which in fact result in the multiplication of failures, and the lowering of the real "levels" of culture. It prolongs for the student the kaleidoscope of information emanating from the "mass-media" and the demoralizing *confusion* which is its result.

The school has not found the balance between its encyclopedic tendency and the need for reflection and meditation; between the accumulation of pieces of knowledge and the methods of acquisition of knowledge; it teaches *according to rational procedures* the results of a full-grown science, without teaching the methods of *discovery* of new knowledge; it confuses the rational and the experimental. The large part of our adolescents come out of the school, the University, and even the "grandes Ecoles" without having the experimental scientific spirit which is nevertheless the leaven of the economic and cultural revolution of our time. The (French) school lets the artistic, bodily and manual aptitudes of adolescents lie fallow; it does not develop at all the faculties of sensibility, affectivity, emotion and enthusiasm, nor feeling, cordiality, fraternity... Discursive cerebrality and verbal-conceptual aptitude are cultivated, but an "excellent" student could have not an ounce of good sense; he could have not a calory of human varnith; he could be absolutely incapable of understanding warmly, of being affectionately aware

⁶ Groupe de réflexion sur l'enseignement des sciences humaines et économiques dans le second degré, *Rapport du président*, chapter 1.

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of his colleagues, his students, his co-workers, his inferiors in the professional hierarchy, his next-door neighbors...

Another major characteristic of our education is the *exclusion*, without doubt involuntary and the result of spontaneous tendencies, but nevertheless practically absolute, of all that part of the human condition which is the most characteristic of the human condition. The student, the child, the adolescent, like all men, lives in a world of passion, of suffering, of violence, of error: the school speaks to him only of knowledge, of certainty. In attending school, man knows all that it is important for mankind to know; in living life, all is ignorance, awkwardness, deception, false appearances. To attend school, all is clear, all can be explained rationally by cause and effect, the real is known, man is powerful, informed, efficient...; to live life, all is ignorance, doubt, inquietude, dissatisfaction; all is strange, unexpected, incoherent... The gap, the abyss, between the beautiful order of the sciences and mathematics and the hubbub of the real perceived daily by the student engenders at the same time an excess of belief in the powers of man and the feeling that the school is cut off from life.

It is necessary to encourage teachers who, beginning today, speak of *gaps in the knowledge of men*, of zones of shade which exist in all the sciences, of the questions posed which have no answer, of questions whose answer is not sure, of approximations which the exact sciences themselves accept, of the gaps between reality and the "mathematical models" which try to represent it. All teaching should be completed by *lessons in ignorance*, by some examples of errors...

All scientific teaching especially should include the teaching of the history of science. Each professor of mathematics, for example, should speak to his students of the history of mathematics and of the history of the teaching of mathematics. Since when, in deference to what efforts, what motivations or influences, to respond to what needs, is taught what is being taught today? In the same way that every mathematics professor is a man, so should all teaching of mathematics include a reflection on the man/mathematician.

The fundamental task is to avoid accentuating in the school man's tendency to deny, neglect, or minimize what he does not

know; to leave in his decisions no place for those factors which cannot be specified precisely or measured; to exclude from his consciousness all that is not included in the "rational model" habitual to his spirit.

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It is useful to recall here some of Unesco's conclusions following its long reflection on the problems of teaching throughout the world.⁷ The school must treat the great problems of the contemporary world, consider the conditions for survival of humanity, point out the global character of the needs of current and future generations, cause us to reflect on the rights of man and the difficulty of respecting them in the face of the temptations of efficiency, certainty, force. The human condition is certainly the subject at hand.

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Today in France, as elsewhere, the human sciences are knocking at the door of secondary education.⁸ How can one be human today without having heard of the results, often crucial, at which these sciences have already arrived, of the methods they use, of the light they shed on each other, on the physical sciences themselves, on societies, on the human condition? And how can one become capable of learning about them, if not by an initiation in the middle school, the so-called secondary school?

I will not list here the human sciences; the list is long and in constant flux. The list that I would give would be open to criticism, without any doubt. It is enough here to list some headings: economics, sociology, psychology, political science, law, demography, urban studies, ecology, the organization of work, linguistics, decision theory... I have cited purposely without a logical order or rational design, in a totally arbitrary fashion; a host of other disciplines will come to the reader's mind. This summary evocation will be enough to show the

⁷ Notably the report "Science, technologie, société", Dec. 1975.

⁸ It will not be totally useless for the reader to call to mind the order in which the sciences were born and the order in which they entered into the secondary school and the teaching of young adolescents and children.

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width of the problems and their importance for the average man; and also to show how poorly informed the average intellectual is in this respect...

It is evident from the beginning that each branch of the human sciences will not find a place in secondary school teaching. They are too numerous and each one is too advanced. Certain sciences might receive a privileged welcome and especially be offered as options, but it is not possible to do everything at once. The problem posed today is that of general information on the human sciences rather than the teaching of such sciences.

The question is the intellectual's openness towards the existence, the spirit and the method of the human sciences. Today, mathematics opens the student to the world of rationality, the physical sciences to the inanimate world. On the other hand, he is only rarely and sporadically given the means to *perceive* the world of men, to know it, to let it have power over him. Today, the student comes out of high school at 18 and, especially the "good student", gravely amputated of his faculties of understanding what is human. In at least eight cases out of ten, this amputation is not compensated for later: it remains definitive.

Not only are the general consequences of this amputation dramatic, but also the secondary consequences on the utility, the efficiency, the practice itself of life. On one hand, this being, overdeveloped in his rational dimensions, overstimulated and as though hypnotized by the mechanical aspects of the real, dominated by the systematic search for an efficient determinism, lets his faculties of sensitivity, artistic emotion, and warmth of sentiment wither. If their instinctual aptitudes are not strong enough to resist in part this training, our children will come out of *lycée* without an aptitude for knowing and recognizing themselves, for entering into friendly relations with others, feeling and radiating cordiality, loving "what will not be seen twice", ... perceiving and understanding as something other than an absurd hubbub and idle chatter every social occurrence, every act of daily life, every spontaneous expression of thought, every literary and artistic work... How then could one not make grave errors in his inevitable, but since then naive, search for happiness, for the ideal society, for the meaning of one's own life?

At a more technical, more utilitarian level, the insufficiency, the lack of human culture which our intellectuals suffer deprives them (in an astonishingly anachronistic way) of the remarkable efficiency tools which a large number of the branches of the applied human sciences give today to daily *practice*; I will just cite haphazardly, as examples: the scientific organization of work (notably school work, house work...), pedagogy, elementary psychology, especially that of human relations (with one's fellows, relatives, professors...), mental health, physical hygiene, dietetics, home economics...

The human sciences must help us to acquire a current, more critical, richer and more coherent knowledge of economic, social and political reality. More generally, the problem is to make men conscious of the gaps in daily information, of the dangers of "rational" treatment of this fragmentary information, of the errors due to their doctrinaire interpretation.

It is essential to note here that overall the human sciences are more difficult to elaborate, teach, learn, and understand than the physical sciences. That is why it is distressing and ingenuous to drain more or less systematically toward mathematics and the physical sciences those students who are hardest working and most fit for intellectual labor. Without doubt the instant understanding of a mathematical formula or of a complicated formula of organic chemistry is more "difficult" than the reading of a general phrase from a manual of history or economics. But the criteria of making results and premisses match, the real and the description given it by the "mental model", are infinitely more complicated and require of the spirit a more complex and more sustained effort. This is why the mathematical and physical sciences could be called exact: they allow in general precise verifications. At least at the level of school, solutions and results are affirmed with certainty; the "true" is distinguished easily from the "false" and the correct from the erroneous. This is far from true in general in the human sciences. Furthermore, the physical sciences are found valid above all by analyses (since the physical real can often be dissociated into isolated groups); the human sciences frequently require *syntheses* whose difficulty is always great. Thus the human sciences have appeared only recently in the history of mankind, although they are the

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most useful to its life and survival; thus they remain at an infant and conjunctural stage.

But these same difficulties, these ambiguities, this lack of reliability work together to render even more necessary the discipline of the human sciences: the easier it is to make errors, the heavier the bondage to ignorance, the more misleading is spontaneity, the more necessary it becomes to assimilate the fragile acquisitions of the past.

The notion of *information* (in the sense that this word has acquired in information theory and computer science) erupted about twenty years ago into scientific research. We know today that this is a key notion, common to mathematics, the physical and natural sciences, biology, the human sciences; it clarifies particularly well some problems of psychology and pedagogy; it stimulates the present evolution of teaching.

The human genetic code is largely insufficient to assure the survival of the newborn and of the child. He needs parental care, then a physical and cultural (mental) education. A "culture" must give progressively to the adolescent, then to the adult, the means to decide and to act beyond the biological reflexes of instinct. Mental education has thus three functions: the brain of the infant must *acquire* information, it must *store* the information, and it must "*treat*" it. The adolescent, the adult must all along the course of his life learn to learn, learn to remember, learn to reflect on what he knows. These mental procedures are necessary to life, to survival. Without them, there is no conscious decision, there is no human act; *a fortiori*, there is no autonomy, there is no person, there is no personality.

By his genetic code alone, the child cannot redo by himself the long and difficult road that mankind has traveled in the past 100 or 500,000 years to emerge from the animal state. More helpless at birth than his distant ancestor, the first "homo sapiens", the child of today must become a man of the 20th century.⁹

The almost incredible slowness of the evolution of humanity

⁹ Today's child is more helpless than his distant ancestors for two series of factors: his genetic code, dominated more and more by conscious thought, has become weakened; *the technical environment*, established by experimental science, has destroyed *the natural environment* to which this instinctual genetic code had adapted itself by "natural selection".

shows the difficulty of the passage, the enormous gap which separates spontaneity from the concrete results which one would like to expect.

The human sciences help man become aware of these disparities, of the obstacles which engender them, of the means to overcome or at least reduce them. The brain perceives with difficulty the reality of the real. It is necessary to learn to *discover* the real, to document oneself, to research the sources of information. The information gathered almost always presents some holes, often major, often enormous. This information is thus often misleading, whether for its fragmentary character, or because of objective error (error in measuring, in identification, in spatial or temporal localization...) or obliteration of the long term by the short term, or a deforming schematization, etc. ... Habit, "pre-conceived" ideas, passion, etc... sort out the perception of the real, block a quantity of sensory stimuli, and cut down on the brain's information faculty.

It is necessary all the same to learn *to store the most pertinent information* and to classify it according to its equivalence with the real; its degree of generality, the number and the importance for man of the questions that it brings up, according to the relationship which is recognized with other information previously stored, etc. Finally, to each level of culture, to each level of school corresponds a level of memory containing the information necessary to the perception and the meditation of the information "media" (written texts, charts, images, words and names...) of each level, to the reception of the "information" issuing from beings and things.

Not only psychology but history and all the other human sciences, mathematics and the physical sciences, language, arts and letters, must work together for those experiences which are certainly favored by the biological aptitudes of the brain, but which are not for that less necessary or arduous. Now, the human sciences are the ones that are confronted most frankly and brusquely with these difficulties of knowledge and decision. Not only that branch of the human sciences which is called, a bit abusively, decision theory, but also sociology, economics, forecasting, and political sciences are unceasingly led to compare previsions, intentions, results.

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All these sciences, and history itself, which underlies them, show how short term information, and not only the "first impression" but also, in the course of reflection itself, the insufficient appreciation of the time element, are often erroneous. They teach how to consider the different long term maturity dates, looking beyond the short term. History can give some characteristic examples of errors: from those of Descartes in the scientific field to those of Napoleon or of the Treaty of Versailles in the political one. The human sciences must make us aware of the rarity of non-erroneous decisions, lead us to reduce their number and identify the factors that contribute to the error.

In order to make the brain function better (or less badly) one must stimulate the curiosity, orient it towards coherent constructions, opening up by degrees; one must maintain spontaneous "creativity", while teaching it to compare itself with the real, to *begin with* the real, to assert itself therefore on contact with the real, while it has a spontaneous tendency at first to ignore the real, to revolt against it in a way that leads to failure, to despair, to "flight"; then to abdicate before it in resignation, apathy, the feeling of the absurd and the suffering it brings about...

* * *

It is thus *the scientific spirit* of the human sciences, and more generally of the sciences in which man can observe without reproducing identical systems (that is, without being able to experiment), that there is the greatest lack in the current mentality of today's intellectuals. In the same way those among them who are specialists in one branch of these human sciences are incapable of putting to work this spirit, this method of perception and explication of the real, outside of their own speciality (many among them yet, an illmeaning critic would say, are only capable in a mediocre way, that is to say very badly, within their speciality itself.)

But, furthermore, the large part of intellectuals living today minimize, and often are even ignorant of the great *results* already reached by the human sciences, results which nevertheless give

mankind information about itself, about the human being, the societies he forms, the human condition, much richer and much more certain (that is, less riddled with errors) than that which existed only a quarter of a century ago.

This insufficiency of experimental culture in the domain of the human sciences has certainly a host of dramatic consequences for the behavior of intellectuals and beyond that, for the conduct of our societies. For example, we have said and we shall come back to it, that the majority of philosophers write as though the genetic code did not exist, as if the human brain did not sort out the information it receives, as if the philosopher's brain contained all the information pertaining to the subject he is treating (as if, in short, the brain of man were the brain of a God...). In this time, the theologian writes as though the galaxies did not exist, as if the history of the evolution of living creatures were not beginning to be known, as if the major idea of the heterogeneity of time did not imply a new approach to the notions of good and evil... etc... etc... In the political field, the absence of the experimental spirit explains the lack, which is so astonishing *a priori*, of a comparison of the *projects* of reform or revolution with the *realities* that later come out of these projects (for example, between the imagined or rational images of socialism and the reality of the existing socialist states.)¹⁰

* * *

Without pretending either to be exhaustive or to enumerate in a rational order the most important headings, I propose here a list of the major pieces of information contributed by today's human and social sciences, and which are totally unknown or strongly minimized by the majority of the members of world *intelligentsia*.

1) The resistance of the human real to rationality (the diffi-

¹⁰ It is only very recently in France that among intellectuals there has arisen a fairly widespread current of opinion interested in comparisons between the ideals and the realities of the revolutions whose inspiration is Marxism. See for example Gérard Chaliand, *Mythes révolutionnaires du tiers monde*, Paris, Editions du Seuil, 1976, and Jean Ellenstein, *Le phénomène stalinien*, Paris, Grasset, 1974.

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culty of representing individual, social or political events by rational, mathematical or other “ models ”.)

2) The heterogeneity of time experienced by living creatures.

The impossibility of characterizing by the same factors series of events considered in the very short term, short term, medium term, long term, very long term.

The facts of chronobiology.

The eruption into the living real of radically new facts (which had never taken place before and will never take place again).

The intervention, following human acts having conscious and voluntary objectives, of immediate consequences which are relatively predictable, and of ulterior consequences (second or third generation) in general absolutely unseen and even unpredictable at the moment of action (the “ unexpected visitors ”).

3) The difficulty for the human brain to perceive the real, even in simple cases.

The contrast between the oneness of clear (conscious) thought that the brain can engender and the complex and evolving swarm of the billions and billions of real beings or objects. The human brain does not perceive the billionth part of the billionth part of the signals emitted by the men and things which exist around him.

4) The genetic and cultural originality of every living creature and notably of every human person.¹¹

5) The superposition in man of an instinctual cerebral system (the paleocephalus) and a cortical system (the neocephalus).

6) The congenital impossibility for man to make *decisions* and consequently to undertake voluntary actions which are correctly adapted to the real. (In effect, the information is in general incomplete and very often erroneous; the treatment of this partial and/or incorrect information is furthermore rough and synoptic; finally, the heterogeneity of time, the complexity of the interactions of innumerable and non-identifiable factors during the delays which are determined before the date of the action, render inevitable the intervention of unexpected effects in the second, third, fourth... generation (see above, point 2).

¹¹ This fact is beginning to be recognized by French intellectuals, notably through the action of professors Jean Bernard and Jean Hamburger. See especially Jean Hamburger, *L'homme et les hommes*, Paris, Flammarion, 1976.

The instinctual reflex, commanded by a specific stimulus in the short term, is at the same time in consonance with the survival of the living species in the long term. But this comes about only through an enormous number of errors.

7) The obligation for a being endowed with a neocephalus (despite the handicaps to voluntary decision called forth in the first paragraph of point 6) to try to improve on instinct.

The difficulty of improving on instinct, in reality and in the long term.

The extreme difficulty of doing better than Nature, less badly than "Destiny", in reality and in the long term.

Evil, suffering, disorder are inherent to a universe which is infinitely complex, in which time is infinitely heterogeneous and in which absolutely original beings and objects appear unceasingly.

8) The behavior of human beings is hardly rational at all and even less is it guided by the experimental spirit.

It is only after 50,000 years of life that *Homo sapiens* has sporadically and maladroitly discovered and sometimes used the experimental scientific method.

It is nevertheless this method which permits man to increase the production of his labor, to come out of a millenary era of famine, to have access to "economic development" and social progress.

9) The broad character types placed in evidence by characterology are an efficient instrument for understanding the daily behavior of men.

In the same way, the "capitalist-proletariat" typology (which is universally known) and the "Atala*-Citroën" typology (sensitivity-feeling-intuition on the one hand/rationality-experimentalism-science-technique on the other).

10) The evolution of organized creatures, from the amoeba to man, has been done on this earth in the direction of increasing autonomy and information, but not in the direction of an increasing stability and "happiness in living".

The human condition is therefore difficult, if not tragic. To

* As is known, Atala, the heroine of Chateaubriand, symbolizes spontaneous sensitivity.

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maintain its existence in the very long term in this complex and mysterious cosmos, mankind has up to now had recourse to imperious morals, imposed by dogmatic conceptions of the world (by religions).

Rationality and experimental science have joined their actions to provoke the collapse of traditional, popular, or "wise" religions. They have not been replaced by anything.

* * *

II. INTELLECTUALS AND THE PHYSICAL SCIENCES

We can treat this section more quickly than the preceding one. First of all because the ignorance of intellectuals with regard to the physical sciences, while remaining catastrophic, is nevertheless a bit less profound than with the social sciences. It follows, since this ignorance is more apparent, that lacunae are better recognized as such; intellectuals are here more conscious of their lacks, to the point where sometimes this consciousness engenders in them an "inferiority complex". Finally, while the methods of the observational sciences are more or less unknown, the *principle* of the methods of the sciences of *experimentation* is very well known: for example, there are few intellectuals in France who cannot cite Claude Bernard and his *Introduction à la médecine expérimentale*. Without doubt there is an abyss between theory and practice, but I have underlined it sufficiently in the preceding pages.

I will limit myself thus to listing, as I did for the human sciences, the major results of the physical and natural sciences which seem to me either unknown or neglected, minimized, scorned, by a large number of contemporary intellectuals, when these results should be, in my opinion, fundamental factors for these thinkers' knowledge of the real and their conceptions of the world, of society, of humanity, and consequently for their social, political and moral action.

1) The universe, also called the cosmos, is in evolution. Atoms enter it in "organizations" (molecules, masses, cells,

¹² See above, the section on *Rationality and Experimental Science*.

“ bodies ”, organs, organisms...) They associate together in “ combinations ”, they form “ substances ”, “ systems ”. Each of these associations, of these bodies, each organization has its own originality, its own evolution, a beginning and an end, its own evolutionary time span.

The totality of these objects, these organizations, that is, the universe (the cosmos) seems also to have had a beginning and must have an end. (Unless the flux of external energy and information is continuously and periodically brought into it; but since the universe contains all physics, this hypothesis cannot be physical; it is therefore metaphysical).¹³

Although we do not like to say it, or write it or think it, this experimentally certain reality of a universe in evolution is profoundly mysterious; that is why it engenders spontaneously in man a number of questions without answers: from where does this universe come? Why does it exist? etc. ... etc. ... The observed real is not sufficient to explain the observed real.

2) This evolution, this unceasing change of the universe and the organizations it contains implies the notion of a physical or cosmic time, a notion parallel to that of social time. Cosmic time is itself heterogeneous, in the sense that each organization of atoms has its own time.

Man has constructed rationally an absolute time that is not real. Real, experimental time is that discovered by Einstein: it is relative to observation and the observer. It does not exist if there is neither observation nor observer.

Time is only a concept elaborated by man to permit him to perceive *the modification of space*.

3) This universe in evolution was traditionally divided into matter and spirit, then into matter and energy. Physics has today discovered the complementarity of matter and energy: $E=mc^2$.

4) Matter is made up of atoms (or forms itself in atoms) of which the simplest and oldest in the history of the universe is the hydrogen atom, and, of those whose name we have succeeded in knowing, the heaviest, most complex and richest in

¹³ In his above-cited book, Tresmontant shows (Chapter 1) that the world-views prevalent among today's intellectuals still derive from beliefs in the eternity of a self-maintaining universe.

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electrons is lawrencium. These atoms, of which many are unstable, have appeared successively in the course of the evolution of the universe and no doubt approximately in the order of their increasing complexity.¹⁴

Atoms are grouped into molecules; certain molecules can, under limited conditions of temperature, pressure and chemical-physical "environment", group themselves into cells, cells into organs, organs into organisms, organisms into "systems" or societies. Beginning at a certain level of complexity, life, in effect, would appear...

5) Under conditions which are equally very exceptional, energy becomes "meaningful" for the matter which receives or contains it: it is then designated by the name of *information*.

Every corpuscle has an energy wave associated with it. This wave is perhaps the most overworked form of information.

In living creatures, the information transmitted from generation to generation by genetic means takes account of procreation and heredity.

6) Thus, whatever we know about matter and energy, about the corpuscle and the wave, is very precious, but makes of the atom a being as mysterious for man as the universe itself. "This strange matter," writes Alfred Kastler.¹⁵

The most astonishing part of this affair is that at the origin of the universe there is only the hydrogen atom and that today there are (in minute but perceptible quantities) not only astonishingly complex molecules of "organic" chemistry scattered everywhere throughout the universe, but also that there exist,

¹⁴ 104 different atoms are known today, of which 83 are stable in the long term and 21 are unstable (radioactive). All are formed of nuclei (protons and neutrons) and of electrons. But the number of these electrons can go from one (hydrogen) to 103 (lawrencium) and perhaps more. In the whole universe, only hydrogen and helium atoms are abundant. The others are very rare: 85% of the atoms existing in the universe are hydrogen atoms, 14% are helium atoms, 0.66% are oxygen atoms (with 8 electrons). All the other elements thus form only 0.034% of the total. The structure of the atom teems with mystery. For example, the number and the nature of the "particles" into which neutrons and protons split when they are ejected from the atomic structure, or the fact that the neutron is 1,819 times heavier than the electron, and the proton, 1,816 times heavier (1,819 and 1,816 are very strange numbers for human rationality). As another example, the filiation of electrons into photons. Etc. ... See for example Albert Ducrocq, *Les éléments au pouvoir*, Paris, Julliard, 1976.

¹⁵ Alfred Kastler, *Cette étrange matière*, Paris, Stock, 1976.

here on this earth, the brains of mammals and of man. The *aptitude to engender* other atoms, bit by bit ever more complex, to which the hydrogen atom has testified, and *to enter into* molecular then organic *organizations*, to give itself or to receive at each level the information necessary to constitute and maintain that level, is the major mystery of the evolution of the universe in particular and of planet Earth in particular.

7) In this reality of complex associations of matter and energy, of corpuscles and waves, of mechanical and informational energy, the notion of *structure* appears fundamental. The "properties" of an atom depend *both* on its internal structure *and* on the structure of its surroundings in this moment and in the course of its "history".

The totality of the real is characterized by its structure. Structural wholes tied together form "systems" in which each molecule present depends on all the others. The human body is a system. A group of men forms a system. At the limit, not only the earth, not only the solar system, but all the universe forms one structure, one "system" in which each thing is linked with every other.

8) The earthly evolution of living creatures is still badly known. It implies an astonishing succession of genetic mutations and (parallel although *a priori* independent) "ecological nooks" capable of selecting these mutations *in the direction of increasing complexity*. Biological evolution would appear here strangely "pulled forward" by the geophysical-chemical evolution of its "surroundings".

But, after all, the procedure matters little, the miracle is that there was a procedure, that it happened.

9) It is unfortunate nevertheless that the little we know of this miracle does not please us at all. Let us read what Jean Hamburger writes about it: "Biology describes to us an unpitying world, in which we are bodily engaged. For an astonishing explosion in human thought, which biology only half-understands, a revolt is born in us against that merciless thing, calling for almost impossible crusades for justice, beauty, love for all men, the fight against illness and suffering, and still other aspirations, against which nature resists. Bravo for this fight: it gives a sense to human existence. But, today, we feel with what tact,

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what sensitivity, what prudence we must conduct the battle, in order not to spoil everything by the ruin of a natural balance of which we have such pressing need. ”¹⁶

10) Causality does not exclude finality.¹⁷

11) Besides the notion of “ structure ” and “ system ”, that of “ force ” and “ force fields ” is fundamental. Force is not part of the perceptible real, it is manifest only by its effects on the perceptible real. The field of force is a surreal concept which is necessary to us for a description of the perceptible real (weight, magnetic and nuclear forces, physical and chemical affinities).

12) The heterogeneity of time and space, we have already said for the human and social sciences, implies error, short and long term contradictions, birth, death and, for the living creature, evil and suffering. This same fact of the heterogeneity of time and space can be found in the physical and astrophysical sciences and has rather analogous consequences.

Stars are born and die. The planets have an origin and an end. Some are too close to their sun for life to manifest itself, others are too far away. Of the innumerable billions of billions of billions of hydrogen atoms existing in the universe, a ridiculously small proportion is incorporated in a living being.

Inversely, if the universe were not in evolution, if what we call time were homogeneous, that is if matter and space were not in the act of change, there would be no life.

* * *

I have already said above that the project of giving here a list anywhere near complete of the information that the physical and human sciences bring to bear in 1976, and which must form the basis of the reflection and action of intellectuals in the economic, social, artistic, political, spiritual and religious domains, surpasses both my intellectual capacity and the scope of this article. I have only evoked certain factors which seemed to me to be the principal ones.

¹⁶ Jean Hamburger, *op. cit.*, p. 154.

¹⁷ See Alfred Kastler, *op. cit.*, especially pp. 12 and 261. Kastler sums up his thought on this point as follows: “ Just as I believe, by simple scientific objectivity, in the existence of a finality, so do I doubt that this finality is unique and is centered on the inhabitants of this earth ”, p. 261.

I would end here on a comment which marks the limits of experimental science and which accentuates my reticence with regard to a too rapid and thus too brutal use of the enormous power which man has at his disposal today to carry out his plans for economic development, his vows of justice and social equality, his " social programs " .

I have already pointed out above that the real is not sufficient to explain the real. In many cases, the real, as it is better and better known becomes more and more mysterious (because the questions without answer multiply). To the extent to which he knows himself better and becomes more powerful, man understands himself less and no longer knows what goal to assign to his life. Neither justice, nor equality, nor even liberty, are goals for existence. They are modalities, at best they are conditions. But what will men do when they are equal? What will they do when society is just? What will they do when they can do " everything " ?

I said above that science had destroyed existing conceptions of the world, traditional religions, without replacing them with other conceptions of the world, with another explanation for evil and suffering, with another *sense* for life. It must be added that experimental science, whose technical efficiency is so great, *is not fit* to envisage final ends for man, the meaning of life and the universe. Its nature and its method imply in effect that it only recognizes " objects ", beings or events that man can know through observation or experimentation, that is by the recording of one or more signals issuing from these objects and either directly or indirectly perceptible through the senses of man (sight, touch, etc.)¹⁸

Now, this methodological, but absolutely nullifying, condition excludes from the tomorrow of science a quantity of events important for man and necessary for his understanding of the world: these are those events which took place only one time or

¹⁸ It has been evident for a long time that this method, this technique of discovery of the real leads by priority to causal descriptions which present the chronology of evolution as a necessary and sufficient explanation of evolution, and distracts from the questioning, equally fundamental nevertheless, beyond the how of things to their why.

This is evidently of great importance, but is rather well-known and debated so that I will not take it up here.

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just a few times *without any (human) observer* being present to record them, those which took place in the past without any earthly observer being present at their expiration, finally those which will take place in the future. There is thus an enormous number of facts which are, *by nature*, in the domain of experimental science but which for the date or the place of their occurrence, of their advent, escape the methodological observation of men. They are observable, but they will never be observed.¹⁹

I propose to qualify these facts as *hyperreal*, whose reality our ignorance must not deny, and which can be envisaged only as long and fragile chains of connection with the observed real, rational chains and thus hypothetical, but which certainly will prove, I believe, indispensable to our understanding of the universe and ourselves, to the persistence of our zest for life, to the earthly survival of our species.

¹⁹ Thus, among innumerable examples, the successive “appearance” of different atoms, the beginning and end of the human species, the birth and death of Christ, the mystical experience of Catherine of Siena or of Jacques Maritain...