

THE MATHEMATICIAN – A NOVEL HERO ¹

Serious studies have reached the conclusion that in few years one fifth of the world's population will be involved in scientific research.

One fifth.

That is I, you, he, she and another one: one of us will be working in research. It goes the same in every country, on every continent: one out of five.

It is not hard to guess how this research is going to be carried out: we are talking about more and more scientific research; maybe the experiments, once organized, will carry on automatically; bibliographic research will also be automatic; computers will help humans in research as excavators are now digging and cars moving in their stead. More and more, man, as a thinking being, will only have to think. But thinking is hard work.

It is so much the harder as scientific knowledge of the world does not allow you to think by approximation. The imperative is: think mathematically.

We are not creating science-fiction novels, even if to some it might seem so. That one fifth of the world that will be working in research, will necessarily speak a mathematical language. This might displease some people; history is not meant to please everybody. Only those who are making it.

But that one fifth of humankind will be drawn a portrait, and they would like it to be true to life. It has been noted long ago: it is not the cold water pitcher that makes the novel heroine a country-girl; neither does the cap make a worker; nor the integral a mathematician. Today, farmers no longer

wear homespun trousers or peasant sandals; neither do workers wear overalls, nor do mathematicians work with equations. Yet, the cherished hero is, in turn, The Count of Montecristo, Nucingen the banker, architect Solness, Ion; each of them dies with his epoch; the Camille would now take streptomycin; each one lives in his epoch. That's what we should be thinking of: how will it be?

Will there be new problems, new situations, new dramas? Can they be foreseen as early as today? Or known? Or analyzed?

The scientist-type called for a caricature: respectful and soothing for the old teacher with his elbow-worn-out jacket (undoubtedly a mathematician, who «in an endless calculation, keeps on reckoning and counting»); respectful and thrilled for Balthasar Claës.

Lots of us would be interested in a book about the way the scientist has been described by novel writers, and poets; this book should be written today; about how they used to be. The A-bomb raised the ethic problem of the scientist in our days; the looks: he may be plump or skinny, tall or short, ostentatiously dressed, smartly or negligent. Special peculiarities: none. Some are generous, others envious, most of them are cultivated, some quite primitive. They used to dance tango in 1916, rumba in 1936, a.s.o. . Today it's twist. When they will make one fifth of humankind, all the «visible» characteristics will be distributed as for the other four fifths. The others?

The subtle psychologists, the ample novel-writers should get ready. Some have already started to: the organizers.

Science today needs organization, management. One can feel the contradiction which is about to be born; the thesis: science, the antithesis: the organization of science; the synthesis: the management of science management.

Archimedes discovered his principle while in a usual bathing tub. Today a phasetron needs complex planning, investment and accounting services. Does it also need scientists? Oh, yes, of course. Do not ask them anything: you risk being considered impolite.

It would be tough without organization: the inventory register calls for an outcome-income one; the latter requires an attendance book. Who dares think of a research institute without scientists clocking on? But: if the mechanic is missing, the weaving loom will tangle up the threads. In a research institute it's the other way round. A lazy clerk will not come to the office; a lazy researcher will stay at the institute; he just stays there, because it is worth it.

I am looking forward to reading some novels on this subject matter. I wish I read them.

The scientist has relationships with his human fellows in order to practice his own science. The retirement inside the ivory tower is a metaphor, which nobody enjoys any longer. Utopia is the place where every «sponsorship» application is readily acknowledged. In every other place one has to look for funding: for the laboratory, for taking part in congresses, for publications.

For mathematicians it is not the case: they just need pencil and paper; not any longer; they need computers now; it is even more expensive; and they don't even destroy cities, don't kill people, so there is no secret in that; it can be justified, so you have to justify it; especially in order to make yourself understood.

Some of them are trying to run away from the computer, the great, expensive, mysterious computer; it's useless: the computer runs faster. Number analysis wants to do it a favor; it is accepted and it asks for a functional analysis; once included, we realize that, unawares, mathematical logic has been approached. A hand is put out towards linguistics, economy, biology, medicine. Watch out! It keeps coming.

One more thing: anyone can count the letters in a book (in technical terms, «character count»); maybe even the blanks. But not anyone knows if letters might not be blanks. Few know that blanks can be signs. It is easy to think it's easy. But people do have the right to laugh. At you? No. Just like that.

It is not easy to judge the efficiency of a scientific work. Will it be done by the title?

A group of serious people has written a book with a title that seemed to be a joke: «Eléments de mathématique» (it was a slogan for «mathématiques» was spelled in the singular.) The editor was smart. He published it. Apply the tollendo tollens system. It gives excellent results. It has been experimented.

Will it be by the content? After the hoax with logic turned into applied science, some are reluctant. Others, on the contrary.

But the problem of efficiency is not only an accounting problem. The Creator Himself, even if without asking for anything, wants yet to convince, to pass His knowledge on, to teach another, to have some followers. Any researcher is a teacher, who wants to teach the others at least what he has discovered himself; there is usually more to it: the way he understands what others have discovered, part of the science he is dealing with, all of the science he is dealing with, its connections with the related sciences, with the farther off sciences, his whole philosophy.

The hope of the scientist is that his work will remain forever carved in the eternal body of science and his doubts, his shyness in hoping will prove a hope in the soundlessness of his shyness. He will return, with new tools, to carving a block forgotten in the middle of the work (not forgotten, but abandoned, pushed aside, thrown away). But what if your work does not touch the souls of others: is it too difficult or too easy? Is it too new or too withered? You have the right to consider yourself misunderstood. Do you have this right? Do you? Who, you? Do you think you are right in considering yourself misunderstood? Haven't you wasted your sleepless nights in vain? Hadn't you better mind your own business, and go for a quiet stroll, watching the beetles and flowers? Was it worth? Is it worth? If you arouse too soon the others' interest isn't it due to your lack of originality, or because of too

easily matching the thoughts of too many? Is it easy to remember, like a song? But does it mean that, if the song is nice and simple, so you can hum it in the street or under the shower, a song that everybody sings, it is therefore commonplace and valueless? Has it no value at all?

Efficiency is a criterion. You state it, you wonder. Is it really a criterion?

Efficiency means that your idea has gone out into the world. Alone. As you released it. It may do good or bad, you can no longer stop it. Not only when it comes to an idea connected with the physics of the nucleus, but any time. How should I know how a theorem is being used now, when all sorts of people are using it, in all the engineering or accounting offices. Or tomorrow, when even the physicians and biologists will understand it? Or the day after tomorrow?

The moral problem does not exist when I know that I know nothing; it arises when you know that you know something.

Because, today, the scientist knows he knows something. How much? To put it modestly: very little. Some say «nothing», meaning «almost nothing», that is «very little» or meaning «I do not know everything», or «there is still a lot to learn», or «the future generations still have a lot of mysteries to solve», or «science still has lots of things to discover», or «science will always have work to do». It's optimistic.

There are some who would like to «be finally through with it». They would like to stop the progress. Is it just to say to the moment: you are too beautiful, stay? Maybe. Is it out of envy, realizing that they will be overcome? Or out of the regret that they will not know what will be found out? Is it out of the thirst for power, for embracing and dominating the whole of science at one moment? Or just in order to organize a better, healthier and more beautiful life, by means of the entire science? Is it out of generous or mean reasons?

This desire is natural; others are better in reading it, deeper, into the soul of those who possess it. And of those who write bulky works, in many tomes, where they slot in an ultimate order whatever is known in a certain field. Whatever is known when? At the date the "print" has been given. What about the next day?

Others only write short notes, indications on trees: this is the way to Einstein's peak. Or large billboards: 300m to the big orchard: Boole's algebrae applied in automatics.

No scientific work should end in «fine», but in «to be continued». Probably by another author.

This goes for the important works, as well as for the others.

Science steps ahead today faster than the scientist; they start together but man is left behind. One should once write the story of those who have become breathless in chasing their own ideas. And the tragedy of those who, unwilling to stay behind, find it impossible to go ahead. And the bitter comedy of those who, incapable of running, try to stop the flood. And the dramas

caused by those who, unable to understand the new, oppress those who practise it; all these will be one day subjects for novels.

And for philosophy.

The scientist is a complete man. The kind of person who is interested but in a single activity is not to be found more often among scientists than among those with different preoccupations. It is not only practical life that he is interested in, since today he is bound to come in contact with it, but, as I have said, he is also interested in arts and international political life, as well as in the life of his own people. As it has been said: in whatever is human. So, in philosophy as well. And since physicists, chemists and biologists are dealing with ontology, logicians and mathematicians with epistemology, engineers or physicians, working with people, are dealing with psychology and efficiency, therefore with the science of practice, these different branches, which used to be once grouped under the large area of philosophy, are even very close to them.

The scientist meditates over his own science; each of the affirmations of science is permanently set to a test. Does that mean casting a doubt on science? Is the methodical doubt of the one who has interwoven the ideas a real doubt? Is it a form of agnosticism?

Each one in its own turn, the restricted relativity theory and quantum mechanics replaces classical mechanics. Whether replaced or contradicted, classical mechanics still holds valid. Although it is not as important for a man of letters as it is for a philosopher, I will insist upon it because it is characteristic to science. In the formulae of the theory of relativity we will find a letter, «c» which stands for the speed of light. Light speed is known to be 300,000 km/second, so in the formulae it should be replaced by 300,000. But, if in the formulae of the restricted relativity theory we take $c = \infty$, the formulae will coincide with those of classical mechanics.

How is this to be interpreted? The correct interpretation is simple: for high speeds we obtain results which are tolerably exact, by using the classical mechanics. So, we will not use the theory of relativity but classical mechanics when studying the evolution of a bicycle or a jet plane: they move too slowly. But the results we would obtain by applying the classical mechanics to electron movement would be very different from those given by the theory of restricted relativity; it is therefore the latter that should be applied.

They say: classical mechanics is a limit case of the theory of restricted relativity, when the speed of light tends towards the infinite. Similarly: classical mechanics is a limit case of quantum mechanics, when Planck's constant tends towards zero. Similarly again: Euclid's geometry is a limit case of the non-Euclidian one, when the curve radius of space tends towards the infinite. It goes the same for logic.

Any invitation to philosophy on this, will only interest the scientist.

The man of science is interested in philosophy, but not in any kind of philosophy.

Obviously, at any moment of cultural history a large – a too large – number of people are interested in obsolete problems, i.e. in verbal formulations which used to have a meaning, but which have lost it as human thinking evolved, due to the improvement of the investigation means and to the endless repetitions of experiments. Let's have an example.

The problem of the criterion that separates the truth from the false has been the object of numberless meditations. The ear is misleading and the eye is lying to us. Do animals dream? Does the baby? What about a primitive being? Can they draw a clear distinction between what they see and what they dream? These things are probably known. I am mentioning them just because this is the beginning. Which is the criterion that distinguishes appearance from reality? In the distance, things seem small. The effects of the perspective. It is useless to continue the list of all the proofs of classical skeptics. These things no longer puzzle us today. The proofs of classical skeptics, with the errors of the senses have a withered perfume. It goes the same with Kant's antinomies. What about the paradoxes, from those of the Megara school, up to the ones of mathematical logic? In studying them, the scientist reveals his new position, as contrasted to that of the classic philosopher. The problem of the logician at this end of last century was to build up the mathematical logic and the theory of sets. When he thought he had done it, the paradoxes arose. Where was the mistake? The researcher in these fields knew that the mistake consisted not in trying to build a mathematical logic, but in the way some would do it; for instance, by excluding the theory of the types. More or less like Michelson-Morley's experiment. The result was not the expected one, or the supposed one. The contradiction does not lie within science, but somewhere between science and what was being expected from it. This has happened before and will happen again. The scientist is aware of what he knows and he is giving it a try; maybe what he knows also works where he is ignorant. Sometimes he tries out of curiosity. Does it work, doesn't it? Some other times, with conviction: he may be right: he calculates the orbit of a new planet starting from the data referring to the orbits of the other planets; he directs his telescope and he sees this new planet. Here is a great success of science: of the old, established science, that of Newton's mechanics. This is the kind of success science needs. And it does have such success, quite often. But it may also go wrong: this is the case of Michelson-Morley's experiment; this is how a new science is born: Einstein's mechanics. Science needs this kind of success as well.

What is truth? After having asked others, someone answered this question by washing his hands of it. This is not the way of science. I won't deny that I would be glad to read a book called «The Search for Truth – A Tough Job». I could find there that at any time the imagination of the scientist surpasses the results included in science. I could also see this fantasy hurt against the laws of logic, against the real world, the suppositions being sometimes confirmed and other times denied. If a theorem has been demonstrated, it is not

only the end of a long line of trials, but also the source of a new row of theorems.

But what if this isn't so?

One should write a book for mathematicians and put together in it the theories emerging from the theorems of unsolvability. Thus, the theory of differential equations resulted from the impossibility of integrating differential equations: theorems of existence, uniqueness, approximation, and others. The theory of the integral comes from the impossibility of an elementary quadrature. The impossibility of solving an equation of the fifth degree gave birth to the theory of algebraic solving of equations. The theory of algorithms comes from the impossibility of solving the problem of words, while «Gödel's paradox» lead to the theory of incomplete formal systems. And many more.

Obviously, scientific work is hard; there are persons who, bored by thinking science, start thinking about science, as they believe it easier. Great error: it is even more difficult. You have to know everything that is known, but also how what we know is known. Then, let's stick to talking about science. This is easier, indeed. It really is.

Or, shall we try getting out of the scientific framework? The trouble is one can not get out of it. (One can obviously make art, but this is not the issue.) Getting out of science is to stop at a particular moment in the history of human thinking, when a form of activity, which was trying to be some kind of knowledge, had not proved illusory yet. It means to try again some failed attempts. If I am able to combine them so that I get a state of poetry, this can be nice; if I can make them nice:

Aujourd'hui date fatidique / Vendredi treize²

or

And lonely now, in your great quiz, / I stay with you to find myself once more / Without desire to be conqueror / Just feel you now and shout: «He is!»

[T. Arghezi]

What is beautiful? I don't know. But it is beautiful.

If the hero of the novel goes astray from the way of science, looking for another means of knowing, I can understand the tragic desperation of such a failure, if the novel writer can explain it to me: an ecstasy like the one caused by some weed juices. The desire of understanding the world is opposed by the possibility to know it.

The problem is not to understand the world as a whole; simultaneously, by intuition, by revelation.

They tried it, but it is no longer being tried.

Could it be that the Great Anonymous [of L. Blaga], with wide wings taken out from properties, is defending Himself? Is it the object that refuses revealing itself just because we want to set it within time and space? Or is it because we «want to feel it with our hands»?

The unknowable wraps itself in its mantle and exits.

“You can’t catch it.”

“It’s been said before. Neither could Achilles catch the tortoise.”

“You can’t overtake it“.

The attempt at overtaking, as well as the attempt at getting the thing in itself is not our problem, but our great grandparents’. Today, the problem is to know, piece by piece, bit by bit. To integrate what has been known; to dominate it; to use it. From the tiniest parasite: the bacteria, the virus. From the molecule, down to the atom and electron, or up to the macromolecule. From coasting to going round the earth; from exploring the atmosphere in a balloon to the exploration of the outer space.

Do not try to discourage me; you can only discourage the discouraged ones.

I know my work is bothering you. It always has. I didn’t mean it to upset you, I’ve only done it because this is my work. You are trying again to make me believe that you are working for someone else, someone who is greater and more powerful. If he is more powerful, why do you defend him? Isn’t he my friend and you would like to turn him into my foe? I have taken the earth out of your hand; you used to dominate it; I have untied it and know it is turning around the sun. It is freer now, no longer depending on you or anyone else. Except Newton’s law. I have taken man out of your claws, making him a brother of the beasts, and flowers and the algae. I have cured him of plague and cholera and now I am doing my best to rid him of hunger.

It is really hard today to deviate someone from scientific knowledge, to try and convince him that what he knows is not «the thing in itself»; it is really difficult to take man out of the world. The fruits of the revelation of the opposition between matter and idea or matter and energy have been cleared up too short ago to reappear under any form; even under the form of matter-information.

Man knows; he knows nature when changing it and changes it by knowledge. Striking a stone against another, he sharpens them into cutting objects and forms the concept of hardness; for next time.

4 — Man knows; his history about «how man gets to know nature» has been written several times. Maybe they will also write the story about «why man can’t believe he does know nature». But it should be written properly. Otherwise, it will have to be re-written.

Let’s not mix things up: according to Kant, the numen can not be known; matter, according to Lenin, is inexhaustible. It is between the interdiction to know and the urge to know that history has struggled for the few last centuries. But humankind has made its choice.

(A. B.)

NOTES

1. An occasional article is not an article where the author reveals his thoughts generated by an occasion, but the one, in which, under a certain occasion, the author reveals his old thoughts; no matter how old. This is an occasional article, in the terms of this definition. The occasion: see pages. 131-134 [containing, in the original magazine, some fragments from the R. Musil's novel].
2. Today, fatidic date / Friday the thirteenth – French in the original. Note of the translator.