What is a problematic?

Patrice Maniglier

Gaston Bachelard’s 1949 book, *Le Rationalisme appliqué* (RA; best translated as *Reason Applied*), is essential to an understanding of his work, and Bachelard is essential to an understanding of twentieth-century French philosophy. That this book has never been translated into English shows how little the anglophone world is yet acquainted with some key aspects of this corpus. Bachelard, like Bergson, is one of those authors that we now need to rediscover. The extract translated below addresses a central concept in his work, one that came to play an important role not only in French thought, but also in general culture: the concept of problematic.*

Every school pupil in France today has to learn how to ‘construct her problematic’ when she works on her ‘dissertation’ in Literature, History, Philosophy, and so on. A ‘problematic’ in this pedagogical sense is not simply a set of questions; it is rather the matrix or the angle from which it will become possible and even necessary to formulate a certain number of precise problems. For instance, if you pick as your essay question ‘What is self-evident?’ (as is perfectly possible in France), your problematic will consist in discovering the philosophical topos that the term alludes to, perhaps opposing formalist and intuitionist approaches in the philosophy of mathematics. Similarly, if you are asked, ‘Does freedom mean doing whatever I like?’, you could oppose individual and social concepts of freedom, or contrast the notion of pleasure with that of law, or even combine the two in a dialectical order. But the point is always to go from a rough theme or question to a precise problem, which has the form of an alternative between already elaborated or structured options.

The word is so popular that everybody has forgotten that it was invented quite recently by Bachelard in *Le Rationalisme appliqué*. This is all the more surprising in that the concept has undergone very sophisticated elaborations in subsequent philosophical history: it inspired Althusser’s reading of Marx and more generally his attempt at constructing a materialist concept of scientific knowledge; it is implicitly behind Foucault’s concept of *episteme* and explicitly at work in his later notion of *problematization*; and it is at the heart of Deleuze’s meditations on the ‘Problem–Idea’ in *Difference and Repetition*. In all these cases, it is meant to open up to a different ‘image’ of thought, a structuralist and a materialist one.

There are three especially important points to note in this regard.

First of all, the concept of problematic initiates a critique of the subject–object relation in the explanation of thought in general and of science in particular. To think is not to try to tell the truth about any particular given objects (be these living organisms, things in motion or brains), as if there was a world out there waiting for us to lay our eyes on it; to think is to try to solve specific, singular problems. It might be worth observing that this substitution of the category of problem for that of object is something the French epistemological tradition shares with both the Popperian and the Heideggerian traditions. It accompanies what Deleuze calls in *Difference and Repetition* the critique of *representation*. Problems cannot take the form of an inquiry about the *essence* of things (‘what is matter?’, ‘what is life?’, ‘what is X?’); instead they constitute that which makes it important, relevant, critical, to know about X. Bachelard thus argues that

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there is not, on the one hand, the world, divided into large ontic domains (matter, life, etc.), each one characterized by a certain number of properties or laws that the various disciplines (biology, sociology, etc.) would have to learn about, and on the other hand, the mind, which would try to map this reality and fill in any blanks with the right information; there are only singular problems which simultaneously determine the subject to think and the object to be thought: ‘We must first posit the object as a subject of the problem, and the subject of the cogito as a consciousness of the problem’ (RA 56).

Neither objects nor subjects, neither things nor minds, exist primarily; there are only problems, which institute the very possibility of the correlation. This clearly commits Bachelard to nothing less than an ontology of problems that has to wait for Deleuze before it finds its full elaboration. But it also gave to Althusser the means to develop a truly materialist epistemology: that is, an epistemology that approaches knowledge not in terms of how well it matches a static reality, but in terms of its actual production, articulated on other levels of production, such that truth serves here as an operator in a dynamic process and not as a kind of revelation or epiphany. This dynamic conception of knowledge is part of the common legacy that even Latourian science studies share with Bachelard.

The second important point worth retaining from the Bachelardian concept of problematic is that it is not only (as it might seem in the first instance) a promotion of interrogation over affirmation, as we can find in the Heideggerian hermeneutic tradition for instance. On the contrary, it is meant to oppose notions like ‘wonder’, ‘bewilderment’, ‘curiosity’ and ‘enigma’. To think is indeed to ‘problematize’, but to problematize is not simply to interrogate or to refer to Being as a Question and not as an Object; it is to criticize the questions themselves. The concept of problematic is thus closely linked to the notion of ‘epistemological break’. This notion has been as widely contested as it has been misunderstood. It means among other things that scientific disciplines do not answer ‘ready-made’ questions we encounter in the course of our ordinary practical life, and have no ground in what Husserl calls the ‘lifeworld’. It is not because we always wondered about the movements of the planets that astronomy exists, but on the contrary because it neutralized these questions and replaced them with precise problems.

In the passage translated, Bachelard gives two examples: the scientific theory of the ‘dew point’ does not give any answer to the ordinary question of whether dew comes from inside or from outside of the plant; it rather demonstrates that each particular level of dew is determined by a more general correlation between vapour pressure and temperature. Similarly, the question as to whether light is faster or slower in air than it is in water is simply irrelevant: none of the terms used here (‘water’, ‘air’, ‘fast’, ‘slow’) can be univocally translated in the scientific statement, because science doesn’t refer to things but to parameters and correlations. This is a very important point for it shows that Bachelard does not situate science against the background of some more fundamental questioning, as Heidegger does, but on the contrary valorizes science for the way it creates new problems and new interests. It is also important because it shows that for Bachelard every science is critical: it consists not in satisfying our curiosity, but in displacing the very questions we have. As Marx said, ‘Not only in their answers but in their very questions there was a mystification’ (The German Ideology). We can call critical a kind of knowledge that does not content itself with filling an already given frame with new items of information, but one that forces the frame itself to be reconfigured. Knowledge is not only an enterprise of acquisition; it is also an exercise in self-transformation. ‘In self-questioning rationalism [le rationalisme questionnant], the bases for knowledge are themselves put to the test, and brought into question by the question’ (RA 57).

We might remark, to introduce a third point, that there seems to be a contradiction between the two first ones: aren’t we saying at the same time both that problems precede and determine all positive statements, and that scientific problems are constructed and depend upon already quite specific scientific theories, and only make sense within such theories? How can scientific theories be provisional solutions to problems, if problems are conditioned by scientific theories? This raises another problem. Does the notion of epistemological break mean that the scientific ‘problematic’
simply has nothing to do with the world in which we live, fear, need and work, and so on, or that a scientific ‘subjectivity’ simply has nothing in common with the living person who walks out of the lab? Putting ‘Science’ in such a position of exception seems such an extreme and implausible idea that it is easily refuted by those who, like Latour, seek to study scientific practices and their actual production.

To answer these two questions we simply need to understand that a ‘problematic’ does not involve the substitution of one set of (bad) questions by another set of (good) problems; it is rather an operation on the very substance of our ordinary life, and an operation that is best described as a ‘structuration’. Scientific practices are indeed determined by their relation with ordinary practices, but this relation is negative (dialectical) and progressive (pragmatic). It is negative in the sense that it only consists in diverting and emptying the semantic content of the notions used in our ordinary intelligence of the world, intuitive notions like weight, speed, volume, and so on, through their being redefined in relation to one another. Thus, instead of having an independent concept of mass, mass is defined by its relation to speed, and therefore is diverted from the isolated meaning it has in the lived experience of weight. Since, conversely, the notion of speed is redefined by the law of acceleration, it appears that the ‘scientific mind’ is characterized by the redefinition of terms through interlocking correlations.

Bachelard calls this process (perhaps following Cassirer’s Substance and Function) the ‘functionalization’ of the terms, since it replaces absolute notions with functional concepts. This is why we must not interpret what Bachelard says about the dew point as meaning that dew is investigated by the scientist only in so far as it confirms or refutes an already given scientific law. It is rather that the phenomenon itself becomes a variant or a variable in the correlation between co-determined concepts. The entire world is as if folded within itself, and all dimensions of reality now refer to one another, as in a play of echoes. The problematic is not the theory itself, it is not the set of formulated laws held to govern any particular domain: it is the structure of the theory; that is, the way the different concepts are diverted from their isolated and immediate ordinary semantic sense and redefined in relation to one another.

It is important to note, however, that this process is never-ending. We don’t go from substantial terms to functional concepts at one stroke; there are degrees and levels of ‘functionalization’ of the terms we use, and no set of concepts is ever entirely functionalized. There always remains some room for what Bachelard would call (without negative overtones) ‘imaginary’ associations. This is why the relation between ordinary language experience and scientific problematization is a progressive one as much as it is a dialectical one. The passage translated here constantly emphasizes this element, the interesting object, for instance, being ‘an object for which the process of objectification has not been achieved’. The scientific mind is for Bachelard an ever greater effort to create within our own thought or our own language a sort of internal environment [milieu] (in the sense in which it is said that the organisms have both an external environment and an internal one), which consists in replacing the external relations that notions of the theory maintain with extra-theoretical entities by internal relations operating within the theory. In other words, if we problematize the world, it is neither because the world reveals itself in some enigmatic light, nor because our theories offer different alternative routes of empirical verification, but because our own thought proceeds as a process that structures a set of propositions. The structure is neither given in advance, nor constructed: it is all in the making.

We can now see how problems can have an ontological dimension for Bachelard, while being at the same time constructed: they are to be constructed, they are the metastable part both of mind and of reality, which will distribute the two sides of the single process-reality differently, according to its requirements. This hints towards a pragmatic ontology for which to be does not mean to be finished, but on the contrary to be in the making. That problems are in fact vectors of structuration, while structures are always in the making, are just some of the wider implications of Bachelard’s concept of ‘problematic’, which are only today beginning to receive their full meaning.
What does Bachelard mean by *rationalisme appliqué*?

Mary Tiles

While Bachelard's *Rationalisme appliqué* can readily be translated as *Applied Rationalism*, neither the French nor the English are very revealing of the position being advocated. In particular one would be led very far astray if one were to think of rationalism as a philosophical position which suggests that knowledge can be logically deduced from first principles that are either immediate and self-evident, or reached by analysis, and then to think that Bachelard is talking about how to apply such rationally grounded theoretical knowledge. This is not at all the perspective from which he approaches scientific knowledge.

First, as the beginning of the translated passage indicates, Bachelard is concerned with the *processes by which scientific knowledge is acquired*. His position is a form of rationalism in the sense that reason has a dominant role here; scientific knowledge is both rationally organized and rationally grounded in experience, and both of these features emerge from the way in which it is acquired. It is not first proposed as theory and then tested empirically (as a Popperian would suggest); the role Bachelard assigns to reason is one of empirical engagement. Applied rationalism is thus an account of empirically (materially) engaged reasoning, not of theoretical reasoning subsequently applied. His position can be hard to grasp because it represents a quite radical departure from philosophical norms, particularly those that analytic philosophy inherited from the logical positivists. He transgresses divisions that others have taken as absolute givens, such as that between abstract and concrete when he talks of the concrete universal.

He is already talking about what Latour would later call the world of hybrids, the material world informed by modern science and technology. This is both the world of industrial mass production and its products and the world of the scientific laboratory where the study of phenomena is heavily mediated by instruments. As Bachelard says, modern science has passed from the phenomenology of nature studies to the phenomeno-technique of the laboratory.¹

Second, Bachelard equates reason, reasoning or deduction not with logic but with the development and deployment of mathematics in organizing both thought and experimental practices. It goes without saying that he rejects logicist and formalist views of mathematics. In this respect he is as guilty as other philosophers of science in taking physics as his paradigm science (although unlike others of his period he does go on to look at chemistry). At the beginning of *Rationalisme appliqué* he says:

> Physics thus has two philosophical poles. It is a veritable *field of thought* which is expressed mathematically and experimentally and which is at its most lively in the conjunction of mathematics with experiment. Prominent in physics is a synthesis which determines an *abstract-concrete* mentality. (*RA* 1)

Bachelard is seeking to characterize this unitary ‘mentality’ in its double action of abstraction and concretization. We find more evidence that this marks a fairly radical departure from other philosophies of science, when he says:

> The time for an epistemology which considers mathematics as simply a means of expressing physical laws are over. The mathematics of physics are more ‘engaged’ … There can be no empty rationality, and no disconnected empiricism. (*RA* 3)

Later on he says:

> People have been too quick to say that mathematics is simply a language which records, in its way, the facts of observation. This language is, more than any other, inseparable from thought. One cannot *speak* mathematics without *understanding* mathematically. (*RA* 180)

He goes on to note that
The necessary dialogue is so tightly knit that one can hardly recognize here the old dualism of the philosophers. It is no longer a question of confronting a solitary mind with an indifferent universe. It is necessary henceforth to place oneself at the centre where the knowing mind is determined by the precise object of its knowledge and where, in exchange, it determines its experience [or experiments] with greater precision. It is precisely in this central position that the dialectic between reason and technique finds its efficacy. We will try to put ourselves in this central position where an applied rationalism is as much manifest as is an instructed materialism. (RA 4)

Here Bachelard signals that there are in fact two chasms established as a result of philosophy in the Cartesian tradition whose erasure he insists has been essential to the project of modern science. One is between abstract thought (the realm of ideas and hence of knowledge) and concrete objects (the world of empirical reality, the object of scientific knowledge), the other is between the individual as knowing subject (the self) and others (other minds). Unlike other philosophers (whether analytic or continental) Bachelard does not try to ground the objectivity of scientific knowledge in a removal of the role of the knowing subject. He self-consciously swims against the anti-psychologistic tide by insisting that any epistemology must include the role of the knower and her/his thought processes. Instead he works to ground the normativity, objectivity and security of scientific knowledge in the essentially social and materially engaged processes of its acquisition. Reason here is not something innate in an individual subject; it is a social, cultural product of the practices through which we simultaneously order and regulate our world and our understanding of it. He writes:

We thus have as our task to show that rationalism is in no way linked with imperialism of the subject, that it cannot be formed in an isolated consciousness. We have also to prove that the materialism of technique is in no way a philosophical realism. Technological materialism corresponds essentially to a transformed reality, a reality rectified, a reality which precisely has received the human mark par excellence, the mark of rationalization. (RA 8)

Here Bachelard wants to emphasize the mark of reason inherent in technical materialism and the mark of concrete reality inherent in applied rationalism. These are really two sides of the same coin. As such, he wants to insist that his position can also escape the charge of psychologism; it is neither psychologism of the individual subject nor the anti-psychologism of its erasure, but alive to the dialectical process by which the individual is socialized as a member of a group with a common culture. Knowledge, scientific knowledge in particular, is a cultural not an individual product. But it is also, according to Bachelard, always a second culture, a culture that defines itself in its distinction from the biases, interests and errors of ‘common sense’ everyday culture. Here again, far from saying with Popperians that science is common sense writ large, Bachelard insists that the scientific attitude requires a constant critical review of assumptions that may have been made uncritically as a matter of habit conditioned by past socialization. Such a review is integral to the process of rationalization, of enumerating and putting in order, consciousness of which is, he insists, part and parcel of genuine scientific understanding, an understanding which is quite distinct from knowledge of a disparate bundle of facts.

It is perhaps easy to see what Bachelard is driving at if one takes one of his own examples: that of measurement. Without some measurement practices scientific knowledge of either the natural or the social world cannot get off the ground. No individual can establish a system of measurement that has a function beyond her own purposes; to be of use in commerce, in architecture, map-making, navigation, and so on, it has to be communicated to others, and others have to be persuaded that it is a good system – that it is accurate and robust enough for the intended purposes. Measurement practices then need to be agreed and established by convention, including standards and ways of checking that procedures are being followed correctly. Once established one cannot depart from agreed practices without risk of penalty (whether practical – things don’t fit or don’t work – or legal – being sued for selling short weight, and so on). Uniform standards of measurement bring order to our lives, and the more widely uniform the wider the power and control that go with practices dependent on them. One
can think here of arguments about currencies as an example: uniformity has one kind of benefit but also has some downsides in terms of lack of independence and autonomy for countries with their own individual currencies. The use of uniform and uniformly agreed units of measurement and standards behind those units is an essential part of the (rational) infrastructure of modern science. The definitions of these units are not, however, immune from critical review, and the history of measurement shows that repeated changes in standards and units have been required, by the demands of new science and engineering, to meet ever more strict levels of accuracy and precision. This is a rather basic but important example of the way in which practices that bring rational order to the material and mental world are at the same time cultural (‘corrational’) not individual and have both abstract and concrete lives. The double character of scientific thought, on which Bachelard repeatedly insists, is that it is a requirement of scientific understanding that one have a critical consciousness of the measurement practices one uses, such that one can, should the need arise, put some of the assumptions behind aspects of those practices in question and be able to argue the case for a change. That critical consciousness will be informed by knowledge of the history of a measurement practice and of the reasons why current standards are as they are, as well as of the problems that were overcome as successive refinements (rectifications) were made.

In light of the example of currencies one can perhaps begin to understand why Bachelard talks of rationalism not in the singular, as would most philosophers, but in the plural. He talks of regional rationalisms, just as one might have regional currencies. At least some of the practices and techniques used to bring (rational) order to a particular domain of scientific study are likely to be specific to the object of the investigation (the object of knowledge). This is particularly true of the instrumentation used to conduct experiments and make and record measurements. This disunity of science, and the communication challenges it presents, have become more apparent since Bachelard wrote, as scientific research has become increasingly specialized and academically compartmentalized. It is noteworthy that at a time when others were writing about the unity of science and of the scientific method, Bachelard was talking about the plurality of regional rationalisms.

In RA he gives the examples of electrical rationalism and mechanical rationalism. Each of these he treats at some length and in detail that it is not possible to convey here. But it is worth just remarking that electricity provides a particularly striking example of the technical basis of the phenomena studied. Experiments to study electricity and electrical phenomena have to be rationally organized and planned in the light of theory realized in apparatuses since there are few natural occurrences of electrical phenomena (lightning, static electricity, but not an apparently continuous electrical current). Moreover, the ability to manipulate electrical and electronic phenomena has quite literally changed, and continues to change, the world in which we live.

The case of mechanics, a science with a long history and a very early matematization, is rather different. In his chapter on this Bachelard seeks to illustrate the continued utility of the framework of rational mechanics, and to separate this from any philosophical (metaphysical) endorsement of mechanism. He is particularly dismissive of philosophers who try to reject science by rejecting mechanism. He says ‘Mechanism is a philosophy that misunderstands the profound and specific interests of scientific research’ (RA 175). Towards the end of the chapter he discusses wave mechanics in order to show that its organizing ‘rationality’ has the same algebraic structure as that of the ‘rationality’ of electricity – the algebra associated with wave equations and Fourier analysis. This commonality invites further questions about the possible future relationship between the domains.

Throughout this work Bachelard is trying to find a language to convey his conviction, based in his experience as a science teacher, that mathematics is integral to the thought processes of scientists. This is not just a language of convenience; to think about a subject matter in mathematical terms is to think in such a way that the thought processes are carried by mathematical procedures which are already not merely mathematical but have physical embodiment. At its core it is something that is hard to convey because it needs to be experienced, which is why he is so insistent that the knowing subject cannot be removed from an epistemology dealing with the acquisition of scientific knowledge. The formalism does not speak for itself and cannot run on automatic. In this at least Bachelard sides with Descartes rather than Leibniz. It would be really fascinating to know what Bachelard would have to say, were he alive now, about the rise in the use of computer modelling in the sciences.

### Note

Corrationalism and the problematic

Gaston Bachelard

If the fear of being accused of psychologism were not so keenly felt by epistemologists they would no doubt pay more attention to the problem of the acquisition of ideas. They would then notice that to each new idea there remains attached a perspective of acquisition, an approach structure which develops in a kind of space–time of essences. They would also see how every new idea, which is at first a maker of mental solitude, becomes in inter-rationalism a need for proselytism. The dialectic ‘I was alone and we will be reunited’ is at play with respect to the validity of each idea, of each experience considered in terms of a broader cultural awareness. It is in the same detail of thoughts that the non-psychologism of the rational I and you become reduced to the psychologism of the isolated subject. The necessary isolation of the subject confronted with a new idea and its communication to another subject do not take place in a general rupture that places the thinking being in the midst of a universal doubt, which would be strictly incommunicable. It requires instead, for each notion, confronted with each object, an appropriate doubt, an applied doubt. Correlatively, the solitude of the subject is not created by a simple declaration; it can only come to consciousness through a minute psychoanalysis – of the empirical memory in search of a rational memory. And before wanting to conquer others, it needs to be very sure that it is not enslaved by the ideas that others have deposited in us by pure tradition. A rational culture must be in possession of a memory rationalized in such a way that all of its results are re-memorized along with the programme of their development.

In effect, when it is a question of presenting an object to scientific thought, one cannot confine oneself to the immediacy of a not-self opposed to a self. The scientific object is presented in the light of its definition, after the self is already engaged in a particular kind of thought, consequently in a particular kind of existence. The rationalist cogito which tends to affirm the thinking subject in an activity of apodeictic thought must also function as an emergence over and above that of an existence already affirmed more or less empirically. The world destroyed by universal doubt could only give way, through constructive reflection, to a fortuitous world. If one does not give oneself the right to go via the circuit of the notion of a creator God, one does not in effect see what guarantee one would have, after a totally destructive doubt, of having reconstructed precisely that real world about which one had previously raised fundamental doubts. The Cartesian universe could say to the philosopher: you will not rediscover me if you have really lost me.

Thus between the two poles of the world destroyed and the world constructed, we propose simply to slip the world rectified.

And immediately the rational self is conscious of the rectification. To describe the full span of the grasp of rational consciousness it is sufficient to pass from the disorganized given to a given organized in the light of a rational end. Universal doubt will irremediably pulverize the given into a mass of heteroclite facts. It does not correspond to any real demand of scientific research. Scientific research demands, instead of the parade of universal doubt, the constitution of a problematic. It really starts with a problem, however ill-posed the problem. Once the scientific self is a programme of experiments, the scientific non-self is correspondingly already constructed as a problematic. In modern physics, one never works on the whole unknown. A fortiori, contrary to all theses that affirm something fundamentally irrational, one does not work on something unknowable.

In other words, a scientific problem is posed by starting from correlations expressed as laws. Lacking

* This text is a translation of sections seven and eight of the third chapter of Gaston Bachelard, Le Rationalisme appliqué, taken from the fifth edition, 1975, pp. 50–60. It appears with the kind permission of Presses Universitaires de France.
a preliminary protocol of laws, a fact limited by direct empirical establishment risks being poorly understood. More exactly, affirmed dogmatically – by an empiricism hoist on its own petard because it cannot but affirm dogmatically what has been established by direct experience – a fact is vassal to the kinds of comprehension that have no relation to today’s science. From this arise errors that the scientific city has no difficulty in exposing. Anyone who has understood, for example, the scientific theory of the dew point is aware that they have been furnished with a definitive proof which closes an ancient controversy. The technique of using a hygrometer such as those of Daniell or Rignall – to cite only apparatus known in the mid-nineteenth century – gives a guarantee of objectivity less easily obtained from a simple ‘natural’ observation. Once one has received this lesson in objectivity, one can hardly make the mistake made by Renan, who believed he could rectify common sense in these terms: ‘The vulgar also imagine to themselves that dew falls from the sky and have difficulty believing the scientist who assures them that it comes from plants.’ The two statements are equally false. They both bear the mark of an empiricism lacking the organization of laws. Whether dew falls from the sky or comes out of plants, it will only give rise to a very brief problematic. The phenomenon of dew is rationalized by the fundamental law of hygrometry linking the pressure of the vapour to temperature. Relying on the rational organization provided by such a law, one can, without risk of contestation, resolve the problem of dew.

Another historian, very concerned about scientific thought, was a victim of a misunderstanding similar to Renan’s. Taine writing in 1861 to his friend from Suckau wanted to bring him up to date with what had been happening in science in recent months: ‘At the moment light is being intensely studied. There are the experiments of Fizeau which prove that light travels faster in water than in air, and those of Becquerel junior which prove that all bodies are phosphorescent.’ Light ‘travels faster in water than in air’. This is the opposite of what he should have said. A simple lapse one might say. No doubt. But a physicist is as shocked by such a lapse as a historian would be on being told that Napoleon’s coup d’etat preceded the revolution of 1848. More precisely, Taine limits himself to giving Fizeau’s experiment only the value of an empirically established fact. If he had appreciated this experiment in the context of the problematic which made it interesting, he would be unlikely to have made the mistake. Fizeau’s experiment is more than a result; it is a conclusion. It has a rational epistemological value. And rightly so, being a crucial experiment which decides in favour of the wave theory of light against the emission theory. Doubtless with the theory of relativity the problem will be revisited; a more vast problematic will require new commentaries. But, for a century, the experiment already required a long commentary, a conferring of value, for it represented an eminent epistemological value. It was more than a historical fact, more than a fact which resulted from an empirical verification. It resolved a problem.

In these conditions, a world which has already an objective security is represented to us as an avenue of well-defined problems. This situation has been very well clarified in several notes by Georges Bouligand where the mathematical scientist presents with admirable clarity the dialectic between a global synthesis (the current state of mathematical knowledge) and problems clearly posed as a function of this global synthesis. In the domain of scientific understanding of the real, the situation is without doubt not as clear as the situation characterized by Georges Bouligand for the progress of the mathematical sciences. But the situation presents the same dialectic. In fact if one wanted to describe the activity of scientific thought in the formerly celebrated style of existentialism, one would have to say that scientific thought is systematically \[\text{situated}\] by precise objectification to which it is exposed as a ladder of precision. Here again we see the enormous superiority of the scientific object over the object of everyday experience for metaphysical instruction, since it is at the point when objectification becomes more and more precise that the important functions of the rationalization of the object are in play. In place of the dualism of the exclusion of the subject from the object, in place of the separation of substances of Cartesian metaphysics, we see in action
the dialectic coupling objective knowledge to rational knowledge.

In the work of scientific precision one can seize the elements of a Copernican revolution of objectivity. It is not the object that designs the precision, it is the method. This metaphysical nuance will be understood if one refers back to some primitive method of measurement. For example, it is said that the term carat comes from the name of an African tree (Kuara) whose seeds once dried are more or less equally heavy. The indigenous people, confident of this regularity, used this grain to weigh gold. Thus, in its first usage, a natural regularity was naively deployed in order to determine a technical precision, and that in the measurement of a precious material. In order to found rationalism on measurement it is necessary to reverse perspective.

Indeed an object can determine several types of objectification, several perspectives of precision; it can belong to different problematics. The study of a chemical molecule can be developed from the perspective of chemistry and from that of spectography. In every case, a scientific object is only the instructor with respect to a preliminary, to-be-rectified construction, a to-be-consolidated construction.

Thus we always confront the same paradox: rationalism is a philosophy which continues; it is never truly a philosophy that begins.

In these conditions, every experiment on the reality already informed by science is at the same time an experiment on scientific thought. It is this double experiment of applied rationalism that is appropriate for discursively confirming an existence, in the object and in the subject at the same time. The existence of the rationalist subject could not be proved in a unitary mode. It takes its surety from its dialectical power. It is eminently dialectical and discursive since it must work outside itself and in itself in taking on a substance and an existence. And if an ontology is to be made of this, it should be the ontology of a psychological becoming which provokes an ontogeny of thoughts.

In this case is it not obvious that the designated object and the object as instructor correspond to two radically different instances of objectification? Respectively they reflect very differently valorized levels of subjective existence. For the most part philosophical discussions of ‘the reality of the sensible world’ ground themselves in concern about objects taken as examples, pretexts or occasions – that is, at the level of the instance of objectification of the designated object. But the simply designated object is not exactly a good meeting point for two minds intending to deepen their knowledge of the sensible world. There is nothing harder to reconcile than philosophical attitudes to a familiar object, divided over whether it should be approached in terms of its familiar setting or on the contrary in terms of its (necessarily original) individuality. And it is yet another quite different thing when one wants to study a phenomenon rooted in an object, a material, a crystal, a source of light. Immediately the necessity for a programme of experiments presents itself, and, for two minds that value their own mutual instruction, the obligation to commit themselves to a single line of further enquiry. It is no longer a question of immediate and intuitive designation, but of a progressive and discursive designation, broken by numerous rectifications.

In order to schematize the rivalry between rationalism and empiricism in this apprehension of objects, this short dialogue might be evoked: To a rationalist, the empiricist has the habit of saying: ‘I know what you are going to say.’ To this, the rationalist should reply: ‘Good! So you are, on the subject of our discussions, as rationalist as I am.’ But the other continues: ‘And you, rationalist, you have no idea what I am going to say.’ ‘No doubt’, replies the rationalist, ‘but I have an idea that you are going to say something that goes beyond the subject of our discussion.’

Here one sees that, from the point of view of scientific knowledge, the object designated by common sense has no virtue as an anchorage. It localizes a name in a vocabulary rather than a thing in a universe. The object designated by this here, even with the index finger pointing, is most often designated in a language, in a world of appellation. Faced with an object that someone designates to me using its usual name, I don’t know whether it is the name or the thing which comes to my thoughts, or even this mixture of name and thing, intertwined, monstrous, where neither experience nor language present themselves in their most important action, their effective inter-psychological work.
All will become clear if we place the object of knowledge in a problematic, if we indicate it in a discursive process of instruction as an element situated between an instructing rationalism and an instructed rationalism. It goes without saying that it is now an interesting object, an object for which the process of objectification has not been achieved, an object which does not return purely and simply to a past of knowledge encrusted on a name. As a passing comment, is it not a sort of philosophical irony that many existentialisms remain nominalisms? Believing they have put themselves on the margins of the philosophy of knowledge, existentialist doctrines are limited, in many circumstances, to doctrines of memory. And often, intending to live their present experience, they leave things with their past of things recognized. The recognized and named object hides from them the object to be known. If one raises with an existentialist an objection about this taste that his theory of knowledge has for the past, he turns entirely towards future knowledge and, faced with no matter what everyday object, he starts to develop the distinguishing trait of his attitude, the subject open to all knowledge. He does not truly envisage an existentialism of progressive knowledge.

The position of the scientific object, of the object actually as instructor, is much more complex, much more engaged. It reclaims a solidarity between method and experiment. One must in this case know the method of knowing in order to seize the object to be known; that is to say, in the realm of methodologically valorized knowledge, the object is likely to transform the method of knowing. But we will come back to this metaphysical discursivity. All that we need for the moment is to have suggested to the reader the necessity of the idea of a problematic antecedent to all experience which wants to be instructive, a problematic founded, before being made precise, on a specific doubt, on a doubt specified by the object of knowledge. Once again we do not believe in the efficacy of doubt in itself, in doubt which is not applied to an object.

In these conditions it is by the exchange of protocols in a problematic that inter-rationalism begins; it is by this precise doubt that the union of those working on a proof is founded. In order to understand the statement of a problem, it is necessary to normalize the neighbouring questions; in other words it is necessary to develop a kind of topology of the problematic. Of course, one must make aberrant questions disappear and attain a corpus of problems. As is so often said, a well-posed problem has been half-solved. Karl Marx, even more briefly, said that to pose a question is to resolve it. To be clear: to pose an intelligent question to intelligent beings is to determine a union of intelligences.

But this union brought about by the opening of a well-determined problematic is not enough; in the passage from a problem to its solution we must see constituted what philosophers of micro-epistemology could call an atom of rational communication.

We are thus trying to determine the textures of the atom of rationality by following the establishment of relations between a rationalist I and you [un je et un tu rationalistes] at the moment that they are obliged to help each other towards the rational resolution of a problem.

We must first present the object as subject of a problem and the subject of the cogito as a consciousness of the problem. In this way the thinking being thinks at the limit of its knowledge after having made an enumeration of what it knows that is relevant to resolving the problem posed. This enumeration, consciousness of a dynamic order of ideas, is consequently polarized by the problem to be resolved. In a merely taught rationalism, the enumeration is codified; it is arranged on a well-defined line, well anchored on its bases. But in a questioning rationalism, the bases themselves are to be proved; they are put in question by the question. The problem is the active summit of research. Foundation, coherence, dialectic and problem are all elements of a rational enumeration, all moments of this mobilization of intelligence.

It is the explicit development of these four moments of applied rationalism that establishes the cogitamus which solidifies the rationalist I and you into a single thought, and consequently into a thinking coexistence. Through this cogitamus, the I and the you are culturally aligned with one another, in the same sense as when mathematicians speak of the conformal mapping of two elements of a surface. Two rational minds do not need to be completely identical to be aware of their concordance; it suffices that they are both established in the role of objectively controlled thought. Controlled roles, functions which function on a normalized object, are better translations of discursive agreement. In other words, the rational cogitamus is less conscious of a having in common than of a common profit. It is an announcement of the fecundity of thought. It determines an obligation to think in accord; in short, it is common consciousness of apodeictic knowledge.

In order to formulate the fundamental cogito of the rationalist subject, it is thus necessary to isolate,
in the formulae of interpersonal psychology, those which correspond to a secure induction. The rationalist subject establishes itself in this security of possible instruction which must obligatorily involve a rationalist other. When it attains this security, after having gained some psychological perspective through a previous psychoanalysis, the rationalist subject can foresee the resistances of irrationalism. It can even amuse itself, in a moderately demoniacal psychoanalysis, by seeing the adversary attached to irrational values thinking through a fatality of errors. The behaviours of irrational singularity are psychoanalytically clear enough. The themes of originality can be easily enough classified. And confronted with such a thinker, presenting itself as an absolute being, the rationalist psychoanalysts can say: We the many, observe it creating the unique.

In these conditions, it seems to us that the cogito of mutual obligation, in its simplest form, should be explicated in this way: I think that you are going to think what I have just thought, if I tell you about the event of reason which just obliged me to think beyond what I used to think. There is the cogito of mutually obligatory induction. This rationalist cogito is not, moreover, properly speaking of the order of joint empirical confirmation. It is formed before the accord of the I and the you, for it appears, in its first form, in the solitary subject, as a certitude of accord with the rational other, once the pedagogical preliminaries have been established. One can compel empirical confirmation: since I recognize that what I am going to think is a normality for a normal thought, I have the means to force you to think as I think. In effect, you will think what I have thought to the extent that I make you conscious of the problem to which I am going to find the solution. We will be united in the proof once we have the guarantee of having clearly posed the same problem. Besides, by recursion, the solution to a problem leads to a new clarity in its statement. The relation problem–solution is an epistemological instance which dominates the empiricism of empirical confirmation. At whatever level one places this confirmation – whether that confirmation is sensory or psychological – once it is confirmation of the resolution of a problem, it benefits from the values of a well-ordered discovery. There is consecration of method, proof of the efficacy of thought, socialization of truth.

Certainly, two minds can find themselves united in the same error. But the shadow which grows is not simply the dynamical inverse of the clarity which is born. Error descends towards conviction while truth mounts towards proof.9 The debate that will need to be engaged here will lead us to studies of descendant psychology, which only find their place in a psychoanalysis of knowledge, when there will be time for us to examine the theses of irrationalism. But for now, if one poses the problem of error on the plane of scientific errors, it appears very clearly – or, better, concretely – that error and truth are not symmetrical, as a purely formal and logical philosophy would have us think. In sciences, truths are grouped into systems, whereas errors lose themselves in an amorphous magma. In other words, truths relate to each other apodeictically, whilst errors are amassed assertorically. In the scientific thought of our time, there is an evident disproportion between, on the one hand, truths rationally coordinated and codified in books provided with the guarantee of the scientific city and, on the other hand, several errors which linger in some bad books, most often marked by a detestable originality.

Consequently, if we rely on the pedagogy of the scientific mind, if we examine actual scientific culture, the notion of epistemological value is clear and one cannot mistake it as a mark of the union of minds in truth. It is in these distinctions, which can seem delicate, but which are indeed real, that we are going to establish the differences between the psychologism of empirical confirmation and the psychologism of normalization. The condemnation – so frequent and so hasty – levelled at psychologism fails to understand these nuances, which are however essential.10

Why then not postulate the coexistence of a common thought when it is from you that I get proof of the fecundity of my own thought? With the solution of my problem, the you brings to me the decisive element of my coherence. It presents the keystone for the arch of a system of thoughts that I do not know how to finish. From him to me, coexistence then appears to precede existence. Coexistence does not come solely to reinforce existence. Or, at least, the reinforcement of the existence that a particular subject can receive from another rationalist subject is only one aspect of the most marked metaphysical nuances. In fact, in the I–you of rationalist thought there appear control, verification, confirmation, psychoanalysis, instruction, normativity, all more or less extended forms of coexistence. But eventually comes the promotion to apodeictic existence, to coexistence by apodeicticity.

To know what upholds the apodeicticity which clings to knowledge is to live a division of my own self, a division that could well be captured by the two words ‘existence’ and ‘surexistence’. The subject promoted to this surexistence by the coexistence of two subjects sees installed in itself the dialectic of controlling and controlled subject. It installs in its own
mind, confronting its I, a sort of vigilant you. The word ‘dialectic’ is not here absolutely the right word, for the pole of the assertoric subject and the pole of the apodeictic subject admit of an evident hierarchy. The cogito which leaves the first pole, to establish itself as subject valorized by a rationalist cogito, cannot return to a cogito of empirical confirmation, to an intuitive cogito. The cogitamus is resolutely discursive. The coexistence of rationalist subjects throws over empirical time its net of logical time. It puts experience in order; it retakes all experience in order to better triumph over all contingency.

The cogitamus opens up to us a veritable tissue of coexistence.

Translated by Mary Tiles

Notes
1. [Note that the French expérience covers both ‘experience’ and ‘experiment’. Where it is used in a scientific context I have translated expérience as ‘experiment’. Trans.]
2. [The dew point is the temperature to which a given parcel of humid air must be cooled, at constant barometric pressure, for water vapour to condense into liquid water. The dew point is a saturation temperature. Trans.]
4. [There is an excellent explanation that illustrates Bachelard’s point at www.ima.co.uk/technical/manual.pdf. Trans.]
5. [It is not quite clear which experiments are referred to here. What is usually referred to as Fizeau’s experiment was conducted in 1851; see http://en.wikisource.org/wiki/The_Hypotheses_Relating_to_the_Luminous_Aether. Trans.]
7. [Emission theory is attributed to Newton; it is sometimes called a particle theory of light. Trans.]
10. Movements of proofs less definitive than the movements of apodeictic proofs can also be analysed in a dual psychology. In the problems of knowledge, help coming from the other, however limited it might be, is always reassuring. Edgar Quinet, in The Creation, talks of a moment of scientific evolution when the geology of the Maurienne Alps caused trouble in palaeontology. Lyell said about this to one of his colleagues: ‘I believe because you have seen it; but if I had seen it myself, I wouldn’t have believed it.’ This anecdote – so characteristic of a psychological point of view where we discover that rare nuance of polite humour – has all the same an epistemological burden. It shows that amazement, so useful in scientific culture, cannot remain individual. A little amazed, one wants to amaze someone else. One instructs in order to amaze. To be mutually instructed is to amaze one another. What proof of the need for renewal which animates all culture! Even in small theoretical cultures, such as perhaps, in fragments, geology, the new event awakens the scientist from his dogmatic slumber..