The dialogical philosophy. La philosophie dialoguée[1]

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Abstract: This essay points out the necessity of evoking several philosophical systems in order to realize the evolution of the scientific theory of knowledge in modern physics. It proposes a sort of spectrum of philosophical systems with seven conceptions set in the following order : realism, empiricism, positivism, rationalism, formalism, conventionalism, idealism. A double filiation unites these philosophies in the center of the spectrum, so that, rationalism, in conjunction with technical materialism, seems to be the most strongly established philosophy, and the backbone of modern scientific thought. Rationalism, far from representing a detached point of view, appears as a dialectical philosophy as soon as it seeks its confirmation in technical experience.

I

If we follow with attention, that is, with passionate interest, the activity of contemporary physics, we see the development of a philosophical dialogue which has the merit of being exceptionally precise: the dialogue between the experimenter provided with precise instruments and the mathematician who aspires to closely inform the experiment. Whereas, too often, in philosophical debates realists and rationalists do not manage to talk of *one same thing*, we have the neat and comforting impression that, in the scientific dialogue, both the interlocutors speak of *the same matter*. Whereas in philosophy conferences, we see philosophers exchanging *arguments*, in the conferences of physics, we see experimenters and theoreticians exchange *information*. Is it not necessary that the experimenter be informed about the theoretical aspect of data that the mathematician judges to be highly coordinated, without which the experimenter's interpretations can fall victim to his own personal views? And is it not necessary as well that the theoretician be informed on

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all the circumstances related to the experiment, without which his syntheses could remain partial and purely abstract? Physics has then two philosophical poles. It is a true *field of thought* which is specified in mathematics and experiments and comes most to life in the convergence of mathematics and experience. As a strong synthesis, physics determines an *abstract-concrete* mentality. Throughout this work we will try unceasingly to characterize this mentality according to its double action of abstraction and concretisation, by never breaking the connecting mark imposed by language – in the absence of a knowledge of more unitary principles – in order that we can *understand the reciprocity of the dialectics* which move along an endless and two-way path from the mind towards things.

The contact between *experience* and *mathematics* develops as a propagating solidarity. When it is the experimenter who brings the first message of a new phenomenon, the theoretician does not rest until he has modified the prevailing theory in order that it can assimilate the new fact. Through this – undoubtedly late – modification the mathematician shows that theory, now softened, *should have envisaged* the innovation. He likes to make a display of a sort of *recurrent fecundity* which is – as we will show – an important feature of rationalism, since this recurrent fecundity constitutes the foundation of *rational memory*. This memory proper to reason, this memory of coordinated ideas, obeys psychological laws completely different from those of the *empirical memory*. These ideas, put in order, reordered and coordinated within the logical time, determine a veritable emergence of memory. Certainly, nobody – and the experimenter even less so – laughs at this return, afterwards, to the sources of the theoretical prevision. On the contrary, the experimenter is pleased that his discovery is assimilated by mathematics. He knows that a new fact, when connected to the modern aspect of the prevailing theory, is guaranteed by a objectivity that is thoroughly overseen, given that the prevailing theory is a system of experimental examination which is active in the brightest brains of the epoch. We have the impression that the phenomenon is properly seen insofar as it *could have been foreseen*. The theoretical perspective *places* the fact where it is supposed to be. If the fact is correctly assimilated by the theory, there is no more hesitation about the place that it *should* occupy in a *thought*. It is no longer a heteroclite fact, a raw fact. It becomes now a *cultural fact*. It has a rationalist status. It is henceforth the subject of a dialogue between the rationalist and the empiricist.

When it is the theoretician who announces the *possibility* of a new phenomenon, the experimenter addresses this perspective, provided that he feels this latter is aligned with modern science. This is why, at the beginning of the wave mechanics of the electron, one searched for a phenomenon

that, in the case of the electron, could correspond to the phenomenon of light polarization. Whenever such a specific investigation ends in vain, it has nevertheless a positive character for epistemology, since it contributes to the limitation and definition of analogies. Experience thus associated with theoretical views has nothing in common with occasional research, with these experiments "to see" which have no place within strongly structured sciences such as physics and chemistry, within sciences too for which the *instrument* is the intermediary necessary for examining a truly instrumented phenomenon, designated as the object of a phenomenotechnique. No physicist would spend "his credit" to build an instrument with no theoretical destination. In physics, Claude Bernard's experiment "to see" is meaningless.

What tacit agreement reigns in the *city of physics*! In what manner the unrepentant dreamers wanting to "theorize" far from mathematical methods are dismissed! The theoretician must actually possess all the *mathematical past* of physics, that is to say, all the rationalist tradition of experience. The experimenter, on his side, must know entirely the *present of technique*. We would be surprised if a physicist used the old vacuum air pump, even if it was provided with the Babinet tap. Modernism of the technical reality and rationalist tradition of every mathematical theory: this is the double cultural ideal that should permeate all the themes of scientific thought.

The philosophical cooperation of these two aspects of physical science – the rational aspect and the technical aspect – can be synthesized in the following double question:

Under what conditions is it possible to give a *reason* for a *precise* phenomenon? Moreover, the word *precise* is essential, for precision is the sphere of *reason*'s engagement.

Under what conditions is it possible to provide *real* evidence of validity for a mathematical organisation of physical experience?

The time is long past since epistemology considered mathematics as a mere instrument to express the laws of physics. Mathematics of physics are "more committed". It is not possible to *found* physical sciences without entering into the philosophical dialogue between the rationalist and the experimenter, nor is it possible without answering the two – somehow *reciprocal* – questions that we have just set. In other words, the modern physicist needs a double certainty:

1. the certainty that reality is directly related to rationality, so that it can obtain the name of *scientific reality*;
2. the certainty that the rational arguments which concerns experience are already moments of this experience.

To put it simply, no rationality without target, no disjointed empiricism (*pas de rationalité à vide, pas d'empirisme décousu*): these are the two philosophical

obligations which found the strict and precise synthesis of theory and experience in contemporary physics.

This *bi-certainty* is essential. If one of the two terms is missing, we can still do experiments and we can still do mathematics, but we cannot participate in the scientific activity of contemporary physical science. This bi-certainty cannot be expressed but through a two-way philosophy, through a dialogue. Nevertheless, this dialogue is so tight that we cannot detect any character of the old philosophical dualism. It is no longer about bringing a solitary mind face to face with the indifferent universe. From now on one must place oneself in the middle, where the knowing mind is determined by the precise object of its knowledge and where, in return, it determines its own experience with greater precision. It is precisely this *central* position which allows the dialectics of reason and technique to reach its effectiveness. We will try to place ourselves in this central position where an *applied rationalism* and an *instructed materialism* arise as well. Thereafter we will also insist on the power of application proper to every scientific rationalism, that is, to every rationalism that can bring its evidence of fecundity up into the organisation of technical thought. Precisely through this application rationalism achieves its objective values. In this sense, the evaluation of scientific thought no longer lies in a formal, abstract, universal rationalism. It is necessary to achieve a concrete rationalism, in solidarity with increasingly particular and precise experiments. This rationalism must also be sufficiently open to receive new determinations from experience. In experiencing this dialectics a little more closely, we are convinced of *the eminent reality of the fields of thought*. It is within these epistemological fields that the exchange of values between rationalism and experimentalism takes place.

II

In fact, the criss-crossing of two opposite philosophies active within scientific thought involves even more philosophies and we should present dialogues which are undoubtedly less tight but that extend the psychology of the scientific mind. For instance, we would mutilate the philosophy of science, if we did not examine how *positivism* and *formalism* are situated, given that undoubtedly they both have proper functions in contemporary physics and chemistry. Nevertheless, one of the reasons why we believe in the validity of our central position is that all philosophies of scientific knowledge are ordered starting from *applied rationalism*. It is barely necessary to comment on the following table, when we apply it to the scientific thought:

Idealism
↑
Conventionalism
↑
Formalism
↑
Applied rationalism and technical materialism
↓
Positivism
↓
Empiricism
↓
Realism

We only indicate the two perspectives of *weakened* thoughts which, on one hand, lead from rationalism to naive idealism and, on the other hand, from the technical materialism to naive realism.

Therefore, when rational knowledge is systematically interpreted as the constitution of certain *forms*, as a mere equipment of *formulae* suitable to *inform* any kind of experience, then a *formalism* is established. If at all, this formalism can receive the *outcomes* of rational thought, but it cannot do all the work of the rational thought. Moreover, we do not always limit ourselves to formalism. We started a philosophy of knowledge which weakens the role of experience. We are very close to considering theoretical science as a set of *conventions*, a series of more or less *convenient* thoughts organized according to the clear language of mathematics, which however become no more than an *Esperanto* of reason. The convenience of conventions does not remove their arbitrariness from them. These formulae, these conventions, this arbitrariness, we will come quite naturally to submit them to an activity of the thinking subject. So, we approach an idealism. This idealism is no longer admitted in contemporary epistemology but it played such a great role in the philosophies of nature in the 19th century that it must be taken into account in a general examination of the philosophical approaches to science.

Besides, we have to underline the powerlessness of idealism to reconstitute a modern version of rationalism, an active rationalism able to inform the knowledge resulting from the new areas of experience. In other words, we cannot invert the perspective that we have just outlined. In fact, when the idealist establishes a philosophy of nature, he limits himself to ordering the images that he creates of nature, indulging in the immediate aspect of these images. He does not go beyond the limits of an ethereal sensualism. He does not un-

dertake a thorough experience. He would be astonished if asked to follow the inquiries of science into essentially instrumentalist experimentation. He does not think he should have to accept the *conventions* of other minds. He would not consent to that slow discipline which intends to *form* his spirit on the basis of the lessons of objective experience. Idealism misses every opportunity to account for modern scientific thought. Scientific thought cannot reach its sound and multiple forms in such a solitary environment, in this solipsism which represents the congenital sickness of idealism. Scientific thought needs a social reality, the agreement of a city of physics and mathematics. We should then rather place ourselves at the central position, that of *applied rationalism*, working on the institution of a specific philosophy proper to scientific thought.

Viewing our table from the other perspective, instead of the evanescence leading to idealism, we find a progressive inertia of thought, which leads to realism, to a conception of reality as synonym of irrationality.

In fact, when we pass from rationalism, in which physical experience is in strong solidarity with theory, to *positivism*, we have the impression of suddenly losing all the principles of *necessity*. Thereafter, pure positivism is no longer able to justify the power of deduction which is active in the development of modern theories; it cannot account for any of the *values of coherence* proper to contemporary physics. This notwithstanding, with respect to pure empirism, positivism appears to be at least the guardian of the hierarchy of laws. It maintains the right to discard sharp approximations, details and varieties. However, this hierarchy of laws does not have the same value as the organisation of necessities clearly understood by rationalism. Moreover, since it is based on judgements of utility, positivism already tends to *pragmatism*, to that hodgepodge of recipes represented by *empiricism*. Positivism is not at all provided with what is necessary to determine the orders of approximation, to feel that strange sensitivity of rationality given by second-order approximations, that is, this more inexact, controversial and consistent knowledge which we achieve through the accurate examination of minute experiments and which helps us understand that there is greater rationality in complexity than in simplicity.

Moreover, going a step further than empiricism, which loses itself in the story of its own achievements, we reach that pile of facts and things with which *realism* is stuffed, and which gives this latter the illusion of richness. We will show later how far from any scientific mind is the postulate, very easily accepted by some philosophers, which considers reality as a pole of irrationality. When we have led the philosophic activity of scientific thought back to its active center, it will be clear that the function of active materialism is precisely to limit what can be qualified as irrational within its arguments and objects.

Chemistry, fortified by its rational *a-priori*, delivers *substances devoid of accidents*, removing from any material the irrationality of its origins.

We will, however, take this discussion up again on the basis of particular examples. We actually think that some precise examples borrowed from scientific knowledge can make general philosophical discussions *more aware* so long as we do not tackle discussions starting from fixed philosophical convictions. What we intended to present through this quick *philosophical topology* is the frame within which most philosophical discussions about science take place. One feature captures our attention: the different philosophical tones that we have mentioned together form a veritable "spectrum" (*spectre*). In this sense, we intend to say that they quite naturally take on a linear order. In light of new philosophical nuances, it will suffice to open this spectrum up a little more and without needing to modify the order of the fundamental philosophies. On the other hand, if we undertook a similar investigation into the elements of a polyphilosophy for other sciences, such as mathematics, biology, sociology and psychology, then we should certainly determine other spectra for philosophical analysis. Nevertheless, no spectrum is more extensive than the one which helps us class the philosophemes of the physical sciences. Undoubtedly, not all the parts of a science are at the same level of philosophical maturity. It is therefore always concerning precise experiences and problems that the philosophical values of a science have to be determined.

III

If we attempt to philosophically characterize the active scientific notions, we will see that each has two sides, always two sides. Every precise notion is a notion that has been given the character of precision. It was precisely clarified through an effort of 'idoneism', according to the meaning given to this term by Gonseth: this idoneism has only become more advanced as the dialectics have become tighter. However, these dialectics already arise from the extreme symmetries of the table that we have proposed. In this sense, we could already clarify the problems facing the epistemology of the physical sciences y of science, if we established the 'dialogical philosophy' of formalism and positivism, epistemological doctrines which are equidistant from the center of the most strongly coordinated thoughts. Formalism would then coordinate with sufficient clarity all the mathematical perspectives which inform the positive laws provided by scientific experience. Without having the apodicticity of rationalism, formalism is provided with logical autonomy.

It would still be possible to detect connections between empiricism and conventionalism: philosophies which are both undoubtedly too loose. Their

dialogue would at least have the charm of a double-skepticism. They are thus generally appreciated by modern philosophers, who observe from afar the progress of scientific thought.

As for the two extreme philosophies, idealism and realism, their dogmatism is their only strength. In particular, it is difficult to explain how scientific realism might emancipate itself from common realism. If science were the description of a given reality, what would ever entitle it to organize this description.

Our task will therefore be to show that rationalism is not at all in solidarity with the imperialism of the subject, that it cannot develop in an isolated consciousness. We shall also demonstrate that technical materialism essentially corresponds to a transformed reality, a rectified reality: a reality which has been granted precisely the ultimate human mark, the mark of rationalism.

So, we will always be brought back to the philosophical center, which is the basis of reflective experience as well as of rational invention, in other words, back to that region in which contemporary science actually operates.

IV

In these conditions, a philosophy like that of Émile Meyerson which, by appealing to two poles *apart from each other*, determines the savant's simultaneous attachment to reality and to the identical, does not seem to give rise to an epistemological field of sufficient intensity. To consider the savant as both an absolute realist and a rigorous logician leads us to juxtapose general philosophies that are ineffective. These are not philosophies at work, but rather *summary*-philosophies which can only contribute to the characterisation of historical periods of time. Through technical progress, the "reality" examined by the savant changes its appearance and loses the character of permanence which is the basis of philosophical realism. For instance, the "electric reality" of the 19th century is much different from the "electric reality" of the 18th.

On the other hand, barely has a reduction to the identical been made when again the research for diversity starts from the identical, so that it will be necessary to unceasingly revive the dialectics of what is identified and what is diversified. Reality, as well will be concerned by a multiplication of the dialectics of analysis and synthesis, of pruning and construction, selection and realisation. A science that is continually rectified in its principles and subjects cannot be granted a unitary philosophical designation. It is dialectics not only because of the detail of its approach, but also for the double ideal of its theoretical coherence and experimental precision.

It is probably no doctrinal accident that led Meyerson to a *static conception* of the psychology of the scientific mind. If one believes that the state of mind

of a pre-Lavoisian chemist, such as Macquer, can be similar to the state of mind of a contemporary chemist, one remains confined to an unmoving materialism, a materialism without dialectics. History of science, in this sense, is often deceptive. It almost never conveys the obscurity of thought. It cannot then grasp the rationality as it takes shape. Our current knowledge clarifies in such a vivid way the past of scientific thoughts that we may take every glimmer for actual lights. One thus believes in a reason constituted without an effort of rationality. Léon Brunschvicg saw the weakness of such an absolutist position was and often insisted on the essential relativity of reason and experience: "We lose touch with the course of reality… with that knowledge, whenever we insist on pushing *rationality* and *objectivity* outside ourselves, and end up isolating and opposing the double entity of *absolute reason* and *absolute object*." As we will see, it is by systemically developing a dialectics of cooperation between reason and scientific object that we will best obtain the rational characteristics of technical materialism and, vice versa, the real characteristics of applied rationalism. Here again, what provides guarantees concerning the object are not the primary experiences but the sharp approximations. Considered in relation to its applications, a rational organisation of experience is not merely the *aim* (*visée*) of a mind which would be enlightened by the mere awareness of the identity of his apperceptions. The intentionality of applied rationalism holds the possibility of self-rectification in reserve. In its application, it is open to those dialectics that can produce resonances up to the principles of organisation. In other words, the second approximation has not the same epistemological structure as the first. It is at the level of the second approximation that dialectics are truly active. These dialectics associate the mathematical mind (*esprit de géométrie*) with the intuitive mind (*esprit de finesse*) into a synthesis which is clearly active in the contemporary scientific mind.

Epistemology must then be as dynamic as science. By multiplying the number of reciprocal figures that we called *Brunschvicg's doublets*[2], we hope to bring together the coherence of rational thought and the *cohesion* of technical materialism. This notwithstanding, the several doublets composed by Brunschvicg according to the Spinozian pattern of *natura naturans* and *natura naturata*, such as *spatializing space* and *spatialized space*, *numbering number* and *numbered number* have to become even *more tightly bound*, in order to account properly for the strong *coupling* of ideas and experiences that arises from the development of contemporary physics and chemistry.

[2] Bachelard, Gaston, 1945, "La philosophie scientifique de Léon Brunschvicg", *Revue de Métaphysique et de Morale*, 50 (1/2): 77-84 <http://www.jstor.org/stable/40899137>, quot. p. 81.

The epistemologist will have to apply the dialogical philosophy to doublets borrowed above all from physics and chemistry, since these doublets allow the traditional debate on the realness of the sensible world to become more precise. However, there will be many occasions to slightly shift the debate. This will be the case, for instance, in the debate on the duality of *symbolising symbol* and *symbolized symbol* in organic chemistry. There is, in fact, a remarkable epistemological difference between the *symbols* that aim only at intuitively translating a general knowledge and the *models* within which a more realist and more particular knowledge emerges. The conventionalism of the early representations, as they were proposed in the 19th century, has been replaced by a technical materialism which *realizes* schemata.

Likewise the objectifying tendency of rational mind is so strong that, in the mathematics aiming at the proliferation of the abstract, it is not impossible to detect structures which may refer to an objective study. There is therefore room for a post-abstractive experience. Of course, we must regard the empiricism which likes to place procedures for surveying land at the basis of geometry as liquidated. Such references serve no purpose in a modern culture, they can be even dangerous, if their naivety is not corrected as soon as possible. In fact, the subject must be constituted according to rationality, and reach *principles of necessity*. In geometry, demonstration is not about showing but proving. It is this kind of *emergence* that precisely occurs in contemporary physical sciences. Values completely different from convention and observation emerge in natural sciences. The philosopher who intends to follow the life of scientific thought in detail, will come to know the extraordinary couplings of Necessity and Dialectics.

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Translated from the French by Gennaro Lauro[3]

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