Chapter One

Bachelard's Historical Epistemology

The characterization "non-contemporary thinker" conveys the distinctive features of Bachelard's thought while also taking into account his work's distinctive historical effect. Bachelard celebrates the great transformations of twentieth-century physics as no one else. He does this, however, with such complete faith in scientific progress that his theory—especially in Bergsonian France—appeared to be a philosophical holdover of the nineteenth century's self-understanding. The positivistic promotion of science to the position of the only reliable mode of knowledge, indeed, his occasional praise of asceticism in research as the ideal for one's entire life-conduct, are leitmotifs that run throughout his historical epistemology and lend his writings a certain pathos. When we consider the far-reaching changes that the natural sciences, especially physics, underwent, as well as the changes in the corresponding philosophical discus-

sions, we can see that many of Bachelard's basic intuitions at the beginning of the century were not isolated phenomena, despite strong opposing philosophical tendencies. Like the thinkers of the Vienna Circle, Bachelard set himself the task of bringing a philosophy that stayed too long in the metaphysical heavens to the standard of the sciences. In the heyday of neo-positivism, however, the strong psychological focus contained in his analyses of the origins of the sciences in research practice prohibited his historical epistemology from gaining a wide reception. Even in the sixties, after the beginning of the so-called "post-empiricist debate," the discussion of the history of science was driven solely by its own steam, without including or even taking note of its French precursor, despite important points of connection with Bachelard's theory. Admittedly, this circumstance and others can be attributed to the fact that Bachelard's large, polemical, and unsystematic body of work does not make easy access possible[1]—and especially not for readers from the Anglo-Saxon tradition.[2]

Even in France Bachelard did not receive the recognition that his influence on the philosophical discussion should have earned him. His epistemology was taken up only later, by the Althusserians.[3] Since then, Bachelard has been discussed from many perspectives. His work is now seen as being relevant to—even the source of—the whole spectrum of theoretical approaches that can be included under the title "structuralism."[4] This suggestion, however, seems even more convincing in the case of Foucault, who explicitly states in his writing that he has utilized Bachelardian themes.

In light of the unsystematic character of Bachelard's work and the limited, solely introductory function that it assumes in the structure of this project, I will forgo a thorough treatment of it here. My depiction will not provide a chronological account of his theoretical development; rather, it will concentrate on the task of examining the thematic connection among several of its aspects. Of course, this approach cannot provide a complete overview of his

work, but it can offer a coherent view of his most important epistemological postulates. This inquiry into Bachelard's epistemological theses will provide the interpretive framework from which a selective questioning of Foucault will proceed. On its basis, I will argue that the lack of clarity in many of Foucault's basic epistemological assumptions is connected with the manner of his appropriation of Bachelard's conceptual scheme—and that their dislocation from their original theoretical context into a new one resulted in systematic difficulties that have stubbornly accompanied the entire development of Foucault's theory.

In the following I will sketch out 1) some characteristics of Bachelard's history of science and 2) the critical function of the concept of "construction" with regard to epistemology. From the idea of construction I will develop 3) the themes of pluralism, the applied character of epistemology, and discontinuity. Finally, I will consider 4) the concept of the epistemological obstacle and the relation between scientific and prescientific experience. Thereby I will arrive at 5) a final critique of Bachelard.

Scientific Progress and Traditional Epistemology[5]

If one wanted to trace Bachelard's epistemology back to one basic question that could serve as the guide to his investigations, then this could be formulated as follows: "How is scientific progress possible?" This focus on the growth of scientific knowledge highlights the originality of Bachelard's approach vis-à-vis other epistemological positions in two respects. For one, the history of science takes on relevance as an essential component of scientific theory; for another, Bachelard is skeptical of all attempts to regulate the creative proliferation of knowledge by means of methodically secure procedures. With great polemical effect, sometimes even with anti-philosophical vehemence, Bachelard repeatedly stresses that the great achievements of the sciences are the only form of acquired knowledge that

has stood the test of time. Guided by an outlook that shows the influence of Husserl's phenomenology, he repeatedly refers in his writings to those aspects of scientific practice that occur independently of, or even despite, philosophy (where by "philosophy" he means "traditional epistemology"). According to Bachelard, traditional epistemology does not possess its own autonomous theoretical force; historically, it was only capable of hovering in the shadows of scientific reason and parasitically claiming an illegitimate cognitive status for its empty formulas superior to that of the sciences. Since philosophy, for Bachelard, represents an obstacle to scientific progress, the task of the scientific spirit should be, above all, a therapeutic one. As the "superego" of the sciences,[6] reflection should free philosophy from its rigid hypostatizations and should defend scientific growth from prescientific influences.[7] Philosophy, according to Bachelard, should go to school with the sciences. If Bachelard's psychoanalytic metaphor is taken seriously, then we can make a provisional attempt at characterizing the decisive role of the history of science in his epistemology.

Like the psychoanalytic process in which recourse to a diachronic dimension makes self-enlightenment attainable in the present, the retrospective historico-scientific examination of past stages of knowledge serves to guarantee the self-certainty of epistemology. If one agrees with Bachelard that science constantly runs the danger of misunderstanding itself due to philosophical, or more generally, prescientific influences (Bachelard speaks of obstacles[8]), then science can only come into its own by reappropriating its history of asserting its identity in the face of unscientific tendencies. "[E]very philosophy of science must help facilitate access to the modernity of science."[9] This access is a historical one. It shows the complicated connections between theoretical theses and factors external to theory that result in the breaks and discontinuities constitutive of the turbulent history of science.[10] Awareness of the obstacles that have slowed progress in the past allows a more certain acquisition of knowledge in the future.

As will be shown later, Bachelard frequently emphasizes that the history of science does not have a calm, continuous course of development, but rather is composed of radical, unpredictable transformations that lend it more of a revolutionary than an evolutionary character. Nevertheless, his positivistic belief in progress is too strong to allow the thesis of discontinuity to lead to relativistic conclusions. Despite the emphasis on breaks in the actual, historical process, his epistemology proceeds from strong, normative premises that are reflected in a reconstructive developmental logic of the stages of the history of science.

In his book on the formation of the scientific spirit,[11] Bachelard proposes a periodization of the history of science which should help in pinning down the specific character of the modern scientific spirit. He distinguishes, in a phylogenetic manner, among a prescientific period that reaches from classical antiquity through the Renaissance to the seventeenth century; a scientific period, from the eighteenth to the beginning of the twentieth century; and finally the age of the new scientific spirit, whose beginning was announced in 1905 with the theory of relativity.

He undertakes a second classification of the history of science with the aim, as it were, of reconstructing in an ontogenetic manner the specific achievements of the modern scientific spirit. In so doing, he sees in the first, concrete stage the mere curiosity and admiration of a playful spirit confined to the phenomenal level. The second, concrete-abstract stage is typified by a geometric attitude in which geometry represents, as it were, a compromise between the abstract and the concrete; that is, the truth of abstraction is confirmed by sense perception. Pure abstraction, independent of sense perception, is first achieved at the third stage.

Bachelard completes his classification of the scientific stages by placing three psychologically understood interests in a hierarchical relation; these interests determine the affective basis of the corresponding cognitive stages. The primordial, playful, childish soul who admires nature is

superseded by the professorial, dogmatic soul who is confined to a sterile repetition of its first abstraction due to its deductive attitude. On the other hand, Bachelard depicts the new scientific spirit's interest at the third stage as a tireless drive to form new hypotheses; the main feature of this drive is the fact that it repeatedly admits to doubt and constantly revises its previous theories.[12]

The thesis regarding the stages of scientific spirit is advanced without making systematic claims and without the support of historical examples. Nevertheless, Bachelard's reconstruction is an undertaking that has a strong normative orientation. Bachelard clearly distinguishes between a merely descriptive and what I would call a reconstructive writing of history:

> I think the history of science should not be an empirical history. It should not be written on the basis of factual bits and crumbs since, in its elevated forms, it is essentially the history of progress in the rational connections of knowledge.[13]

In a move similar to Piaget's developmental logic, Bachelard declares that scientific knowledge, in principle, cannot bring about a regression in knowledge. Regressions and periods of historical decadence can cause science to stagnate or even to be forgotten, but these incidences are merely aspects of a historical dynamic that do not change the logical form of development of historico-scientific processes. Bachelard calls the developmental logic of the sciences "judged history,"[14] thereby referring to the value judgments that the historian of science must make in order to present the logical sequence of the science's truth-content. The question of the normative background which makes "judged history" possible can only be clarified by recourse to the truth-content of modern science.

> Undoubtedly it is knowledge of the past that lights up the path of the sciences. But one can also say that under certain circumstances it is the present which illuminates the past.[15]

The values of modern science, then, are also the values of the history of science, according to Bachelard. For this reason the history of science can never be written once and for all; it changes with the changes in science itself. Every new scientific epoch must write its own history of science. The criterion for reconstructing the sciences' developmental logic can be found in the increasing degree of abstraction of scientific procedures, according to Bachelard. Abstraction, however, must be more closely determined by differentiating between its scientific form and its other forms. In this project Bachelard orients himself on the model of mathematics and mathematical physics; his epistemology's normative content is derived from the description of their procedural method.

Constructions

Microphysics and the theory of relativity set the standards for Bachelard's epistemology. By rupturing the trusted framework of spatial measurement always already assumed by prescientific experience, the advances of modern physics effected an important event, one that should radically transform the methods of procedure both for scientific and philosophical thought.

The result for the natural sciences is that within mathematics, which for Bachelard acts as the model of the scientific disciplines, arithmetic takes priority over geometry. For scientific theory it means that the line of questioning of classical epistemology becomes irrelevant when faced with the revolutionary content of twentieth-century physics. Both the idealistic claim that one can derive the source of truth from the attributes of the epistemological subject and the realistic idea that one can attain a pure access to reality come up empty-handed, according to Bachelard. They constitute two sides to one and the same coin. Their error results from the fact that both ignore the actual procedures whereby the sciences attain knowledge. What they overlook, in his view,

is that the mathematicization of the natural sciences implies a new formulation of the subject-object relation. Bachelard uses the concept "construction" to try to interpret for the natural sciences this threshold, the other side of which the traditional epistemological question becomes obsolete.

By "constructions" Bachelard understands the sciences' unique achievement of setting up theories or systems of theories that are not based on prescientific intuitions or metaphysical principles but are supported solely by mathematical calculations and the mathematical systems upheld by these calculations. The scientific spirit has always had a mathematical core. Yet it took the scientific revolution of the twentieth century for it to first be able to assert its autonomy over and against philosophy. According to Bachelard, the task of critical epistemology is to acknowledge construction as the only mode for attaining knowledge and to criticize traditional epistemology's realistic and idealistic variants on the basis of its description.

Bachelard's thesis is convincing. In the earlier stages of development of scientific spirit it could be argued that the scientist investigated a particular, pregiven phenomenon and on the basis of its controlled observation abstracted a lawlike regularity, as it were. But today such a view, given the level of abstraction of the research process, is no longer tenable. It is no longer possible to speak of data as being "given" in the prescientific sense because they are themselves prejudiced by theory. The insight of microphysics, that the phenomenon is inseparable from the conditions of its being recorded, is exemplary in depicting the epistemological status that Bachelard attributes to scientific knowledge. He stresses both that the problematization of theoretical questions results in theory formation and that the object that is the focus of theory construction as such is only conceivable within a theoretical system and is only able to be produced technically with the aid of experimental equipment. "Nature's true order is the order that *we* put into it with the technical means at our disposal."[16] Thus,

scientific spirit develops with the assistance of constructions and of experiences that are also constructed and dependent on theory. It proceeds, so to speak, blindly, orienting itself only on the axioms of mathematical physics and on its own experimental equipment. Bachelard points out that the specific achievement of scientific constructions lies in looking beyond the prima facie isolated phenomenon in order to seek relation, to look beyond the simple to the complex. "Application is complication."[17] Changes in scientific thinking are subordinate both to theoretical formations and to the object itself; they make the idea of an immediate access to reality untenable. Reality becomes realization, objectification of theoretical assumptions.

> For a scientific spirit, all knowledge is a response to a question. If there has not been a question, there cannot be any scientific knowledge. Nothing comes from itself. Nothing is given. Everything is constructed.[18]

The concept of construction, understood as the principle that constantly revises and radically reformulates theories, should depict the specific achievement of science in a manner that does justice both to the attainment of knowledge through theoretical structures as well as to the unpredictable revolutionization of these structures. This explanation of scientific practice allows Bachelard to anchor progress in the very definition of science.

The focus on the essential connection between science and progress can also clarify the differences between Bachelard's constructive rationalism and classical rationalism. The development of the sciences can no longer be said to simply change the substance of knowledge; rather, it also changes all spatial and temporal categories, thereby altering the constellation of the subject-object relation. As a result, every a priori commitment to the subject-object relation proves to be nothing but an obstacle for science itself. In the foreword to *The Philosophy of No* Bachelard writes:

> The mind [*l'esprit* or spirit] lives by this one piece of evidence. It makes no attempt to create any other evidence. Identification of the mind with *I think* is so clear that the science of this clear consciousness immediately becomes the consciousness of a science, a certainty of founding a philosophy of knowledge. The consciousness of the identity of the mind in all its various portions of knowledge is, in itself alone, the guarantee of a permanent, fundamental, definitive method. In the face of such success, why postulate the necessity of modifying the mind and going in search of new knowledge?[19]

Philosophical rationalism requires revision to the extent that its theses are not able to take into account the abstract, constructive moment of the sciences. In his critique of Descartes,[20] Bachelard stresses that a rationalism that is aware of the state of affairs of the sciences can no longer be based on prescientific foundations because it must have already called into question these foundations and their meaning within the system. If one takes as a given that there are now no more certainties or intuitions which, under the scrutiny of science, would not relinquish their immediacy to the complex network of theoretical relations, then it has been shown that the theoretical constructions developed from the mathematical model are the actual form of scientific knowledge. In this way the axioms presupposed by theory in each case take on a quasi-transcendental significance as conditions of possibility for scientific knowledge. Due to the fact that the scientific object represents a kind of objectification of theory and of the related experimental procedures (as we have seen), according to Bachelard the axioms that replace the naive prescientific intuitions must have a constitutive moment.

One peculiarity of Bachelard's critique of empiricism and rationalism is his vagueness with regard to the tendencies he criticizes. He only rarely concerns himself with one author or with one clearly identifiable school of thought. In most cases empiricism and rationalism appear as two

basic psychological options that are described such that they exemplify the intent of the critique. Indeed, Bachelard is not concerned with strengthening or criticizing particular schools within the epistemological tradition. Scientific constructions and experimental equipment give rise not only to a theory's a priori framework but also to its object domain, thereby excluding the relation between the subject and the object of knowledge from their field of experience. As a result the knowledge question, insofar as it can be defined as a problem of the relation between the subject and the object of knowledge, is also excluded since it is seen as a question that is superfluous to the sciences.

Bachelard advocates the necessity of an autonomous science that is discontinuous from life-practice. Thus, he views traditional epistemology and its conceptual apparatus (which originated in prescientific experience) as an undertaking that strove to link science with deceptive ideas arising from prescientific experience, thereby hindering the progress of abstract scientific thought. For this reason Bachelard is also skeptical about the topic of the foundations of the sciences.[21] He points to the apodictic certainty that emerges in mathematics and mathematical physics whenever a new, convincing theory is formulated. Bachelard does not characterize an individual thesis or a set proof as apodictic, but rather a network of relations, a construction that, taken in its entirety, leads to increased coherence. Apodicity is "of a rational order, of a relational order."[22] If one agrees with Bachelard's statement that one always already knows what a good theory is (he points out as an example that most mathematicians demonstrate no interest in the foundations of mathematics), then the question of the acceptability of axiomatic systems and their corresponding theories is by no means left to the arbitrariness of researchers. Rather, their acceptability can be justified apodictically ("apodictic" is understood here on the basis of how coherent they are) in the concrete field of their application by providing plausible theoretical links among theories in the form of contextual constructions.

> The apodictic value thus is revealed more in extension than in reduction. The multiplicity of relations in some way doubles the evidence, because this multiplicity is the evidence from different points of view. . . . The superstructure of science strengthens the foundation. . . . All solidity is consolidation.[23]

Interregional Rationalism and Discontinuity

Bachelard describes the process of consolidating scientific knowledge with the aid of motifs of thought similar to those found in the research community.

The agreement of the researchers provides apodictic certainty with its requisite confirmation. The sterile certainty of the cogito ("I think") is replaced by the permanent discursive renewal of agreement by the cogitamus ("we think").

> Control, verification, confirmation, psychoanalysis, instruction, normativism appear in the I-Thou of rationalist thought; all are more or less extended forms of co-existence.[24]

Although it is only presented in outline form, the intuition of the cogitamus clearly indicates that reflective forms of knowing are not precluded by making mathematics the paradigm of the sciences. Nevertheless, for systematic reasons Bachelard cannot pursue the implications of the idea of the cooperative production of knowledge. In order to secure the autonomy of the scientific process vis-à-vis everyday life, Bachelard is forced to dispense with propaedeutic considerations regarding the universal, normative presuppositions of science and to reduce the validity basis of science to the theory-internal, apodictic certainty of construction. He accepts without reservation the "relativism" that unavoidably results from this move. That is, he does not see it as an aporia that must be addressed, but as an appropriate description of the state of the sciences today that confirms his own approach.

The historical fact that science works with many different axiomatic systems and that, as a result, we are confronted not by one but by many different geometries and kinds of physics and mathematics that constitute a corresponding number of independent object domains, leads Bachelard to develop the thesis of a *regional rationalism* that corresponds to the plurality of theories.

If scientific spirit is not to be confined to the sterility of a metaphysics "this side" of the actual development and multiplication of theories, then scientific rationality itself must be understood as a multiplicity of various regional rationalities. Whereas the philosophical attitude tries to reduce the plurality of phenomena to a unity, research practice shows how every step towards progress and every refinement of its conceptual apparatus and its experimental procedure leads, not to stronger syntheses, but to more progressive differentiation. Far from an increased uniformity among the sciences, Bachelard can confirm his epistemology by pointing to the formation of ever new disciplines. Epistemological pluralism celebrates the differentiation of the sciences as guaranteeing their continual progress. The sciences evolve by distributing themselves into regions of rationality, each with its own language that cannot be translated into a metalanguage. The regional rationalisms are, so to speak, shortsighted forms of rationality that only come into contact with one another through their overlapping spheres of application. Bachelard insists on the dependence of all theory on its experimental context and speaks of *applied rationalism* in this sense. If one separates a theory from its sphere of application in order to extend the validity of its properties beyond its disciplinary borders, then it loses all scientific validity. Due to the applied nature of the sciences, their processes of differentiation, which take place by forming new axiomatic systems or postulates, are not arbitrary. Theory construction follows the rhythm of the revolutions and differentiations within scientific progress; its development is always dependent on a problem area within a particular sphere of appli-

cation. Thus, Bachelard does not see the new axiomatic systems as positing an immediate and unsubstantiated beginning; rather, as "new beginnings," they are attempts to correct pregiven theories. As both the self-criticism of preceding theories and the preconditions of new theories, they posit as a priori that which they constructed a posteriori from the open questions of preexisting theories.[25] Although Bachelard accounts for the proliferation of axiomatic systems by referring to their applied character and thus to the fact that every new construction is rooted in questions of experimental practice, he is aware that the constitution of scientific regions through the formation of new axiomatic systems implies the execution of radical breaks which, viewed structurally, differ from the "normal" research within an already established theory. Bachelard uses the term *discontinuity* to address the topic of the unpredictable change that occurs with the constitution of new scientific object domains.

Since Bachelard's "applied rationalism" does not permit the formation of metatheories independent of experimental practice, each step towards differentiation in the object domains of knowledge results in discontinuity. According to Bachelard's regional rationalism, the languages of the different theoretical areas are untranslatable; the constitution of a new scientific region always implies a break.[26] Above all, however, discontinuities can be identified diachronically in the history of science, at those critical junctures where the construction of a new theory revolutionizes one's entire understanding of an object domain. The previously mentioned examples from modern physics offer Bachelard sufficient occasion to problematize, as radical upheavals, those occurrences that do not harmoniously fit into a cumulative view of progress.

If one compares Bachelard's interpretation, which attributes a quasi-transcendental status to a theory's axiomatic presuppositions and claims that a new object domain is constituted with the emergence of each new theory, with the numerous instances of unpredictable breaks in

the history of science, then one can see that the discontinuity thesis is a necessary addition to his historical work. According to Bachelard's history of science, it is not only the major revolutions in the physics of this century that represent insurmountable breaks. Discontinuities also show themselves in many less obvious transformations, where the continuity in the use of a term or a word betrays one or more changes in meaning to the eye of the historian of science—changes which are conditioned by the further development of scientific knowledge.[27] In the description of the revolutions that occur in the course of the history of science, or rather, in the fragmentation of the various scientific domains, the discontinuity thesis represents a plausible—and, in the complete architectonics of his work, even necessary—component of applied constructivism. But this thesis assumes an even more important role for Bachelard due to its connection to his concept of construction and thus to the normative premises of his epistemology.

For a philosophy that sees its main task as explaining the progress of the sciences, the discontinuity thesis is central because it promises to answer the question of the emergence of the new by way of a further explication. Each construction in the course of the progress of the sciences is an expression of discontinuity. I use the formulation "expression of discontinuity" here because with this thesis Bachelard's reflection takes a turn that leaves the field of experimental research and joins a metaphysics of discontinuous time.[28] In *La dialectique de la durée* Bachelard consciously starts down the metaphysical path by attempting, so to speak, to stand Bergson's philosophy on its feet. "We accept almost everything from Bergsonism except continuity."[29] In the critique of Bergson, as always, physics acts as the model to which Bachelard refers. In particular, he relies on the quantum mechanical thesis that matter is convertible to energy and that energy is convertible to matter.[30] From the reversibility of matter and energy Bachelard infers that if the movement of energy demonstrates a rhythmical character, matter must do so as well. Matter

> is not only sensitive to the rhythms, it *exists*, in all the senses of the word, on the plane of rhythm, and the time in which it develops certain delicate appearances is an undulating time, a time which has only one way of being uniform: the regularity of its frequency.[31]

Bachelard goes so far as to name the vibrated energy "the energy of existence"[32] and draws the conclusion that the "vibrated time" that was attained with the help of quantum physics amounts to the universal and original determination of time altogether. "For us the original time is vibrated time."[33]

The concern here is not to use matter to explain the phenomenon of vibration but the other way around: to use vibration to explain matter. Rhythm is the origin of all possible appearances, from matter to spiritual life, and rhythm is composed of moments; it is a "system of moments."[34] Thus, Bachelard can argue against Bergson's thesis of the primordiality of duration and contend that duration is constructed out of moments. Time becomes a discontinuous sequence of moments, a "rosary without the thread"; "the thread of time is covered with knots."[35]

Aside from this highly questionable attempt to derive a kind of dialectic of nature from the discontinuous character of modern physics, Bachelard's revision of Bergson is interesting because it represents a systematically necessary addition to his epistemology.

Namely, Bachelard's response to the question of progress in the sciences is based on a concept of construction that, lacking further determination, does not seem to be sufficiently substantiated. Bachelard must forgo characterizing the constructive spirit as having definite features of rationality because by doing so he would tacitly reintroduce a kind of a priori reason that would contradict his critique of every nonapplied form of knowledge. In order to avoid compromising the principles of his epistemology and yet be able to claim that knowledge by way of constructions that sur-

pass the contingency of historical examples is the normative method of procedure for scientific spirit, he must rely on an achievement that, without possessing a priori features that could be isolated even before application in concrete scientific areas, can be reflected in the many forms of scientific rational construction. To the degree that this is accomplished, this achievement can be understood as a rational force. Bachelard defines this supple rational or rationality-producing force on the basis of his critiques of Bergson's conception of time.

According to Bachelard, the *philosophie de la durée* is not only incapable of thinking the revolutionary emergence of the new;

> the philosophy of the *élan vital* has not been able to give its full meaning to what we will call the purely ontological success of being, that is, to the renewed creation of being by itself, in the intellectual act of consciousness.[36]

The new can be thought successfully, however, within the framework of a discontinuous metaphysics of time. Within this framework are found the philosophical premises that permit the moment of creative (*kreativ*) construction so indispensable to scientific spirit to be traced back to a creative (*schöpferische*) force that produces the new creatively (*kreativ*) and in an unpredictable manner. In this way Bachelard finally arrives at an idealistic sublimation of vitalism.[37] The scientific spirit, with its constant transgression of scientific theories, becomes the highest form of expression of the human and of the universal rhythmic being. His passionate formulation of this unique mix of Bergsonian influences and scientific themes conveys the driving force this intuition has for his philosophy.

> For isn't the brain the true center of human evolution, the terminal bud of the vital spirit? . . . By what light do we recognize the importance of these sudden syntheses? By an ineffable light that brings security

> and happiness to our minds. This intellectual happiness is the first sign of progress. . . . Understanding has a dynamic dimension; it is a spiritual élan, a vital élan.[38]

The application of Bergsonian terminology by an author like Bachelard should not be taken too literally since, for rhetorical purposes, he takes great liberties in using expressions from other philosophies. Nevertheless, his frequent recourse to terms like "energy," "force," or "activity" is informative with regard to his characterization of the scientific spirit. As a result, it seems appropriate to characterize his epistemology as a "romanticism of intelligence."[39] The scientific spirit expresses an idea of "living thought"[40] that always surpasses itself. The structure of scientific spirit, according to Bachelard, "changes"[41]; its progressive orientation stems from this changeable structure as well as the "openness" of an epistemology that is aware of the procedure of scientific spirit and that, like the sciences, functions by constantly contradicting earlier knowledges.[42] Against this background Bachelard composes his portrait of a philosophy that remains on a prefallibile level and that, due to its closed nature, must ignore the theoretical significance of scientific progress.

The Epistemological Obstacle

Coming to terms with the problem of philosophy's perpetual "late arrival" vis-à-vis the sciences is a motif that has always permeated Bachelard's thought. He regards the philosophical, or rather, the epistemological, line of questioning as a stubborn perversion of pure scientific rationality that cannot be overcome once and for all. Moreover, it often leads to a distortion or misperception of the specific character of the sciences, including the scientist's own self-understanding.

But philosophy is only one aspect of a prescientific experience that also expresses its substance in the cognitive

habits of daily life, in poetry, and in the imaginative products of the sensible world. According to Bachelard, the imaginative capacity is an indispensable aspect of intellectual life that intersects with the abstractive achievement of the sciences.[43] For him the imaginary is related to science just as the unconscious is related to the ego. Therefore, he finds it necessary to subject the tension between scientific thought and prescientific experience to a "psychoanalysis of objective knowledge" that should free the development of scientific abstraction from its mortgage to prescientific contents. Bachelard calls the many moments that repeatedly interfere with the pure development of scientific spirit *epistemological obstacles*.

Nourished by a daily life laden with prejudices, epistemological obstacles rely on an instinct of preservation[44] that prefers the comfortable confirmation of the already known to the *élan vital* of the constructive spirit. Bachelard's psychoanalysis of the objective spirit internalizes, as it were, the knowledge problematic. Here it is not a matter of the relation between the subject and the object of knowledge but rather of the inner-psychic conflict between scientifically proven constructions and trusted ideas from daily life or from the cultural tradition. What distinguishes scientific content from epistemological obstacles is their respective relation to sense perception. While mathematics introduces a knowing of pure relation, philosophy and the unproblematized ideas from everyday life are limited to perceptions which are unable to produce knowledge as such. Evidence from the world of perception is deceptive because perceptions are an active achievement that carry the stamp of both imaginary and unconscious motivations. Thus, sense perception merely represents forms of expression of the unconscious—as do the philosophies whose conceptual apparatuses, despite their higher level of abstraction, easily betray their origin in prescientific experience. Epistemological obstacles, like the sciences, are structured and constructed, but while scientific constructions, as pure forms of relation, represent the conscious form of abstract

rationality, epistemological obstacles have a status that more closely approximates that of rationalizations. They are firmly established opinions that misunderstand their own constructed status and are satisfied with the deceptive immediacy of their evidence. The substance of knowledge arises from the unconscious production of the prescientific spirit from which, so to speak, the scientific spirit differentiates and delimits itself. Seen as an epistemological obstacle, this substance forms the negative, prejudicial, and yet necessary background for the emergence of science. "When it [scientific spirit] encounters scientific culture, it is never young. It is even very old, because it is as old as its prejudices."[45] Thus, epistemological obstacles are not external factors that disturb the development of the sciences; rather, they belong to its very structure, serving as the negative background against which the history of the implementation of scientific rationality is played out.[46]

In order to classify the epistemological obstacles found in Bachelard's scientific theory, we can set up one schema with three tiers that correspond to the three basic modes of knowledge. Those forms of knowledge are placed at the first, lowest stage that, according to Bachelard, are of interest to life and that comprise the sphere of everyday experience. There, in immediate proximity to perceptions and instances of practical life, authentic cognitive interests must be sacrificed for the benefit of inclinations or needs that impair the cognitive validity of their constructions. They represent the most simple and immediate form of epistemological obstacle.

> To connect the two interests, interest to life and interest to spirit, by means of a vague pragmatism, is to unite two opposites arbitrarily. It is the business of the psychoanalysis of the scientific spirit to distinguish these two opposites and to break the solidarity of spirit with the interests of life.[47]

Unreflective forms of knowing, such as opinion, belong to the first stage which, together with perceptions, Bachelard