FIVE

The Living and Its Milieu

The notion of milieu is becoming a universal and obligatory mode of apprehending the experience and existence of living beings; one could almost say it is now being constituted as a category of contemporary thought. But until now it has been quite difficult to perceive as a synthetic unity the historical stages in the formation of this concept, the various forms of its utilization, and the successive inversions of the relationship in which it is one of the terms—in geography, in biology, in psychology, in technology, in economic and social history. For this reason, philosophy must take the initiative in synoptically investigating the meaning and value of this concept. By initiative, we do not mean what appears to be an initiative but only consists in reflecting on the sequence of scientific explorations so as to compare their appearance and results. Rather, through a critical comparison of several approaches, we mean, if possible, to bring to light their common point of departure and to postulate their fecundity for a philosophy of nature centered on the problem of individuality. We shall thus examine one by one

the simultaneous and successive components of the notion of *milieu*, the varieties of its use, from 1800 to our time, the various reversals of the relationship between organism and milieu, and, finally, the general philosophical impact of these reversals.

Historically speaking, the notion and term *milieu* were imported from mechanics into biology during the second half of the eighteenth century. The mechanical notion (though not the term) appeared with Newton, and in its mechanical meaning the term can be found in the article "Milieu" in d'Alembert and Diderot's *Encyclopédie*.[1] Lamarck, inspired by Buffon, introduced it into biology, but he used it only in the plural. This usage was established by Henri de Blainville. Étienne Geoffroy Saint-Hilaire (in 1831) and Auguste Comte (in 1838) used the term in the singular, as an abstract term. Honoré de Balzac introduced it into literature in 1842 (in the preface to *The Human Comedy*), and Hippolyte Taine established it as one of the three principles of the analytic explanation of history—the other two being race and moment.[2] It is from Taine, rather than from Lamarck, that French neo-Lamarckian biologists after 1870—Alfred Giard, Félix Le Dantec, Frédéric Houssay, Johann Costantin, Gaston Bonnier, and Louis Roule—inherited this term. The idea came from Lamarck, but the term, as universal and abstract, was transmitted to them by Taine.

The French mechanists of the eighteenth century called "milieu" what Newton had referred to as "fluid." In Newton's physics, the type—if not the sole archetype—of fluid is ether.[3] In Newton's time, the problem mechanics had to solve was that of the action of distinct physical bodies at a distance. This was the fundamental problem in the physics of central forces. It was not an issue for Descartes, however. For him, there is but one mode of physical action, collision, in one possible physical situation, contact. This is why we can say that the notion of milieu has no place in Cartesian physics. Descartes' "subtle matter" is in no way a milieu. But there was difficulty in extending the Cartesian theory of collision and contact to the case of distinct physical bodies, for their actions blend together. We thus understand how Newton came to pose the problem of the medium of action.[4] For him, luminiferous ether is fluid as the medium of action at a distance. This explains the passage from the notion of fluid as vehicle to that of its designation as milieu. The fluid is an intermediary between two bodies; it is their milieu; and insofar as the fluid penetrates all these bodies, they are situated in the middle of it [*au milieu de lui*]. According to Newton and the physics

of central forces, one can speak of an environment, a milieu, because there exist centers of force. The notion of milieu is an essentially relative one. When we consider separately the body that receives an action transmitted by the milieu, we forget that a *milieu* is a medium, *in between two centers*, and we retain only its function as a centripetal transmitter, its position as that which surrounds a body. In this way, milieu tends to lose its relative meaning and to take on that of an absolute, a reality in itself.

Newton is perhaps responsible for the importation of the term from physics into biology. He used ether not only to solve the problem of the phenomenon of illumination but also to explain the physiological phenomenon of vision and, finally, to explain the physiological effects of the sensation of light, that is, muscular reactions. In his *Optics*, Newton considers ether to be continuous in the air, the eye, the nerves, and the muscles. It is thus the action of the milieu that guarantees the relation of dependence between the illumination of a perceived light source and the movement of the muscles by which man reacts to this sensation. This, it seems, is the first example of an organic reaction being explained by the action of a milieu, that is to say, by the action of a fluid strictly defined by physical properties.[5] Indeed, the aforementioned *Encyclopédie* article confirms this view and borrows all its examples of a milieu from Newton's physics. And it is in a purely mechanical sense that water is said to be a milieu for the fish that move about in it. It is also in this mechanical sense that Lamarck first uses the term.

Lamarck always speaks of milieus—in the plural—by which he expressly means fluids like water, air, and light. When Lamarck wishes to designate the ensemble of actions that act on a living being from the outside—what we today call the milieu—he never says "milieu," but always "influencing circumstances."[6] Consequently, circumstance is for Lamarck a genus, whose species are climate, place, and milieu. This is why Léon Brunschvicg, in *Les étapes de la philosophie mathématique*,[7] could write that Lamarck had borrowed from Newton the model for a physical-mathematical explanation of the living by a system of connections with its environment. The connections between Lamarck and Newton are direct at the intellectual level and indirect historically. Buffon links Lamarck to Newton. We might simply recall that Lamarck was Buffon's student and the tutor of his son.

Buffon in fact combines two influences in his conception of the relations between the organism and the milieu. The first is Newton's cosmology, of

which Buffon was a constant admirer.[8] The second is the tradition of anthropo-geographers, which, after Machiavelli, Jean Bodin, and John Arbuthnot, was kept alive in France by Montesquieu. The Hippocratic treatise *On Airs, Waters, and Places* can be considered the first work to have given a philosophical form to this anthropo-geographical conception.[9] These are the two elements Buffon brought together in his principles of animal ethology, to the extent that the mores of animals are distinctive and specific characteristics and can be explained by the same method geographers use to explain the diversity of men—the variety of races and peoples on the earth's surface.[10]

Thus, as teacher and precursor to Lamarck in his theory of milieu, Buffon appears at the convergence of the two components of this theory: the mechanical and the anthropo-geographical. Here is posed a problem of epistemology and of the historical psychology of knowledge, a problem whose scope greatly exceeds the present example. Shouldn't we interpret the fact that two or more guiding ideas combine at a certain moment to form a single theory as a sign that—in the final analysis and despite their apparent differences—they have a common origin, whose meaning and very existence we forget when we consider separately their disjointed parts? We will return to this problem at the end of the present essay.

The Newtonian origins of the notion of milieu thus suffice to account for its initial mechanical signification and the use that was first made of it. The origin determines the meaning and the meaning determines the usage, to such an extent that Comte, when proposing a general biological theory of milieu in 1838 (in the fortieth lesson of his *Course of Positive Philosophy*), had the impression he was using *milieu* as a neologism and claimed responsibility for erecting it into a universal and abstract notion of biological explanation. Comte says that by this term he no longer means only "the fluid into which a body is immersed" (thereby confirming the mechanical origins of the notion) but "the total ensemble of exterior circumstances necessary for the existence of each organism." But we also see in Comte—who has a perfectly clear sense of the origins of the notion, as well as of the import he would like to give to it in biology—that its usage will remain dominated by the mechanical origins of the notion, if not of the term. Indeed, it is quite interesting to notice that Comte is on the brink of forming a dialectical conception of the relations between the organism and the milieu. We are

alluding here to the passages in which he defines the relation of the "appropriate organism" and the "suitable milieu" as a "conflict of forces," and the act constituting that conflict as function.[11] He posits that "the ambient system could not possibly modify the organism if the organism did not exert on it in turn a corresponding influence." But, apart from the human species, he holds the organism's action on the milieu to be negligible. In the case of the human species, Comte, faithful to his philosophical conception of history, admits that, by the intermediary of collective action, humanity modifies its milieu. Still, for the living in general Comte refuses to consider this reaction of the organism on the milieu—judging it to be simply negligible. This is because he very explicitly looks for a guarantee of this dialectical link, this reciprocal relation between milieu and organism, in the Newtonian principle of action and reaction. Indeed, from a mechanical point of view, the action of the living on the milieu is almost negligible. And Comte ends up posing the biological problem of the relations between the organism and the milieu in the form of a mathematical problem: "In a given milieu, and given an organ, find the function—and vice versa." The link between the organism and the milieu is thus that of a function to an ensemble of variables, an equation by way of which, "all other things being equal," one can determine the function by the variables, and each variable by the function.[12]

In the forty-third lesson of the *Course of Positive Philosophy*, Comte analyses the variables for which the milieu is the function. These variables are weight, air and water pressure, movement, heat, electricity, and chemical species—all factors that can be studied experimentally and quantified by measurements. The quality of an organism is reduced to an ensemble of quantities, despite Comte's professed distrust of the mathematical treatment of biological problems—a distrust that came to him from Bichat.

In sum, the benefit of even a cursory history of the importation of the term *milieu* into biology during the first years of the nineteenth century is that it accounts for the originally strictly mechanistic acceptance of the term. If in Comte there appears a hint of an authentically biological acceptance and a more flexible usage of the word, this immediately gives way to the prestige of mechanics, an exact science in which prediction is based on calculation. To Comte, the theory of milieu seems clearly to be a variant of the fundamental project that the *Course of Positive Philosophy* endeavors to complete: first the world, then man; to go from the world to man. If Comte

anticipates the idea of a subordination of the mechanical to the vital—the idea he would later formulate in mythical form in *The System of Positive Polity* and *The Subjective Synthesis*—here he nevertheless deliberately represses it.

But there is still one lesson to be taken from the use—absolute and without qualification—of the term *milieu* as it was definitively established by Comte. The term would henceforth designate the equivalent of Lamarck's "circumstances" and Étienne Geoffroy Saint-Hilaire's "ambient milieu" (in his 1831 thesis at the Académie des Sciences). These terms, *circumstances* and *ambience*, point to a certain intuition of a formation around a center. With the success of the term *milieu*, the representation of an indefinitely extendible line or plane, at once continuous and homogeneous, and with neither definite shape nor privileged position, prevailed over the representation of a sphere or circle, which are qualitatively defined forms and, dare we say, attached to a fixed center of reference. *Circumstances* and *ambience* still retain a symbolic value, but *milieu* does not evoke any relation except that of a position endlessly negated by exteriority. The now refers to the before; the here refers to its beyond, and thus always and ceaselessly. The milieu is truly a pure system of relations without supports.

From there one can understand the prestige of the notion of milieu for analytic scientific thought. The milieu becomes a universal instrument for the dissolution of individualized organic syntheses into the anonymity of universal elements and movements. When the French neo-Lamarckians borrowed from Lamarck, if not the term *milieu* in the singular and in its absolute sense, then at least the idea of it, they retained of the morphological characteristics and functions of the living only their formation by exterior conditioning—only, so to speak, their formation by deformation. It is enough to recall J. Costantin's experiments on the forms of the arrowhead leaf or Frédéric Houssay's experiments on the form, fins, and metamerism of fish.[13] Louis Roule was able to write, in his small book *La vie des rivières*, that "fish do not lead their lives on their own; it is the river that makes them lead it; they are persons without personality."[14] We have here an example of what a strictly mechanist usage of the notion of milieu necessarily leads to.[15] We are brought back to the theory of animal-machines. In the end, this is just what Descartes said, in saying of animals that "it is nature which acts in them by means of their organs."[16]

From 1859 on—that is to say, after the publication of Darwin's *The Origin of Species*—the problem of the relations between organism and milieu is dominated by the polemic between Lamarckians and Darwinians. To understand the meaning and importance of this polemic, it is necessary to recall the originality of their respective points of departure.

In his 1809 *Zoological Philosophy*, Lamarck writes that if by action of circumstances or milieus one takes him to mean direct action by the exterior milieu on the living, one is putting words into his mouth.[17] It is via the intermediary of need, a subjective notion implying reference to a positive pole of vital values, that the milieu dominates and compels the evolution of living beings. Changes in circumstances lead to changes in needs; changes in needs lead to changes in actions. If these actions are long-lasting, the use or nonuse of certain organs causes the organs to develop or atrophy, and these morphological acquisitions or losses, obtained by individual habit, are preserved by the mechanism of heredity, on condition that the new morphological characteristic is common to both parents.

According to Lamarck, the situation of the living in the milieu is distressful and distressed. Life exists in a milieu that ignores it, as two asynchronous series of events. Circumstances change on their own, and the living must take the initiative to make an effort not to be "dropped" by its milieu. Adaptation is a renewed effort by life to continue to "stick" to an indifferent milieu. Since it is the result of an effort, adaptation is thus neither harmonious nor providential; it is gained and never guaranteed. Lamarckism is not mechanist, and it would also be inaccurate to call it finalistic. In reality, it is a bare vitalism. There is an originality in life for which the milieu does not account and which it ignores. Here the milieu is truly exterior, in the proper sense of the word: it is foreign, it does nothing for life. This is truly a vitalism because it is a dualism. Life, says Bichat, is the ensemble of functions that resist death. In Lamarck's conception, life resists solely by deforming itself so as to outlive itself. To our knowledge, no portrait of Lamarck, no summary of his doctrine, surpasses the one given by Charles Augustin Sainte-Beuve in his novel *Volupté*.[18] One sees how far one has to go to get from Lamarck's vitalism to the French neo-Lamarckians' mechanism. Edward Cope, an American neo-Lamarckian, was more faithful to the spirit of the doctrine.

Darwin had a completely different idea of the environment of the living, as well as of the appearance of new forms. In the introduction to *The Origin*

of Species, he writes: "Naturalists continually refer to external conditions such as climate, food, etc. as the only possible cause of variation. In one limited sense, . . . this may be true."[19] It seems that Darwin later regretted having attributed only a secondary role to the direct action of physical forces on the living. This comes across in his correspondence. Marcel Prenant, in his introduction to a collection of Darwin's texts, has published some particularly interesting passages on this topic.[20] Darwin looks for the appearance of new forms in the conjunction of two mechanisms: one that produces differences, namely, variation; and one that reduces and tests the differences thereby produced, namely, the struggle for life and natural selection. The fundamental biological relation, in Darwin's eyes, is the relation of one living being to others; it prevails over the relation between the living and the milieu conceived as an ensemble of physical forces. The first milieu an organism lives in is an entourage of living beings, which are for it enemies or allies, prey or predators. Between these living beings are established relations of use, destruction, and defense. In this competition of forces, accidental morphological variations count as advantages or disadvantages. And variation—the appearance of small morphological differences by which a descendant does not exactly resemble its ancestors—stems from a complex mechanism: the use or nonuse of organs (the Lamarckian factor applies only to adults), correlations or compensations in growth (for the young), or the direct action of the milieu (on germ seeds).

In this sense, one can say that for Darwin, by contrast to Lamarck, the initiative to variation comes sometimes—but only sometimes—from the milieu. One gets a somewhat different idea of Darwin depending on whether one accentuates this action or not and whether one limits oneself to his classic works or instead considers the entirety of his thought, as revealed in his correspondence. In any case, for Darwin, to live is to submit an individual difference to the judgment of the ensemble of living beings. This judgment has only two possible outcomes: either death or becoming oneself part of the jury for a while. So long as one lives, one is always judge and judged. As a result, in Darwin's oeuvre as he left it to us, the thread linking the formation of the living being to the physico-chemical milieu can seem fairly thin. And when mutationism, a new theory of the evolution of species, used genetics to explain the appearance of immediately hereditary species variations (Darwin had underestimated this phenomenon), the role of the milieu was reduced to eliminating the worst without participating in

the production of new beings, normalized by their unpremeditated adaptation to new conditions of existence, monstrosity becoming the rule and originality a temporary banality.

In the polemic between Lamarckians and Darwinians, the same arguments and objections are made in both directions and applied to both authors: finalism is denounced and mechanism celebrated sometimes in one, sometimes in the other. This is no doubt a sign that the question has been badly put. In Darwin, one can find finalism not in things themselves but in his choice of words—he has been frequently reproached for his term *selection*. In Lamarck, it is less finalism than vitalism. Both are authentic biologists, to whom life appears as a given that each seeks to characterize, instead of trying analytically to explain it. These two authentic biologists are complementary. Lamarck thinks of life in terms of duration, and Darwin thinks of it mostly in terms of interdependence: a living form presupposes a plurality of other forms in relation to it. The synoptic vision that is the essence of Darwin's genius is missing in Lamarck. Darwin is more closely related to the geographers, and we know how much he owed to his voyages and explorations. The milieu in which Darwin depicts the life of the living is a bio-geographical milieu.

At the beginning of the nineteenth century, two names stand for the birth of geography as a science conscious of its method and dignity: Carl Ritter and Alexander von Humboldt.

In 1817, Ritter published his *Comparative Geography*.[21] Humboldt published, during the decade beginning in 1845, a book whose title, *Kosmos*, perfectly captures its spirit.[22] In these two works are united the traditions of Greek geography: that is to say, on the one hand, the science of the human ecumene since Aristotle and Strabo, and on the other, the science of the coordination of human space in relation to celestial configurations and movements—the science of mathematical geography, which Eratosthenes, Hipparchus, and Ptolemy are considered to have founded.

According to Ritter, without man's relation to the land—to all land—human history is unintelligible. The earth, considered as a whole, is the stable ground for the vicissitudes of history. Terrestrial space and its configuration are, consequently, not only geometrical and geological objects of knowledge but also sociological and biological ones.

Humboldt was a naturalist-traveler, who repeatedly covered what it was possible to cover of the world in his time and who applied a whole system of barometric, thermometric, and other measurements to his investigations. Humboldt's interest was above all focused on the distribution of plants according to climate: he is the founder of botanical geography and zoological geography. *Kosmos* is a synthesis of knowledge concerning life on earth and the relations of life to the physical milieu. This synthesis does not aim to be an encyclopedia but rather to arrive at an intuition of the universe; it begins with a history of *Weltanschauungen*, with a history of the Cosmos whose equivalent it would be difficult to find in a work of philosophy. It is an absolutely remarkable overview.

It is essential to note that Ritter and Humboldt applied to their object—the relations between historical man and milieu—the category of totality. Their object is the whole of humanity on the whole Earth. With Ritter and Humboldt, the idea of determining historical relations by the geographical substrate was consolidated in geography. It gave rise first to Friedrich Ratzel and anthropo-geography in Germany, and then to geopolitics. The idea then invaded history by contagion, starting with Michelet (let us recall his *Le tableau de la France*).[23] Finally, as we have already said, Taine contributed to the spread of the idea to all milieus, including the literary milieu. We can sum up the spirit of this theory of the relations of geographical milieu to man by saying that doing history came to consist in reading a map, where this map is the figuration of an ensemble of metrical, geodesic, geological, and climatological data, as well as descriptive bio-geographical data.

The treatment of anthropological and human ethological questions—a treatment that became more and more deterministic or, rather, mechanistic the farther one went from the spirit of its founders—was doubled by a parallel, if not exactly synchronous treatment in the domain of animal ethology. The mechanistic explanation of the organism's movements in the milieu succeeded the mechanistic interpretation of the formation of organic forms. Let us simply recall the works of Jacques Loeb and John B. Watson. Generalizing the conclusions of his research on phototropisms in animals, Loeb considered all movement of the organism to be movement forced on it by the milieu. The reflex, considered to be an elementary response of a segment of the body to an elementary physical stimulus, is the simple mechanism whose composition allows one to explain all behaviors of the living.

Along with Darwinism, this exorbitant Cartesianism is incontestably at the origin of the postulates of behaviorist psychology.[24]

Watson assigned to psychology the task of conducting analytic research into the conditions of the adaptation of the living to the milieu by experimentally producing excitation and response relations (the stimulus-response pair). There is a physical determinism in the relation between excitation and response. The biology of behavior is reduced to neurology, which itself is reducible to energetics, the science of energy. The evolution of Watson's thought led him from a conception that simply neglects consciousness as useless to one that nullifies it as illusory. The milieu thus comes to be invested with all power over individuals; its power [*puissance*] dominates and even abolishes that of heredity and genetic constitution. Since the milieu is given, the organism gives itself nothing it does not, in reality, already receive. The situation of the living, its being in the world, is a condition or, more exactly, a conditioning.

Albert Weiss intended to construct biology like a deductive physics, by proposing an electronic theory of behavior. It fell to the psycho-technicians—who expanded Taylorist techniques for timing movements through the analytic study of human reactions—to perfect the work of behaviorist psychology and constitute, through their science, man as a machine reacting to machines, as an organism determined by the "new milieu" (Friedmann).

In short, because of its origins, the notion of milieu first developed and spread in a perfectly determined way, and we can say, applying to this notion the methodological norm it stands for, that its intellectual power was a function of the intellectual milieu in which it had been formed. The theory of milieu was at first the positive and apparently verifiable translation of Condillac's fable of the statue.[25] When the air smells like roses, a statue is rose-scented. In the same way, the living, within the physical milieu, is light and heat, carbon and oxygen, calcium and weight. It responds by muscular contractions to sensory excitations; it responds with a scratch to an itch, with flight to an explosion. But one can and must ask: Where is the living? We see individuals, but these are objects; we see gestures, but these are displacements; centers, but these are environments; machinists, but these are machines. The milieu of behavior coincides with the geographical milieu; the geographical milieu, with the physical milieu.

It was normal, in the strong sense of the word, for this methodological norm to have first reached its limits and the occasion for its reversal in

geography. Geography has to do with complexes—complexes of elements whose actions mutually limit each other and in which the effects of causes become causes in turn, modifying the causes that gave rise to them. Trade winds are a typical example of a complex in this respect. They displace surface water that has been heated by contact with the air; the cold deep waters rise to the surface and cool the atmosphere; low temperatures engender low pressure, which generates winds; the cycle is closed and begins again. The same type of complex can be observed in plant geography. Vegetation grows in natural ensembles, in which different species limit each other reciprocally and where, in consequence, each contributes to creating an equilibrium for the others. The ensemble of these plant species ends up constituting its own milieu. Thus the exchanges between plants and the atmosphere end up creating a sort of vapor screen around the vegetal zone, which limits the effect of radiation, and this cause gives rise to an effect that will in turn slow down the cause, and so on.[26]

The same approaches must be applied to animals and to man. However, the human reaction to provocation by the milieu is diversified. Man can give several different solutions to a single problem posed by the milieu. The milieu proposes, without ever imposing, a solution. To be sure, in a given state of civilization and culture, the possibilities are not unlimited. But the fact of considering as an obstacle something that may later be seen as a means to action ultimately derives from the idea, the representation, that man (collective man, of course) builds himself out of his possibilities, his needs. In short, it results from what he represents to himself as desirable, which is inseparable from the ensemble of values.[27]

Thus, the relation between the milieu and the living being ends up reversed. Man, as a historical being, becomes the creator of a geographical configuration; he becomes a geographical factor. We simply call to mind here that the works of Paul Vidal-Lablache, Jean Brunhes, Albert Demangeon, and Lucien Febvre and his school have shown that, for man, there is no pure physical milieu. Within a human milieu, man is obviously subjected to a kind of determinism, but this is the determinism of artificial creations, from which the spirit of invention that brought them into existence has been alienated. In the same line of thought, the work of Friedmann shows how, in the new milieu that machines create for man, the same reversal has already been brought about. Pushed to the extreme limits of its ambition, the engineers' psycho-technics that descended from Taylor's

ideas succeeds in grasping, as an irreducible center of resistance, the presence in man of man's own originality in the form of a sense of values. Even when subordinated to machines, man cannot apprehend himself as a machine. His productive efficiency improves the better aware he is of his centrality with regard to mechanisms intended to serve him.

Much earlier, the same reversal of the relation between organism and milieu had taken place in animal psychology and the study of behavior. Jacques Loeb led to Herbert Spencer Jennings, and John B. Watson to Robert Jacob Kantor and Edward C. Tolman.

Here, the influence of pragmatism is obvious and well-established. If pragmatism served as an intermediary between Darwinism and behaviorism—in one sense by generalizing and extending the notion of adaptation to the theory of knowledge, and in another by emphasizing the role of values in relation to the interests of an action—John Dewey led the behaviorists to see the reference of organic movements to the organism itself as essential. The organism is considered a being on which not everything can be imposed, because its existence as organism consists in its proposing itself to things on the basis of certain orientations that are proper to it. Tolman's teleological behaviorism, first developed by Kantor, consists in searching for and recognizing the meaning and intention of animal movement. What appears essential in the movement of reaction is that it persists, through a variety of phases, which can be errors or lapses, until the moment when the reaction either brings the excitation to an end and re-establishes rest or leads to a new series of acts, entirely different from those that have been concluded.

Before Tolman, Jennings, in his theory of trial and error, had shown (against Loeb), that the animal does not react as a sum of distinct molecular reactions to a stimulant that can be divided into units of excitation. Instead, the animal reacts as a whole to total objects, and its reactions are regulators for the needs that govern them. Naturally, one must recognize here the considerable contribution of *Gestalttheorie*, and in particular of Kurt Koffka's distinction between the milieu of behavior and the geographical milieu.[28]

Finally, the relation between organism and milieu is reversed in von Uexküll's studies of animal psychology and in Goldstein's studies of human pathology. Each of them makes this reversal with a lucidity that comes from a fully philosophical view of the problem. Von Uexküll and Goldstein agree

on this fundamental point: to study a living being in experimentally constructed conditions is to make a milieu for it, to impose a milieu on it; yet it is characteristic of the living that it makes its milieu for itself, that it composes its milieu. Of course, we might still speak of interaction between the living and the milieu even from a materialist point of view—between one physico-chemical system cut out from a larger whole, and its environment. But to speak of interaction does not suffice to annul the difference between a relation of the physical type and a relation of the biological type.

From the biological point of view, one must understand that the relationship between the organism and the environment is the same as that between the parts and the whole of an organism. The individuality of the living does not stop at its ectodermic borders any more than it begins at the cell. The biological relationship between the being and its milieu is a functional relationship, and thereby a mobile one; its terms successively exchange roles. The cell is a milieu for intracellular elements; it itself lives in an interior milieu, which is sometimes on the scale of the organ and sometimes of the organism; the organism itself lives in a milieu that, in a certain fashion, is to the organism what the organism is to its components. In order to judge biological problems, we thus require a biological sense, to whose formation von Uexküll and Goldstein can greatly contribute.[29]

Von Uexküll chooses the words *Umwelt*, *Umgebung*, and *Welt* and distinguishes between them with great care. *Umwelt* designates the milieu of behavior proper to a certain organism; *Umgebung* is the banal geographical environment; *Welt* is the universe of science. The milieu of behavior proper to the living (*Umwelt*) is an ensemble of excitations, which have the value and signification of signals. To act on a living being, a physical excitation has not only to occur but also to be noticed. Consequently, insofar as the excitation acts on the living being, it presupposes the orientation of the living being's interest; the excitation comes not from the object but from the living. In order for the excitation to be effective, it must be anticipated by an attitude of the subject. If the living is not looking, it will not receive anything. A living being is not a machine, which responds to excitations with movements, it is a machinist, who responds to signals with operations. Naturally, this is not to contest that it happens through reflexes whose mechanism is physico-chemical. That is not where the question lies for the biologist. Rather, the question lies in the fact that out of the abundance of the physical milieu, which produces a theoretically unlimited number of

excitations, the animal retains only some signals (*Merkmale*). Its life rhythm orders the time of this *Umwelt*, just as it orders space. Along with Buffon, Lamarck used to say that time and favorable circumstances constitute the living bit by bit. Von Uexküll turns the relation around and says: time and favorable circumstances are relative to certain living beings.

The *Umwelt* is thus an elective extraction from the *Umgebung*, the geographical environment. But the environment is nothing other than the *Umwelt* of man, that is to say, the ordinary world of his perspective and pragmatic experience. Just as this *Umgebung*, this geographic environment external to the animal, is, in a sense, centered, ordered, oriented by a human subject—that is to say, a creator of techniques and a creator of values—the *Umwelt* of the animal is nothing other than a milieu centered in relation to that subject of vital values in which the living essentially consists. We must see at the root of this organization of the animal *Umwelt* a subjectivity analogous to the one we are bound to see at the root of the human *Umwelt*. One of the most gripping examples cited by von Uexküll is the *Umwelt* of the tick.

Ticks live off the warm blood of mammals. The adult female, after mating, climbs to the end of a tree branch and waits. She can wait up to eighteen years. At the Rostock Institute of Zoology, ticks were kept alive in captivity without eating for eighteen years. When a mammal passes under the tick's lookout and hunting post, she drops down. It is the smell of rancid butter emanating from the animal's coetaneous glands that guides her. This is the only stimulant that can set off this falling movement. This is the first stage. When she has fallen onto the animal, she attaches herself there. If the odor of rancid butter has been artificially produced—on a table, for example—the tick will not stay there, but will climb back up to her observation post. Only the temperature of the blood keeps her on the animal. She is fixed to the animal by her thermal sense and, guided by her tactile sense, she seeks out places on the skin where there are no hairs. She buries her head there, and sucks the blood. Only at the moment when the mammal's blood enters into her stomach do the tick eggs (encapsulated ever since the moment of mating and capable of remaining encapsulated for eighteen years) open, mature, and develop. The tick can live for eighteen years to perform her reproductive function in several hours. It is noteworthy that, over a long period of time, the animal can remain totally indifferent, insensible to all the excitations that emanate from a milieu such as the forest, and that the

sole excitation that can release its movement—to the exclusion of all others—is the odor of rancid butter.[30]

A comparison with Goldstein is imperative here, for Goldstein bases his theory on a critique of the mechanical theory of reflexes. A reflex is not an isolated or gratuitous reaction. A reaction is always a function of the opening of a sense to stimulations, and of its orientation with regard to them. This orientation depends on the signification of a situation indistinct from this ensemble. Isolated stimuli have meaning for human science, but none for the sensibility of a living being. An animal in an experimental situation is in an abnormal situation, a situation it does not need according to its own norms; it has not chosen this situation, which is imposed on it. An organism is thus never equal to the theoretical totality of its possibilities. One cannot understand its actions without appealing to the notion of privileged behavior. "Privileged" does not mean objectively simpler—just the inverse. The animal finds it simpler to do what it privileges. It has its own vital norms.

The relation between the living and the milieu establishes itself as a debate (*Auseinandersetzung*), to which the living brings its own proper norms of appreciating situations, both dominating the milieu and accommodating itself to it. This relation does not essentially consist (as one might think) in a struggle, in an opposition. That applies to the pathological state. A life that affirms itself against the milieu is a life already threatened. Movements of force—for example, reactions of muscular extension—translate the exterior's domination of the organism.[31] A healthy life, a life confident in its existence, in its values, is a life of flexion, suppleness, almost softness. The situation of a living being commanded from the outside by the milieu is what Goldstein considers the archetype of a catastrophic situation. And that is the situation of the living in a laboratory. The relations between the living and the milieu as they are studied experimentally, objectively, are, among all possible relations, those that make the least sense biologically; they are pathological relations. Goldstein says that, in the organism, "'meaning' and 'being' are the same"; we can say that the being of an organism is its meaning.[32] Certainly, the living can and must be analyzed in physico-chemical terms. This has its theoretical and practical interest. But this analysis is a chapter in physics. In biology, everything is still to be done. Biology must first hold the living to be a significative being, and it must treat individuality not as an object but as an attribute within the order of values. To live is to

radiate; it is to organize the milieu from and around a center of reference, which cannot itself be referred to without losing its original meaning.

While the relation between organism and milieu was being reversed in animal ethology and in the study of behavior, the explanation of morphological characteristics was undergoing a revolution that led to the acceptance of the autonomy of the living in relation to the milieu. We are alluding here to the well-known works of William Bateson, Lucien Cuénot, Thomas Hunt Morgan, Hermann Müller, and their collaborators, who took up and extended Gregor Mendel's research on hybridization and heredity.[33] In creating the science of genetics, they came to maintain that the acquisition by the living being of its form and, hence, its function depends, in a given milieu, on its own hereditary potential and that the milieu's action on the phenotype leaves the genotype intact. The genetic explanation of heredity and evolution (the theory of mutations) converged with August Weismann's theory. Premature isolation of the germ-plasm during ontogenesis nullified the influence on the development of the species of somatic modifications determined by the milieu. Albert Brachet, in his *La vie créatrice des formes*, could write that "the milieu is not, properly speaking, an agent of formation, but rather of realization,"[34] invoking as an example the variety of forms of oceanic living beings within an identical milieu. And Maurice Caullery concludes his discussion in *Problème de l'évolution* by recognizing that evolution depends much more on the intrinsic properties of organisms than on the ambient milieu.[35]

But we know that the conception of the total autonomy of hereditary genetic material has been criticized. One critique emphasized that nucleoplasmatic disharmony tends to limit the hereditary omnipotence of genes. In sexual reproduction, although each parent supplies half of the genes, the mother supplies the egg cytoplasm. Now, the fact that offspring from the crossbreeding of two different species are not the same—depending on which of the species is the father or the mother—leads one to think that the genes' strength varies as a function of the cytoplasmic milieu. At the same time, H. Müller's experiments (1927) inducing mutations in fruit flies through the action of a milieu of penetrative radiation (X-rays), seemed to shed light on how an organic phenomenon that has perhaps been too smugly used to highlight the separation of the organism from the environment can be conditioned from the outside. Finally, there was a renewal of Lamarckism in the polemics—at least as ideological as scientific—surrounding the

indignant repudiation of the "pseudo-science" of Russian geneticists, whom Trofim Lysenko led back to the "sound method" of Ivan Vladimirovich Michurin (1855–1935). Experiments on the vernalization of cultivated plants such as wheat and rye led Lysenko to affirm that hereditary modifications can be obtained and reinforced by variations in conditions of nutrition, maintenance, and climate, leading to a dislocation or rupture of the hereditary constitution of the organism, wrongly supposed by geneticists to be stable. Insofar as we can summarize the complex experimental facts within our present scope, we can say that, according to Lysenko, heredity is dependent on metabolism and metabolism is dependent on conditions of existence. Heredity would thus be the assimilation, by the living, over the course of succeeding generations, of exterior conditions. The ideological commentaries surrounding these facts and this theory do indeed bring to light its sense, regardless of its ability to accommodate, or even to withstand, the experimental counter-proofs and criticisms that are the rule in scientific discussion and that, of course, lie outside our competence.[36] It seems that the technical—that is, agronomic—aspect of the problem is essential. The Mendelian theory of heredity, by establishing the spontaneous character of mutations, tends to damp human—and specifically Soviet—ambitions for the total domination of nature and to limit the possibility of intentionally altering living species. Finally, and above all, recognition of the milieu's determining action has a political and social impact: it authorizes man's unlimited action on himself via the intermediary of the milieu. It offers hope for an experimental renewal of human nature. It thus appears progressive in the highest degree. Theory and practice are inseparable, as befits Marxist-Leninist dialectics. One can then understand how it is that genetics could be charged with all the sins of racism and slavery, and Mendel presented as the head of a retrograde, capitalist, and idealist biology.

It is clear that, although the heredity of acquired characteristics may have regained favor, this does not authorize one to designate the recent theories of Soviet biologists as Lamarckian without qualification. What is essential in Lamarck's ideas, as we have seen, is that the organism's adaptation to its milieu is attributed to the initiative of the organism's needs, efforts, and continual reactions. The milieu provokes the organism to orient its becoming by itself. Biological response by far exceeds physical stimulation. By rooting the phenomena of adaptation in need, which is at once pain and

impatience, Lamarck centered the indivisible totality of the organism and the milieu on the point where life coincides with its own sense, where, through its sensibility, the living situates itself absolutely, either positively or negatively, within existence.

In Lamarck, as in the first theoreticians of the milieu, the notions of "circumstances" and "ambience" had a very different meaning from that in ordinary language. They evoked a spherical, centered arrangement. The terms *influences* and *influencing circumstances*, which Lamarck also used, take their meaning from astrological conceptions. When Buffon, in *De la dégénération des animaux*, speaks of "dye" from the sky, which man gradually receives, he uses, no doubt unconsciously, a term borrowed from Paracelsus.[37] The very notion of "climate" is, in the eighteenth century[38] as well as at the beginning of the nineteenth, an undivided notion, at once geographical, astronomical, and astrological. The climate is the change in the sky's appearance, degree by degree, from the equator to each pole, and it is also the influence that the sky exerts on the earth.

We have already indicated that, in the beginning, the biological notion of the milieu combined an anthropo-geographical component with a mechanical one. The anthropo-geographical component was even, in a sense, the entirety of the notion, for it included the astronomical component, which Newton had converted into a notion of celestial mechanics. At its origin, geography was, for the Greeks, the projection of the heavens onto the earth, the bringing into correspondence of the sky and the earth: a correspondence at once topographical (geometry with cosmography) and hierarchical (physics and astrology). The co-ordination of the parts of the earth, and the subordination to the sky of an earth whose area is coordinated, were underlain by an astro-biological intuition of the Cosmos. Greek geography had its philosophy—that of the Stoics.[39] The intellectual relations between Posidonius, on the one hand, and Hipparchus, Strabo, and Ptolemy, on the other, are incontestable. What gives meaning to the geographical theory of milieu is the theory of universal sympathy, a vitalist intuition of universal determinism. This theory implies the comparison of the totality of things to an organism and the representation of this totality in the form of a sphere, centered on the situation of a privileged living being: man. This biocentric conception of the Cosmos persisted through the Middle Ages and blossomed in the Renaissance.

We know what became of the idea of the Cosmos with Copernicus, Kepler, and Galileo, and how dramatic the conflict was between the organic conception of the world and the conception of a universe decentered in relation to the ancient world's privileged center of reference, the land of living beings and man. From Galileo and Descartes on, one had to choose between two theories of milieu, that is, between two theories of space: a centered, qualified space, where the mi-*lieu* is a center; or a decentered, homogeneous space, where the *mi*-lieu is an intermediary field. Pascal's famous text *Disproportion of Man* clearly shows the ambiguity of this term for a mind that cannot or does not want to choose between the need for existential security and the demands of scientific knowledge.[40] Pascal knows perfectly well that the Cosmos has broken to pieces, but the eternal silence of infinite spaces terrifies him. Man is no longer in the middle [*milieu*] of the world, but *he is a milieu* (a milieu between two infinities, a milieu between nothing and everything, a milieu between two extremes[41]); the milieu is *the state in which nature has placed us; we are floating on a vast milieu; man is in proportion with parts of the world, he has a relation to all that he knows*: "He needs space to contain him, time to exist in, motion to be alive, elements to constitute him, warmth and food for nourishment, air to breathe. He sees light, he feels bodies, everything in short is related to him."[42] We thus see three meanings of *milieu* intervene here: medial situation, fluid of sustenance, and vital environment. In developing the last sense of the term, Pascal presents his organic conception of the world, a return to Stoicism beyond and against Descartes:

> Since all things are both caused and causing, assisted and assisting, mediate and immediate, providing mutual support in a chain linking together naturally and imperceptibly the most distant and different things, I consider it as impossible to know the parts without knowing the whole as to know the whole without knowing the individual parts.[43]

And when Pascal defines the universe as an "infinite sphere whose center is everywhere and circumference nowhere,"[44] he paradoxically attempts, by using an image borrowed from the theosophical tradition, to reconcile the new scientific conception (which makes the universe an indefinite and undifferentiated milieu) with the ancient cosmological vision (which makes the world a finite totality connected to its center). The image Pascal uses

here is a permanent myth of mystical thought, a myth of Neo-Platonic origin, in which the intuition of a spherical world centered on and by the living is combined with the already heliocentric cosmology of the Pythagoreans.[45]

Up to and including Newton, there was no one who did not take from Jacob Boehme, Henry More ("the Platonist of Cambridge"), and their Neo-Platonist cosmology some symbolic representation of what a ubiquitous action radiating out from a center would be. Newtonian space and ether maintain an absolute quality, which the scholars of the eighteenth and nineteenth centuries were not able to recognize: space, as the means for God's omnipresence, and ether, as the support and vehicle of forces. Newtonian science, which was to underlie so many empiricist and relativist professions of faith, is founded on metaphysics. Its empiricism masks its theological foundations. And in this way, the natural philosophy at the origin of the positivist and mechanicist conception of the milieu is in fact itself supported by the mystical intuition of a sphere of energy whose central action is identically present and effective at all points.[46]

If today it seems completely normal to anyone trained in mathematics or physics that the ideal of the objectivity of knowledge demands a decentering of the vision of things, it also seems that the moment has come to understand that in biology, following the words of J. S. Haldane in *The Philosophy of a Biologist*, "it is physics that is not an exact science." As Edouard Claparède writes: "What distinguishes the animal is the fact that it is a *center* in relation to ambient forces that are, in relation to it, no more than stimulants or signals; a center, that is to say, a system with internal regulation, whose reactions are determined by an internal cause: momentary need."[47] In this sense, the milieu on which the organism depends is structured, organized, by the organism itself. What the milieu offers the living is a function of demand. It is for this reason that, within what appears to man as a single milieu, various living beings carve out their specific and singular milieus in incomparable ways. Moreover, as a living being, man does not escape from the general law of living beings. The milieu proper to man is the world of his perception—in other words, the field of his pragmatic experience, the field in which his actions, oriented and regulated by the values immanent to his tendencies, pick out quality-bearing objects and situate them in relation to each other and to him. Thus the environment to which he is supposed to react is originally centered on him and by him.

Yet man as scientist and bearer of knowledge constructs a universe of phenomena and laws that he holds to be an absolute universe. The essential function of science is to devalorize the qualities of objects that comprise the milieu proper to man; science presents itself as the general theory of a real, that is to say, inhuman milieu. Sensory data are disqualified, quantified, identified. The imperceptible is presumed, and then detected and proven. Measurements substitute for appreciations, laws for habits, causality for hierarchy, and the objective for the subjective.

Hence the universe of the scientist [*l'homme savant*]. Einstein's physics is its ideal representation: a universe whose fundamental equations of intelligibility are the same, no matter what the system of reference may be. Because this universe maintains a direct relation to the milieu proper to living man—albeit a relation of negation and reduction—it confers upon this proper milieu a sort of privilege over the milieus proper to other living beings. Despite finding his ordinary perceptual experience contradicted and corrected by scientific research, living man [*l'homme vivant*] draws from his relation to the scientist [*l'homme savant*] a sort of unconscious self-conceit, which makes him prefer his own milieu over the milieus of other living beings, as having more reality and not just a different value. In fact, as a proper milieu for comportment and life, the milieu of man's sensory and technical values does not in itself have more reality than the milieus proper to the woodlouse or the gray mouse. In all rigor, the qualification *real* can be applied only to the absolute universe, the universal milieu of elements and movements disclosed by science. Its recognition as real is necessarily accompanied by the disqualification, as illusions or vital errors, of all subjectively centered proper milieus, including that of man.

The claim of science to dissolve living beings, which are centers of organization, adaptation, and invention, into the anonymity of the mechanical, physical, and chemical environment must be integral—that is, it must encompass the human living himself. We know well that this project did not appear too audacious to many scientists. But we must then ask, from a philosophical point of view, whether the origin of science does not reveal its meaning better than the claims of certain scientists do. In a humanity to which, from the scientific and even the materialist point of view, innate knowledge is rightly refused, the birth, becoming, and progress of science must be understood as a sort of enterprise as adventurous as life. Otherwise, one would have to admit the absurdity that reality contains the science of

reality beforehand, as a part of itself. And we would then have to wonder to which among the needs of reality this ambition to determine reality scientifically could correspond.

But if science is the work of a humanity rooted in life before being enlightened by knowledge, if science is a fact in the world at the same time as it is a vision of the world, then it maintains a permanent and obligatory relation with perception. And thus the milieu proper to men is not situated within the universal milieu as contents in a container. A center does not resolve into its environment. A living being is not reducible to a crossroads of influences. From this stems the insufficiency of any biology that, in complete submission to the spirit of the physico-chemical sciences, would seek to eliminate all consideration of sense from its domain. From the biological and psychological point of view, a sense is an appreciation of values in relation to a need. And for the one who experiences and lives it, a need is an irreducible, and thereby absolute, system of reference.