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Reinventing the Philosophy of Nature[†]

PHILOSOPHY of nature is not currently considered standard fare in philosophy. Rather than the title of an area of inquiry, it has become the name of an isolated historical phenomenon—the *Naturphilosophie* of Schelling, Goethe, and Hegel, or a label for some school doctrine—the continuing tradition built upon the first books of Aristotle's *Physics* or the newer one rooted in Whitehead's *Process and Reality*. Philosophers do not typically see these systems of thought in terms of a common problematic, certainly not one which is presently viable or important.

We tend to believe that the natural sciences inform us about the natural world in so far as it is possible rationally to do so. And we have the philosophy of science to provide necessary interpretation of the manifold logic of inquiry, the structures of explanation, and the meanings of fundamental concepts within the sciences. Natural science together with philosophical analysis of science, then, yield a self-reflective understanding of nature. There appears to be no need for philosophical attention to nature as such; indeed, we find it difficult to see (or say) how the philosopher, *qua* philosopher, might address nature in any direct or distinctive way.¹

Now I think that we must accept the view that natural science, in its deepest sense, aims to be a philosophical inquiry into the fundamental entities, processes, and structural relations of the natural world. Rightly interpreted, it *is* philosophy of nature. And when philosophers today seek to assess the remarkable implications of basic scientific concepts—in quantum physics, for example, or in molecular biology,

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physiological psychology, or ethology—they simply join their scientific brethren in a common task to call natural science to full self-clarity, internal coherence, and completion *as* natural philosophy.² Yet the question remains whether and how the philosopher might be understood to bring to this common task some special contribution, not only an admittedly special commitment to fundamental, systematic thinking, but some concrete insight into the natural world.

What could this possibly mean? We have long since abandoned the notion that philosophers have special charge of certain sorts of facts; there is no domain of existence without its regnant science or sciences. This is what it means for philosophy of nature to have become quantified, empirical, technical, autonomous. Nor is it any longer plausible that distinctive philosophical work lies in providing specific explanatory hypotheses within the diverse sciences or coordinating the sciences with one another. Theory construction, as well as specialization and unification of theory, take place in the sciences largely in response to their own internal intentionalities. On the other hand, it might be that there is some *nondiscipline-specific*, *prescientific*, primary knowledge of nature which needs continually to be evoked, reassessed, and related to developing specialized knowledge. To engage in this task would constitute a creative philosophical role within, or dimension of, the philosophy of nature. The aim would be to bring forth such background knowledge as the framework for ongoing scientific inquiry and for interpreting its results. I want to reflect on this possibility in what follows, for it seems to me to be basic to what philosophy of nature, from the beginning, has been up to. Distinctively philosophical attention to nature is neither outmoded nor senseless, but its sense is readily buried and forgotten. We do not have to invent the philosophy of nature, but we may, from time to time, have to rediscover or to reinvent it.

The issue is whether there are any conditions on a philosophy of nature which do *not* simply stem from the changing

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content and style of the sciences of nature themselves, and if so how these conditions are to be understood. I believe that there are such conditions, that they are in a broad sense empirical, and that they are normative for interpreting the sciences and, therefore, essential to any philosophy of nature. In order to see this, we need to explore how the natural world, first experienced as surrounding and situating human life, is scientifically mediated.³

I

Independent of any science, at an implicit level which we rarely articulate, human beings find nature as the nonhuman reality in and with which they live and through which they have to find their way. Through perception and action, we are in constant, manifold transactions with nature in this sense. This is what Husserl calls nature as "lived" and Dewey the nature experienced in our "doings and sufferings." Whitehead speaks of our "enjoying" the world in this sense, Heidegger of our understanding it, and Wittgenstein of our "knowing our way about" in it. These characterizations are not identical, but they do converge on an important thesis. Common experience and common speech, as well as the testimony of philosophers, permit us to say that, in some perfectly obvious way, we know what nature is.

But, of course, we both know and do *not* know what nature is. We may know its living contours, but not what it is in detail for specific practical or theoretical purposes. These details are subject to inquiry—across all the craft lore, sciences, and scientifically based technologies, as these develop, within diverse cultural contexts, over extended historical time. In this process, the forms of inquiry themselves have been constituted. What we now call the natural sciences are products of a very particular thread of development from still not well understood beginnings in Greek religion, mathematics, and philosophy. Their style has incorporated the Judeo-

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Christian doctrine of creation, Stoic views of natural law, a Renaissance lust for observation and experiment, and, eventually, the academic and professional organization of the medieval and modern universities. Within such a generic form of inquiry, communities of investigators engaged in concrete programs of research and projecting specific metaphysical, theoretical, and experimental assumptions, evolve through a complex history of cooperation, conflict, and continuous, fundamental reorientation of thought. The implicit intent of this work has been to increase the precision and depth of human intersubjective understanding of prescientific or lived nature.

However, in the process, the face of lived nature has been transformed. The modern natural sciences have become both effective social systems of research and development and far-reaching bodies of tested, if necessarily risky, knowledge. Both of these outcomes have been "world-transforming"—one through a linkage with practical power, and the other through the power of theoretical representation.

Thus, at another level, we are confronted with a knowing and not knowing what nature is. What we do not know in a living, implicit way, we can come to know through inquiry, but through a form of inquiry which transforms the nature with which we begin. The question inevitably arises, how we are to understand this result. Scientific inquiry as we know it is so technical in formulating facts and explanations of facts, so preoriented to serve human interests in prediction and control, so selective and, in the historical-cultural sense, arbitrary in its intellectual style and assumptions, that we must wonder whether, or in what sense, it can provide us with revealing knowledge of nature at all. It becomes difficult to say what we know through the sciences which were to tell us what we did not know of the lived natural world.

This sense of arbitrariness surfaces again and again in reflection on the sciences. It is expressed in various forms of positivism, instrumentalism, and historicism within philosophy of science; in the attitudes of practicing scientists that their work is a "job" to be done which does not, or should not, raise ultimate questions; and in a general public image of science which tends to combine vague misgiving with resigned

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uncomprehension. As Husserl put it in one of his rare moments of humour, the intelligibility of the sciences is about on a par with that of the Egyptian pyramids!⁴ And the issue is not that we cannot easily see what scientists do, or even how they think, but rather that we cannot make out what their reconstruction of the natural world finally means. No doubt the essential incompleteness of science is part of the problem. And no doubt knowledge already at hand is not sufficiently well understood or interpreted. But the issue is precisely how to go about the interpretation. This is an ontological issue; it requires assessment of the ontological significance of natural science; and this requires reexamination of the relationship between our historically developed, theoretical style of scientific knowing and the primary, pretheoretical experience of nature upon which it depends.

II

But *is* there, after all, such a primary, pretheoretical presence of the natural world in human experience? Is it not mute? Or if not, does it not speak through our giving it words? And will these words not express historical-cultural assumptions of their own? And, in fact, will not certain of these assumptions be, broadly speaking "scientific"? These are crucial questions, to which I can only respond in a preliminary way.

There is evidence, I believe, that the natural world appears in human experience in certain distinctively structured ways which are bound up with our living-bodily transactions with it. Such structures of lived nature are expressed, not simply produced, in common speech; they are to a considerable degree historically and culturally invariant and invariant with respect to shifts in explicitly scientific doctrines about the world; and they are available to discovery and to at least heuristically suggestive description. It is a task of

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inquiry to bring forth these structures, an inquiry in which direct experiential self-reflection—the phenomenological moment—is combined with various interpretive human sciences—the anthropological, psychological, and ethological moments—in an effort to reconstruct human and closely related, animal life-worlds. It seems, for example, that Merleau-Ponty's phenomenology of the primordial perceptual world converges with appropriately interpreted findings of Piaget on the structures of perceived reality and sociality which develop in children and that these, in turn, converge with possibilities already present in the life-worlds of higher animals.⁵ The extent and precise significance of these convergences is not clear; inquiry must tell us. Proposed descriptions are frequently distorted by presuppositions, among them scientific presuppositions; the inquiry must aim to reveal them. Nonetheless, it is both intrinsically plausible and increasingly apparent that such exploration can recover certain features of the primary experience of nature.

What might some of these features be? A sketch will have to suffice. What we know of nature independently of science is tacit and emerges in and through our bodily receptivity and activity with things as we seek to satisfy our needs and purposes.

Within this context, in the first place, certain elements of the world—events, processes, things—stand out as structural-functional units from the background of their changing and, in many respects, indeterminate relations to one another and to us. Call these the "objects" of the lived natural world. An event is fixed through its relations to antecedents and consequences; a process continues while certain related matters remain constant; a bodily thing is, just as Aristotle said it was, what endures through, or perhaps what evolves in its own way through, changing perspectives and active

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relations to other things. Certain relations among events, processes, and things, also persist in varying circumstances. And all these constancies are discerned relative to anonymous, almost automatic bodily-perceptual "sets" for, or expectations of, such constancy. Of course, our particular needs or purposes in identifying objects may alter. But this fundamental structure seems to remain: Objects are identified and reidentified as typical unities presented through multiple aspects over time.

In the second place, as is already clear, objects are inseparable from one another, as relational unities, within an indefinitely extensive world-horizon, or field. This is the amorphous field of body spatiality and temporality, of moving and grasping, seeing and seeking, remembering and expecting, which we "inhabit," as Merleau-Ponty put it. And in this field, objects inevitably bear with them a characteristic significance as incompletely determinate and open to further determination, as their extensive relations—internally and externally, to the past, to the future, to other parts of space—are explored and specified.

Yet, third, as this field of interrelated unities-in-multiplicity is explored and specified in daily life, it is encountered as other, as "already there," all along present, "pregiven," in Husserl's words. Objects in the natural world are experienced as independent of our actions, as passive obstacles or active powers transcending us and each other, as "available," to be sure, but also as inexhaustible, opaque, always more than we know and ever surprising us.

Finally, the entire sense of the natural world is to be that world *in* which *we* are—which not only transcends and surprises

us, but which *includes us*. There are two inseparable structures here: The natural world is experienced as *for us*, and we are experienced as *in it*. It is not hard to see that at the margin of each individual's experiencing of things is the unstated, but assumed presence of other experiencers. The distinctive sense of a nonhuman natural world is given by contrast with and for the human community, or at least a potential one. Thus, the concrete unities-in-multiplicity in space and time with which each of us interacts are experienced as open not only to my changing perspectives but to

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ours. And essentially so. To be experienced as an object in the natural world is to be experienced so for an open-ended, possibly surprising and necessarily critical, *intersubjective* life. The natural life-world is an intersubjective life-world.

At the same time, at the margin of each individual's experiencing is his own living, active body—experienced as a part of the surrounding world. Merleau-Ponty points out incisively that this experienced self-inclusion in the world, the experience of embodiment, is an essential element in our experience of the world as not simply for us, but as transcendent, as that in which we are involved, upon which we depend, and to which we are, ultimately, exposed.⁶The natural life-world is experienced as an intersubjective life-world, but it is experienced also, and essentially, as a world which includes and conditions this very intersubjectively experiencing community as a part of itself.

In sum, then, what we may claim to know of nature prescientifically is that it is a field extended in a horizon of space and time, revealing reidentifiable events, relations of events, processes, and things, open to exploration and determination, but always transcending any of its presented aspects, and constituting the referent and inclusive situation of all our embodied, intersubjective praxis.

III

What does such an account achieve? Just this, I think. *If* something like this is true of our prescientific knowledge of nature, and if the natural sciences do reconstruct nature, as thus understood, in certain selective, historically evolving, theoretical and experimental ways, *then* in order to assess the implications of science for a philosophy of nature we must specify the relation of scientific activity to the natural world thus prescientifically known.

At this point, then, I need to make my thesis explicit.

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There are but two fundamental alternatives: Either one supposes that scientific thinking, in some direct, or at least asymptotic way defines nature as it is in itself, as *the world behind the world* we know in primary experience; or one holds that such a supposition is indefensible, unnecessary, and, in the end, senseless, and that *there is but one world*, the lived world, in which scientific activity takes place and to the understanding of which it is historically devoted. Evidently, this is the alternative which I propose to explicate and defend. It is only on such a view, I believe, that the intelligibility of natural science as natural philosophy can be made clear.

Why do I say this? Because it is only on such a view that we can remove the sense of arbitrariness which infects the reconstructive inventiveness of scientific thought. Upon what basis would it be reasonable to consider scientific constructs to have the nature-revealing and penetrating power we typically believe that they have and not merely an instrumental, predictive value? We can do so in so far as these constructs can be shown to have their fundamental meaning in reference to the lived world of nature *already given as existing*. We can exhibit the ontological import of natural science if and, I believe, only if, we can show that *its* praxis is a selective, technical expression of the *prescientific* praxis through which the very notion of ontological import is given its sense.

Now actually carrying this out is a subtle and delicate task touching all the issues of philosophy of science. It requires attending to historical patterns of scientific inquiry, to the communal context of hypothesis and criticism, to the roles of mathematical abstraction, postulational thinking, exploring analogies, performing experiments, and so on. The claim to be made out would be that although natural scientific thinking is carried on in special communities and in response to special demands of a constructive method, it nonetheless recapitulates and refines the forms of prescientific, embodied,

intersubjective experience of the natural world which we earlier described. In ordinary life, depending on our purposes, objects continually emerge from amorphous background experience and return to it in accord with certain structural-functional principles. Perceived regularities are

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registered, analogically extended, and modified. What scientists do, within their "worlds" of research, should be able to be seen to be continuous with ordinary observing, manipulating, typifying, and projecting, within the horizon of the perceived world, in search of more and more coherent unities through the multiple perspectives of perceived objects. And the methodological constraints upon framing theoretical models—that they be simple, coherent, and empirically applicable with increasing precision and scope (i.e., fertile)—should be able to be seen as continuous with the structural-functional constraints implicit in prescientific exploration of objects in lived nature. I cannot fully defend these claims here.⁷ But I want to point to some striking evidence of their truth.

The thesis is that theoretical science is carried on as an exploration of the world of lived nature and that tested theories function to represent perceived objects, to permit us to see them, and their selected aspects, parts, and structures, in new and intellectually perspicuous ways. These new ways of seeing satisfy demands for predictability and regularity already implicit in perception, open up the perceived world for more and more detailed exploration, and enrich the content of perception through suggesting new observational means of access to otherwise hidden entities.⁸ If this is correct, then we should expect that the criteria implicit in scientific judgments of the reality of some new entity, or some new effect or structure, should be closely analogous to the criteria implicit

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in judgments of reality in prescientific perceptual life. This does seem to be the case.

We have good general evidence from methodologists of science such as Michael Polanyi and Karl Popper who, again and again, characterize the experience of the "sting" of reality, within scientific investigation, as a variant of the perceptual experience of a risky expectation being corroborated or falsified, especially in surprising ways.⁹ However, there is more particular evidence as well. Dudley Shapere has studied existence claims actually made by physicists.¹⁰ He found that a physicist was inclined to acknowledge the existence of some new particle, say, in so far as any of the following conditions is shown to hold: The new existent either (1) *interacts* with some other existents; or (2) *manifests a property*, for example, a spin, *hitherto only suspected*; or (3) is *detected and identified through several independent experimental arrangements* and is subject to several different theoretical accounts. It is worth adding that these criteria seem to be at work in physical thinking not only in contexts in which particles, but also other entities, such as forces and fields, are at stake as well.¹¹

Now these criteria are strangely familiar. How do we know that entities so marked off are "real"? Why are these appropriate criteria of existence in physical thinking? Why should we accept them? The answer seems obvious: These

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criteria are present and implicit in the perceptual encounter with things. The essence of the perceived object, as we earlier saw, is precisely (1) that which acts on us and on other objects and on which we act; (2) that inexhaustible source of perspectives or properties which is ever surprising us; and (3) that which remains constant or has a unity through, and transcending, different perspectives—that is, under different transformations. Perceived reality, as we experience it, is always this perspectival unity, that which is more than we see, which has another side, an inside, and further as yet unexpressed capacities, that which interacts with us and with other things. There could be no more conclusive evidence than this to show that the practice of physics presupposes reference to characteristics of the lived natural world. Apart from this reference there would be no adequate warrant for judgments of physical reality.

IV

There is, of course, a formidable objection to this entire view. It is that we expect physics, and the other natural sciences,

not only to enlarge, but to *alter*, sometimes radically alter, our picture of the world. And as they do so, we seem to confront a "strangeness" of theoretically postulated reality which belies the reference to lived nature. In the twentieth century, we have seen physical models radically changed. We confront a mathematical representation of the macrostructure of space-time which seems to defy realization in experience. Similarly, we now confront a representation of the micro-world in which respectable particles, waves, and fields, have given way to quantum mechanical state-functions, the behavior of which is anomalous with respect to lived space and time and with respect to lived causal dependence. Material nature seems to harbor probabilities, causal indeterminacies, space-time discontinuities, instantaneous "actions at a distance," and other oddities.

Do these developments refute the view that the marks of the real are parasitical on the structures of lived nature? I do not think so. For several points demand notice. First, we

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have to take seriously the fact that precisely as these newer theoretical "worlds" stretch the criteria of lived reality, physicists, as well as the rest of us, are led to wonder about the ontological significance of these worlds and to be tempted by instrumentalist interpretations. This tendency reveals the operative force of the criteria. Second, we need to guard against an overly narrow construction of the meaning of these criteria. To say that natural science ultimately refers to lived nature is not at all to say that its theoretical models must be visualizable or imaginable; nor is it to say that these models may not specify discontinuities or indeterminacies, or contain other unusual features. But it is to say that such "world-variations" must have *some* limits and that theoretical models must share *some* structural features with perceived realities if they genuinely are to be taken to specify aspects, parts, or structures of the world. Finally, we should note that it is plausible to maintain that the ontological criteria in lived experience are still satisfied by the new models, albeit in an attenuated form.¹² Quantum mechanical state-functions do specify reidentifiable systems, although these are precisely *not* corpuscles or waves in any classical sense, but are, rather, structured probability distributions or potentialities for the realization of measured properties. These systems of potentiality do interact, among themselves and with our instruments, although in unusual ways. And they do, in certain respects, show lawful predictability over time, in accord with the Schrödinger equation. These are recognizable structural features of lived natural entities.

Now it would be madness for a metaphysician to claim to understand the ontological significance of quantum physics, since the quantum theorists do not. I certainly do not claim this. The issue is precisely in doubt; a whole spectrum of interpretations, from the most subjectivistic to the most realistic, is still espoused by those who know. What I do claim is that the issue *is*, precisely, how to construe the quantum

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world *as* a world, or better, as a refined, micro-analysis of selected features of *the* world. We must hope for new ontological insights from the content of fresh theory, but a "world" for natural science must be, in outline at least, what the world is for prescientific experience; namely, a field with *some* continuity in space and time, in which *some* local unities, however momentary or indeterminate, are identifiable and have, at least in *some* respects, regularly predictable careers and interactions. Without some such features, without an evident relationship between emerging scientific "worlds" and the world of prescientific experience, we simply cannot tell the difference between reality and useful fiction. We may not in fact be able, at certain junctures, to tell this difference. We have learned from Thomas Kuhn that certain moments in the history of a science are critical precisely in the sense that "obvious" ontological presuppositions are in question. At such moments our sense of "reality" may falter. At the same time, it seems to be a continuing presupposition of there being such crises, one not easily given up, that there is some yet-to-be-understood convergence between scientific ontology and the ontology of the prescientific life-world. For this reason, philosophy of nature keeps returning us to critical reflection upon the structures of this prescientific world.¹³

V

What do these considerations now suggest? They suggest that within philosophy of nature there may be a type of dialectic at work. Rather like the Rawlsian notion of an interplay between the intuitive meaning of justice and its

theoretical reconstruction, there is an interplay between intuitively lived nature and our reconstructions of it. We cannot intelligibly give up either one, and we must have their convergence as a regulative ideal. We are motivated to engage in natural science on the basis of, and in order to enlarge, our prescientific, praxical knowledge of nature. As scientific investigation proceeds we are driven to represent natural reality in ever more abstract and selective, but also more precise, comprehensive, and penetrating ways. These theoretical representations open us up to new structures and meanings of the "real." They also require us critically to reexamine descriptions of the original experience of nature with which we began, sometimes to revise them and sometimes to recapture their hitherto unappreciated meaning. In the process our understanding of the criteria of natural reality, implicit in primary experience, itself evolves and becomes more adequate.

The history of science, from this point of view, is not only a history of shifts in fundamental theory, but a history of forced reexamination of the primary experience of nature. Aristotle, for example, believed his physics to be a physics of the world of primary experience. Its fundamental categories are remarkably faithful to the elementary phenomena of constancy and change. However, as we well know, he also took certain features to be essential to the experience of nature which we can now see not to be so. He considered the distinction between the terrestrial and celestial regions to be structural; he took the movement of objects against a resistance, or through a medium, to be definitive of all motion; he saw in all natural systems the telic character which is found, or found most straightforwardly, only in living ones. The seventeenth century revolution in mechanics forced a critique of these doctrines. It demonstrated the power of mathematical analysis to exhibit certain fully general features of physical systems, a power Aristotle had failed adequately to appreciate. And it demanded, in light of this analysis, a reexamination of the structures of primary experience in order to discern the motivating possibilities for the new vision of physical reality.

As the "new mechanics" developed, however, some

thinkers became so enamored of it that they tended to define the primary experience of nature in rigorously mathematical terms. Thus Kant argued that the possibility of physics depends upon pure intuitions of mathematical space and time and upon pure interpretive categories of substance, causation, and reciprocity, which are, at the same time, the necessary conditions for any *experience* of objects whatever. The twentieth century revisions of classical mechanics, to which we earlier referred, required both a critique of this view of physics and a reopening of prescientific experience to more faithful rendering. The result is that we are now able to appreciate the enduring experiential meaning of Kant's insights more adequately. As we have seen, there are certain intersubjective structures of the prescientific experience of nature, but they are more amorphous than Kant thought. And while these structures are arguably fundamental for physics, they are more schematic and flexible in application than would appear from Kant's use of them.

As science develops, we should expect this dialectic to continue and to open up new possibilities for perceived coherence between the "world" of scientific representation and the world of primary experience. Miličević, following Bergson and Whitehead, has argued, in fact, that the new physical picture *more* closely conforms to carefully (and dialectically) purified primary experience than ever. He seeks to show, in particular, how the theory of special relativity articulates the pervasive experience of temporal process, of the fieldlike interrelation of events and the irreversible directionality of change.¹⁴ One might also observe that indeterminacy and statistical determination in quantum theory only confirm, in the physical "world," an indeterminate and amorphous character pervading the world of lived nature. Similarly, Carl von Weizsäcker has argued that increasing evidence for cosmological models of an historical-developmental sort permits us to see new convergence between structures of nature as theoretically known and structures of historicity in human

experience.¹⁵ Developments in systems and information science have suggested further possibilities for convergence between theoretical and experiential analysis, in this instance in regard to the hierarchical structure and goal-directed behavior of living organisms. Naturally, these theses are controverted. I cannot decide the issues; my concern is to interpret their sense. And, as before, they make sense only on the presupposition that primary human experience constitutes knowledge of nature and that this experience, in ways we have yet to grasp, is coherent with, and thus a model for, the best theoretical reconstructions natural science can deliver.

Again, we both know and do not know what nature is. We know its perceived forms, but we do not even know what

these are or mean until scientific findings more fully explicate and, in the process, reinterpret them. This historical dialectic is essential to philosophy of nature. And it shows us the sense in which nature must be considered an "open" concept. Natural science does tell us what the natural world is like; it permits us to transcend momentary personal and cultural perspectives to a remarkable degree; it augments our stock of knowledge in unsuspected ways. We may theoretically view the natural world as it extends indefinitely in time and space, in the small and in the large. But we do so only from a point of view, a scientific point of view, which is rooted for its evidence, for its fundamental rationality, in prescientific knowledge of nature—a knowledge which, in its turn, only becomes fully explicit as science proceeds.

VI

I need now to take a new direction in the argument. I have been trying to formulate and warrant conditions upon philosophy of nature as a form of inquiry. They are found in the inescapable reference of that inquiry to nature as lived,

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and consist in criteria of ontological import which derive from that reference. We could call them *reference conditions*. Lived nature seems to set minimal conditions for something's being recognizable as a part or structure of the natural world. Are there any other such conditions? Is there some further way, as Kant might put it, in which we may anticipate nature? It seems to me that there is and that it is equally fundamental. It too derives from the experience of lived nature, in particular from taking seriously the experienced presence of human reality within nature. One might call it a *coherence condition* for philosophy of nature.

It is a truism that "man is a part of nature." But the meaning of this expression is not, in the first instance, theoretical; rather, it is experiential. The experience of lived nature, we said, is precisely an experience of what surrounds us *as* other, as independent, active, and ever surprising us, as set over against our individual and collective human life. It is also, we said, an experience of this human life *as* situated within the surrounding world, dependent upon and exposed to it through our embodiment. The same bodily organs through which we perceive the natural world are perceived as within it; the same communal history in and through which we encounter the natural world is encountered as within it. The experience of lived nature is, thus, at once an experience of nature *for* human life and of human life as firmly *in* nature. It is this full experience of situatedness, I think, which gives meaning to the thesis that man is a part of nature. However, it is an experience, the meaning of which is, at the same time, unclear. Another example of knowing and not knowing. We know, in the lived sense, and by reflection on it, how we, the humanly experiencing and acting, intersubjective community, are a part of nature; but we do not know, for particular theoretical purposes, what this comes to. It is a task for inquiry to find out. And in the process, this prescientific knowledge of human reality should be expected to be modified and clarified.

As before, however, the open-endedness of inquiry is limited by the experience which gives it meaning. Inquiry, if it is not to invent an arbitrary world, is under constraint to explicate, not to negate, primary experience. The reality of human *experiencing*, of the life that finds itself, in its

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distinctive way, over against but in nature, must be expressed in any valid theoretical reconstruction. So we might formulate it as a condition on the philosophy of nature, and thereby for the sciences of nature, that no view of nature will be counted adequate which does not permit coherent inclusion of human reality, *as* it experiences itself, within nature.

Now this condition is in no way new or unusual. It has been evident since the earliest philosophy. Nature harbors, in man, a distinctive power of thinking and acting, a distinctive kind of history and social life, a distinctive way of being. The natural world has men in it, not just as it has molecules, but as world-experiencers, world-interpreters, world-makers. It has long been of the essence to try to make sense of this.

The first point to observe, again, is that this requirement is not a speculative one; it stems from responsiveness to primary experience. Moreover, if this coherence condition is correct, if it is as well experientially motivated as it seems to be, then one persistently recurring way of making sense of man in nature is ruled out. This is the way of physical reduction, when this is taken, finally, to eliminate human living and the human life-world *from* nature. Of course, this is never done

simpliciter; instead, human reality is redefined. Prescientific understanding of human reality, as we said, requires to be revised and clarified in interplay with developing natural science. However, there is a limit to this revisability—a point at which human reality becomes no longer recognizable, or, in the hands of certain beautifully scrupulous spirits, a point at which human reality remains recognizable, but is, in effect, exiled from scientifically described nature. This latter point, in its self-conscious *incoherence*, is dramatized in Wilfrid Sellars's "Philosophy and the Scientific Image of Man." In the last paragraph, he writes,

A person can almost be defined as a being that has intentions. Thus, the conceptual framework of persons is not something that needs to be *reconciled with* the scientific image, but rather something to be *joined* to it. Thus, to complete the scientific image we need to enrich it *not* with more ways of saying what is the case, but with the language of community and individual intentions, so that by construing the actions we intend to do and the circumstances in which we intend to do them in scientific terms, we *directly* relate the world as conceived by

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scientific theory to our purposes, and make it *our* world and no longer an alien appendage to the world in which we do our living.¹⁶

There is, to be sure, a profound truth here. By activity in the world, by using theoretical knowledge in carrying out our purposes, we do make the scientific "world" *our own* in an important sense. We make nature our own in various modes of praxis, among which is scientific activity itself. This is important enough for Fichte and Marx to have built their entire philosophies of nature around it. Yet it does not at all follow that we must, or even that we may, intelligibly, rest content with this. We are simply to "join" the two worlds; we are to refuse to *think* the unity of the scientific image with our living and with the world in which we do our living. We are not to recognize that the object of scientific investigation, the natural world, precisely includes the individual and communal intentional life of those who investigate and who use the results of the investigation. This is not inconsistent, but it is incoherent.¹⁷

There is no doubt that physical reduction constitutes a powerful intentionality within natural science. When Charles Gillispie, as a historian of science, seeks to express the meaning of that history, he calls it *The Edge of Objectivity*, in which "objectivity" is consistently supposed to entail the effort to reconstruct nature without reference to the presence of the effects of human or any other experiencing life.¹⁸ This is the story of the scientific revolution in biology, both evolutionary and molecular, in medicine, and also, in beginning ways, in psychology. It is a story with remarkable

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successes which demand to be taken seriously. But objectivity only requires procedures for achieving intersubjective validity, it does not entail eliminative reduction. It is important to see that this reductive strategy must ultimately fail because it conflicts with the way we experience ourselves as transcending nature and situated by it, the very experience which makes all science possible in the first place.

VII

But all this has been pointed out again and again. The interesting question is where adherence to the coherence condition might lead scientific inquiry. At the risk of overusing the term, I believe it leads to another dialectic. Ernan McMullin has termed it the "dialectics of reduction."¹⁹ And I believe this is correct in perhaps a wider sense than he intended.

The task of natural science, we have said, is to represent the parts and structures of lived natural entities in an experimentally and theoretically perspicuous fashion, which means, as nearly as possible, in a unified theory of what there is and how it is in nature, *including*, as we now see, all levels of complexity, of evolutionary development, of subjectivity and historicity. Natural science must, as Whitehead put it, seek simplicity and mistrust it. As philosophers of nature, we must affirm this search because it is rooted in primary experience—in the experience of continuity, of interdependence, and ultimately, of the spatiotemporal inclusiveness of lived nature. However, the history of science already shows that reductive efforts frequently lead not to reductions, but to transformations and enrichments of fundamental theory. Theories

of restricted scope do not remain untouched when used to explain new phenomena. As Bohr adapted atomic theory to explain spectroscopic effects, the entire theory of atomic structure was altered. As chemists explore complex substances, new dispositional properties of the physical

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constituents, properties which permit them to form those complexes, are discovered and integrated within physical chemistry. And it is arguable, at least, that the celebrated "reduction" of classical genetics to molecular genetics is simply a research program which, as it is pursued, is enriching and will alter the theoretical content of biochemistry through extension to the phenomena of reproduction, growth and development, and hierarchical structure.²⁰ We do not know how this search will eventuate. There is little likelihood that the result would be very simple. Levels or regions will surely remain.²¹ No one knows what even a unified physics would look like; we have even less notion of what it might mean fully to incorporate chemical, biological, and human phenomena within it. No doubt any "fundamental physics" which would permit us to understand organic and human behavior would be filled with dispositional terms of which we know nothing. The dialectical "feedback" to fundamental concepts would be likely to be very great. But no evidence suggests, and primary experience refutes, absolute barriers in the way of integral theoretical understanding.

On the other hand, precisely by meditating the inclusion of human reality within nature, we open up another possibility; namely, that what is characteristic of embodied, intersubjective, world-related human life, is not an aberration, but is structurally analogous to what is found in other regions of the natural world. What is suggested, from this perspective, is a continuity of structures, each level or region constituted by centers of activity which define a way of being together as a world, coordinated on a scale, from the physical through the human, of increasing complexity, inwardness, and recognizably social—that is, internal—relations. Nature would thus be construed as a hierarchy of "forms of life-world."

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This possibility has motivated Whitehead and other speculative thinkers, and its heuristic value for the sciences seems considerable as new integrations of fundamental theory are explored. At the level of human behavior, it is evident that there is an explanatory role for personal and cultural life-worlds; language and culture, as well as more particular institutional settings, define the terms in which bodily needs and capacities come to expression in human actions.²² At the various levels of evolutionary development, distinctive life-worlds for each species seem obvious, and the essential role of social organization, habitat, territoriality, and the like, is especially striking in higher animals.²³ We might see elementary biological systems as defining a distinctive level of organization in virtue of information coding and control, internal to each genotype, which establishes, with respect to each, a form of life and a necessary environment.²⁴ And at the limit, we might see evidence, in quantum field theory, of a very distinctive structural level at which fluctuating fields, spread throughout space, interact among themselves, and constitute the range of potentialities for actualization and transformation of the various types of elementary particle, thus perhaps defining a world of activity in more than a merely metaphorical sense.²⁵

The force of what I have called the coherence condition is that explanations such as these would properly be considered as the dialectic of inquiry develops. Beyond this, it reminds us that, as persons who live nature intimately at a certain level, we could, in a reflective and empathetic way, in some measure, enlarge the world we live to include responsiveness to life-world structures at other levels.

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VIII

Let me close these reflections with an afterthought. It seems clear that the motivating problem for philosophy of nature, and, *a fortiori* for the sciences of nature, has always been an existential one, although it has been experienced differently at different times.²⁶ This problem derives simply from the human situation in the world, our presence in and for a world which solicits, encompasses, and threatens us. We are exposed to what is "Other." And it becomes important, as far as

possible, to explore and interpret that Other and thus, at least symbolically—better yet empirically and practically—to domesticate it, to order, predict, and use it. Or, in equivalent terms, it becomes important, as far as possible, to discover how far that Other admits of being interpreted, ordered, and used. The answer is, "Very far indeed." Agriculture and craft, religious story and ritual, mathematics, and natural philosophy are among the expressions of these interests.²⁷

Greek philosophy of nature was characteristically "objectivist" in the way it took the results of its speculative, theoretical efforts. That is, the surrounding world of nature, for them, *is* a cosmos; it is experienced as embodying in itself certain norms of unity, fitting arrangement, mathematical proportion, and temporal regularity. From Anaximander to Aristotle, and through the Roman schools as well, the world is thus a meaning-filled world, a world which is either intrinsically telic or, if not, as with the atomists, still intrinsically lawful, possessing in itself an order, even if incomplete—a fitting of part with part, event with event, an internal necessity which is, ultimately, what its "nature" is. For them all, Aristotle's definition of the natural applies: it is some principle of movement and change internal to a thing. "Nature" is thus a normative concept; to say that something is natural is

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to say that it follows some norm intrinsic to it. And, in this sense, as R.G. Collingwood points out, all the ancient philosophers of nature found nature to be alive.²⁸ As I might now put it, following the preceding reflections, nature was taken not only experientially, but intrinsically, to be a life-world. Within such a nature, human reality quite naturally fits "as a part" and the entire ethic of living in harmony with nature meant to recover human meaning from norms intrinsic to nature, to which, as parts of nature, human reality is necessarily subject.

This view of nature was destroyed in what we call the scientific revolution. At this time, the Greek *physis* becomes the modern *physical*. Thanks to the incisive Galilean and Cartesian critiques, nature becomes viewed as an idealized space-time continuum, filled later, by Newton, with inert material bulk, and radically cut off from all forms of human experience, save for mathematical representation. Even this intuitive access, through mathematics, to the natural in itself is then taken away by the Humean and Kantian critiques, which leave nature as wholly other, an in-itself, open directly only to God and to varied, explicitly subjective, human theoretical interpretations and practical uses. Nature as *physis* was an intrinsically meaningful whole within which man could find himself as an intelligible part; not so the newer physical world. Neither scientific knowing, practical life, nor philosophical self-reflection could be intelligible in these terms.

This situation was the motivation for Kant's own heuristic natural theology and, later, for *Naturphilosophie* in the strict sense. Schelling and Hegel were immensely suggestive for nineteenth century science. What they seem to have done, however, was to try to return to Greek objectivist thought. They postulated an absolute world-life, essentially the Divine life, in physical nature, exhibited more fully and completely in living things, and flowering in man. In doing so, they treated as an accomplished, cosmological fact what was only a regulative ideal—what I called the "coherence

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condition"—for an ongoing inquiry. On the other hand, what philosophy of nature properly does, as I see it, is to pursue their goal of a fully self-reflective knowledge of nature with a clearer, more critical awareness that meaning in nature is experientially present in and through the human life-world; that experience, not speculative thought, is the source of ontological understanding. Nature forms a meaningful whole not because this meaning is absolutely realized in nature itself apart from human engagement and inquiry, nor because this meaning is humanly imposed. Nature is the intrinsically meaningful whole that it is just *as* the world with and in which humans experience themselves to be engaged and into which they inquire. Nature simply in itself is a "world well lost." There is but one nature, the nature we live. As a regulative ideal, philosophy of nature, in the inclusive sense I take it to have, aims to exhibit and interpret that nature as it is in itself for us.

Moreover, this is its continuing existential value. The Greeks were surely right that we human beings are inauthentic, not fully ourselves, if we are not, in some ultimate sense, in harmony with nature. Through the environmental crisis, we have become painfully aware of the danger in attitudes of exploitation and domination reinforced by a philosophy which divests nature of meaning entirely. Although we cannot go back to Greek cosmological views on their own terms, a view which rediscovers our embodied life with nature and which interprets natural science as a way of representing lived nature, is one which opens us up to the natural world. Such a philosophy recognizes human powers, but sees them within natural limits. It enables us to extend our experience of embodiment, our common destiny with nature, as far as scientific

inquiry and imagination permit, and thus to promote authentic human life.

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Footnotes

† The Presidential Address, delivered at the Twenty-ninth Annual Meeting of the Metaphysical Society of America, Manhattanville College, March 16, 1979. ¹ Ernan McMullin analyzes the range of historical and current approaches in his "Philosophies of Nature," *New Scholasticism*, 43 (Winter 1969): 29-74. ² This is the spirit, for example, of Ivor LeClerc's "The Necessity Today of the Philosophy of Nature," *Process Studies* 3 (Fall 1973): 158-68. Also see his *The Nature of Physical Existence* (New York: Humanities Press, 1972). ³ In doing so, my special debt to Husserl's *Crisis*, Merleau-Ponty's *Phenomenology of Perception*, and Dewey's *Experience and Nature* will soon become evident. ⁴ Edmund Husserl, "The Vienna Lecture," in his *Crisis of European Sciences and Transcendental Phenomenology*, tr. David Carr (Evanston: Northwestern University Press, 1970), p. 295. ⁵ Maurice Merleau-Ponty, *Phenomenology of Perception*, tr. Colin Smith (New York: Humanities Press, 1962), and *The Primacy of Perception*, ed. James M. Edie (Evanston: Northwestern University Press), chaps. 2-4; Jean Piaget, *The Construction of Reality in the Child*, tr. Margaret Cook (New York: Basic Books, 1954); Mary Midgley, *Beast and Man: The Roots of Human Nature* (Ithaca: Cornell University Press, 1978). ⁶ Maurice Merleau-Ponty, *The Visible and the Invisible*, tr. Alphonso Lingis (Evanston: Northwestern University Press, 1968), esp. chap. 5. ⁷ For a somewhat fuller account, see my "Natural Science and the Experience of Nature" in James Edie, ed., *Phenomenology in America* (Chicago: Quadrangle Press, 1967), chap. 4, and "Understanding Science," *Dialectica* (1963): 155-76. Also see the closely related analyses drawing on the hermeneutic tradition in Patrick Heelan, "Hermeneutics of Experimental Science in the Context of the Life-World," *Philosophia Mathematica* 9 (1972): 101-44, and Theodore Kisiel, "Scientific Discovery: Logical, Psychological, or Hermeneutical?" in David Carr and Edward Casey, eds., *Explorations in Phenomenology* (The Hague: Nijhoff, 1973), pp. 263-84. ⁸ It is worth noting that this represents a significant departure from the Husserlian view according to which scientific inquiry essentially directs attention away from the life-world and impoverishes it. On the scientific enrichment of the life-world, see Patrick Heelan, "Nature and its Transformations," *Theological Studies* 33 (1972): 486-502. ⁹ Michael Polanyi, *The Tacit Dimension* (Garden City: Doubleday, 1966), pp. 23-24; Karl Popper, "Three Views Concerning Human Knowledge," in his *Conjectures and Refutations* (New York: Basic Books, 1962), pp. 114-19. ¹⁰ Dudley Shapere, "Notes Toward a Post-Positivistic Interpretation of Science," in Peter Achinstein and Stephen Barker, eds., *The Legacy of Logical Positivism* (Baltimore: Johns Hopkins Press, 1969), pp. 138-39. ¹¹ Faraday, for example, concluded that magnetic lines of force had a "physical character," not merely a formal one, on grounds that they seem, like lines of electrical induction, to be affected by the intervening medium (i.e., they are curved) and they act to induce an electric current in moving wires. He withheld physical reality from the gravitational field on grounds that it manifested no detectable properties (specifically no transmission time or effects from the intervening medium) other than those for which it was first introduced. See Mary Hesse, *Forces and Fields* (Totowa, New Jersey: Littlefield, Adams, and Co., 1965), esp. pp. 195-212. ¹² This is the argument of Henry Margenau's *The Nature of Physical Reality* (New York: McGraw Hill, 1950), chaps. 17-18. Also see Karl Popper, "Quantum Mechanics Without 'The Observer'" in *Quantum Theory and Reality*, ed. Mario Bunge (Berlin: Springer Verlag, 1967), pp. 7-44. ¹³ Kuhn also holds that no clear direction is to be discerned in the historical development of ontology within physics. This may be correct and yet beside the present point. What is at stake is the ontological value of physical theory as such and that is not to be determined by the internal history of physics alone, but rather by continuing exploration of the intersection of that internal development with the prescientific experience of nature. See Thomas Kuhn's *The Structure of Scientific Revolutions*, 2d ed. (Chicago: University of Chicago Press, 1970), chaps. 9, 13, and the postscript, pp. 206-207. ¹⁴ Milic Capek, *The Philosophical Impact of Contemporary Physics* (Princeton: Van Nostrand, 1961); and *Bergson and Modern Physics* (Dordrecht: Reidel, 1971). ¹⁵ Carl F. von Weizsäcker, *The History of Nature* (Chicago: University of Chicago Press, 1949); and *Die Einheit der Natur* (Munich: Hanser, 1971). ¹⁶ Wilfrid Sellars, *Science, Perception, and Reality* (London: Routledge and Kegan Paul, 1963), p. 40. ¹⁷ This is not at all

to say that, for Sellars, there is no incorporation of human reality within the scientific image. There is. Human reality, in many respects, with the possible exception of the sensuous manifold, is open to scientific explanation. But the communal, intentional life of persons, in the world in which they do their living, is not part of scientifically known nature. It is thought to define, a la Kant, a distinct framework, the framework of human action and practical reason. ¹⁸ Charles C. Gillispie, *The Edge of Objectivity* (Princeton: Princeton University Press, 1960). ¹⁹ Ernan McMullin, "The Dialectics of Reduction," *Idealistic Studies* 2 (1972): 95-115. ²⁰ David Hull, *Philosophy of Biological Science* (Englewood Cliffs: Prentice-Hall, 1974), chap. 1. ²¹ They may very well turn out to be derivable within some comprehensive theory. See William Wimsatt, "Reductionism, Levels of Organization, and the Mind-Body Problem," in *Brain and Consciousness*, ed. G. Globus, G. Maxwell, and I. Savodnik (New York: Plenum, 1976); also see Howard H. Pattee, ed., *Hierarchy Theory* (New York: Braziller, 1973). ²² See for example, Rom Harré and Paul Secord, *The Explanation of Social Behavior* (Totowa, New Jersey: Littlefield, Adams, and Co., 1973). Also see my "Human Action, Human Science, and Human Nature," in *Tulane Studies in Philosophy* (1979), forthcoming. ²³ Midgley, *Beast and Man*. ²⁴ Marjorie Grene, *The Understanding of Nature* (Dordrecht: D. Reidel, 1974), esp. chaps. 3 and 4. ²⁵ Freeman J. Dyson, "Field Theory," *Scientific American*, April 1953, pp. 3-7. ²⁶ See Karl Löwith, *Nature, History, and Existentialism*, ed. Arnold Levinson (Evanston: Northwestern University Press, 1966), chap. 2. ²⁷ Jürgen Habermas, in *Knowledge and Human Interests*, tr. Jeremy J. Shapiro (Boston: Beacon Press, 1971), esp. the appendix, has been suggestive for what follows. ²⁸ R.G. Collingwood, *The Idea of Nature* (Oxford: Clarendon Press, 1945), introduction and part 1.