

### 13. HEIDEGGER'S HERMENEUTICAL GROUNDING OF SCIENCE: A PHENOMENOLOGICAL CRITIQUE OF POSITIVISM

FREDERIC L. BENDER

UNIVERSITY OF COLORADO AT COLORADO SPRINGS

**ABSTRACT.** It is argued that, despite the neglect which Heidegger's writings on science have generally received, the "fundamental ontology" of *Being and Time* reveals certain structures of experience crucial for our understanding of science; and that, as these insights cast considerable doubt upon the validity of the empiricist/positivist conception of science, Heidegger deserves considerably better treatment as an incipient philosopher of science than has been the case thus far. His arguments for the distortive effects of the alleged "change over" from *praxis* to *theoria*, for the circularity of all human understanding (including scientific understanding), for the necessity of interpreting scientific method in terms of the hermeneutic circle, and for viewing scientific "crises" in ontological terms, are examined and evaluated. The article concludes with some reflections on the later Heidegger's views on the limits of his earlier idea of science.

#### INTRODUCTION:

#### PHENOMENOLOGICAL AND POSITIVISTIC CONCEPTIONS OF SCIENCE

One of the chief goals of the phenomenological movement has been to develop a decisive refutation of the positivistic conception of scientific knowledge. According to this view--and the reader should note that I am using the terms "positivism" and "positivistic" to denote a philosophical current going back to Bacon, Hume, Comte, Spencer and Mach, as well as to its more recent incarnation in the early Wittgenstein, the Vienna Circle and other twentieth-century thinkers whom they have influenced--properly scientific knowledge must be modelled upon the methodology established already in seventeenth century mathematical physics, construed either phenomenally or materialistically. It is alleged that it is due to its unique method that science provides the only valid knowledge there is. Consequently, this method must be analyzed, understood and applied if knowledge is finally to free itself from anthropomorphism and the allegedly meaningless speculations of metaphysics. Philosophy, too, must itself either adopt this method or lose all

cognitive significance. On the condition that it purge itself of any references to forces or entities beyond observable facts or scientific laws, such a philosophy has the legitimate task of ascertaining the general principles common to all the sciences, the "logical analysis" of scientific language, and the "semantic analysis" of the meaning of scientific terms and concepts.

Positivist thought assumes a methodological unity common to all properly scientific knowledge, regardless of object domain. Whatever differences might happen to exist among sciences would reflect only their relative stages of development rather than any inherent differences in their presuppositions or methodologies. In the logical empiricist version of the positivist creed, the presumption is that all sciences will someday be modelled upon mathematical physics, that eventually all knowledge will reduce to that of the physical sciences, and that all scientific statements will reduce to physical statements.<sup>1</sup> In other words, for logical empiricism, what is decisive for a discipline's becoming a science is its acceptance of the principle of the empirical verifiability of its statements. Philosophy, on the other hand, must confine itself to the task of being the "underlaborer" of science.

Despite its pretended objectivism, logical empiricism, in its dominant phenomenalist mode, regards the question of whether things exist objectively as absurd; it reduces factual claims to phenomenal ones: all that can be said is that I see the red color, not the rose. Facts are taken to mean not objective things, events or phenomena, but sensations, perceptions and other phenomena of our consciousness. Thus, it is held that factual statements are reducible to self-evident "protocol statements" of the form "Here now an experience of red" or to the latter's allegedly equivalent, empirically testable, physicalistic reformulation: "This body Carnap is in a state of red-seeing." The so-called principle of verifiability and its derivatives (confirmability, testability) are, of course, reformulations of the key concept of the supposedly universal scientific method elaborated in seventeenth century physics by Descartes and Newton, although in phenomenalist distorted forms.

The phenomenological school, on the other hand, holds that the naturalistic methodology of the sciences arises from a distorting process of abstraction introduced subsequent to our pre-reflective experience in the life-world (Husserl) or, alternatively put, from our pre-thematic being-in-the-world as *praxis* (Heidegger) or as perception (Merleau-Ponty), such that the sciences can secure their claims to certitude only once they have been grounded upon, and if necessary revised in accordance with, an ontologically or epistemologically prior phenomenological interpretation of such pre-reflective, pre-thematic being-in-the-world. From this perspective, natural science can be said to yield certitude only relative to its chosen abstract standpoint; its claims are valid only to the extent that this abstraction from pre-reflective experience is kept in view. On the other hand, the most fundamental truths, from the phenomenological perspective, are those which can be disclosed only by a foundational "science" based upon a method quite different from scientific method: phenomenology (Husserl, Merleau-Ponty) or phenomenological "fundamental ontology" (Heidegger), which undertakes to describe the ontological and/or epistemological conditions for the possibility of human being-in-the-world in general, from which all interpretation, including scientific interpretation, can be shown to be derived. Further, Heidegger and later representatives of philosophical hermeneutics such

as Ricoeur and Gadamer, maintain that there is an inescapably circular structure underlying all possible forms of human understanding, such that truth in any domain, including natural science, cannot be merely a matter of the subsumption of particular facts or events under causal laws.

Indeed, phenomenological hermeneutics, like post-positivist philosophy of science (Kuhn, Feyerabend, Bhaskar), suggests that there are no "facts" independent of interpretation. If these and related claims can be substantiated, our understanding of the epistemological foundations and ontological limits of natural science would be altered substantially from that given in empiricist or positivistic philosophy of science. It is the purpose of this article to advance the awareness of this question by examining in detail Heidegger's rather neglected contribution to our understanding of science in his first major work, *Being and Time*. Although Heidegger returns to the theme of science (and technology) in later works, such as *What is a Thing?* and works subsequent to his "reversal" including "The Age of the World Picture," "The Question Concerning Technology," "Science and Reflection," *What Is Called Thinking?* and *Releasement (Gelassenheit)*, it is *Being and Time's* hermeneutic phenomenological conception of science which will be examined here. I shall show that Heidegger's way of viewing science rests upon two key elements of the "existential analytic" of Dasein. Part I examines the alleged "change-over" of Dasein's mode of being-in-the-world from *praxis* to *theoria*, through which the being of entities encountered within-the-world "changes over" from "readiness-to-hand" to "presence-at-hand." Part II examines Heidegger's claim that all human understanding, including scientific cognition, possesses a "circular" structure. Part III examines how, *contra* positivism, scientific method shares in this circularity and how this defines its cognitive limits and the distinction between the natural and human sciences. Part IV elaborates the relation between scientific circularity, crises, and the ontological presuppositions of science at any given time. Finally, Part V explores the view of science found in Heidegger's writings subsequent to *Being and Time*, illustrating the continuity of Heidegger's conception of science throughout his writings.

It is interesting to note that recent work on Heidegger's conception of science largely has ignored *Being and Time* and has focussed instead upon his later essays; it would appear that the "philosophy of science" elaborated in *Being and Time* has been discussed in detail only by Kockelmans<sup>2</sup> and Seigfried.<sup>3</sup> The latter has, I believe, convincingly made the point that *Being and Time* is in a very fundamental way "about" science. Despite decades of "existentialist" readings of *Being and Time*, and, of course, its more properly "ontological" interpretation in light of Heidegger's subsequent "reversal," in Siegfried's view,

*Being and Time* is meant to be read as a treatise in the philosophy of science proper. For, . . . the elaboration of the being question aims at ascertaining "the a priori conditions of the possibility of the sciences" by explaining the possibility of the correlative ontologies, which, in turn, explain the possibility of the various positive sciences by analyzing and justifying the various systems of categories used as proximal clues in the observation and explanation of the various areas of scientific research.<sup>4</sup>

Heidegger's project of establishing science's *a priori* existential-ontological foundations is, indeed, one of the key motifs of *Being and Time*. Needless to say, it differs in principle from the positivist attempt to establish science's logical-mathematical foundations. Unfortunately, Seigfried's discussion of *Being and Time* as a treatise in the philosophy of science proper does not demonstrate in the necessary detail how the existential analytic undermines the positivist conception of science. In offering some interesting "introductory reflections" recapitulating Heidegger's view of science, Kockelmans sets the stage for their more detailed consideration. The present article, then, seeks to lay out in the appropriate detail those *a priori* existential-ontological foundations of science suggested by Heidegger in *Being and Time* and to show that Heidegger's conception of the role of "basic concepts" and scientific "crises" anticipates in detail the highly influential work of Kuhn and other recent post-positivist philosophers of science. Although I shall discuss Heidegger's later contributions to the understanding of science only tangentially, as these have already been examined by numerous commentators,<sup>5</sup> nonetheless, in my concluding section I shall discuss the validity of Heidegger's existential conception of science in light of his "reversal" and abandonment of the initial project of *Being and Time*.

## I. THE "CHANGE-OVER" FROM PRAXIS TO THEORIA AS THE EXISTENTIAL-ONTOLOGICAL BASIS OF SCIENCE:

### I. A. Praxis: How Dasein is Most Primordially in the World:

In the face of the highly impressive triumph of scientific method and its positivistic interpretation, Heidegger attempts to show that the scientific conception of the world is derived from a failure to understand properly the way Dasein most primordially exists. Heidegger's conception of the world as an *existential* attempts to articulate the world as experienced prior to any cognitive separation of self and world. In this way, Dasein's "world" is seen to be the ultimate meaning-context within which Dasein dwells and projects possibilities, prior to all conceptualizing, thus prior to any awareness of subject and object or their relations. The "world" in this sense is not the sum of entities; rather, entities are always encountered *within* the world because the "world" is always already presupposed in any of Dasein's possible experiences. In this light, theoretical cognition, including scientific knowledge, will be seen to have been derived from an ontology which seems correct only to the extent that Dasein has lost awareness of its own immediate (pre-conceptual) being-in-the-world.

In ordinary language, "being-in" signifies a relation in which one entity is contained by another, such as the way water is contained within a glass or garments are contained within a closet. But, for Heidegger, we have to think of Dasein's "being-in" the world in a fundamentally different way, for the way Dasein is "in" the world is not the same sort of way one corporeal Thing is contained within another. According to Heidegger, the existential "in" connotes "to reside" or "inhabit", where *habitare* connotes "to dwell", signifying Dasein's *familiarity with* or *being-accustomed* to the world.<sup>6</sup> This existential "residing in" or "being familiar with" the world is unique to Dasein, in contrast to the way Things present-at-hand may be contained "within" or located

"alongside" one another. We would never say that water "resides in" or "is familiar with" the glass in which it is contained. This description of existential "being-in" does not deny that Dasein also has a "being-in-space" ("spatiality"); it does, however, suggest that Dasein's spatiality is not identical to the relative positioning of things present-at-hand within uniform mathematical space. Indeed, Heidegger argues at some length that the concept of a uniform mathematical spatial manifold is an impoverishment or levelling of Dasein's existential spatiality, with its meaningful "regions" and particular "places" to which entities ready-to-hand are assigned. For example, that the hammer's "place" is in the workshop rather than in the bedroom--and that this is part of the way Dasein experiences entities spatially--derives from such "regioning." Existentially considered, space is not uniformly quantitative but possesses such regions within which we encounter entities in their readiness-to-hand for praxis.

Further, Dasein's "being in" the world is not merely a matter of standing side-by-side other entities in a world conceived as the sum total of entities present-at-hand. Such a notion of standing side-by-side points rather to a non-practical, inactive "relation" between Dasein and entities present-at-hand, a "staring at them" (*theoria*) quite distinct from Dasein's "active" way of being-absorbed-in-the-world in practical activity ("concernful dealings" with entities). Indeed, Dasein is uniquely that kind of being capable of "encountering" other entities. Thus, we cannot accurately say: "The chair touches the wall," because only Dasein, strictly speaking, can touch, and thereby encounter, explore and respond to, something like a wall. Unlike Dasein, the chair is just locatable adjacent to the wall in mathematical space; it does not, and cannot, touch it.<sup>7</sup>

Now according to Heidegger, it is only because there is something like a "world" in which Dasein dwells and with which Dasein is a priori familiar, that Dasein can encounter entities within the world, e.g., can touch the wall. The "worldhood" of the world is an a priori structure of Dasein, that context of projectible meaning out of which entities can manifest themselves as encounterable for praxis, such that entities within-the-world may become accessible in their readiness-to-hand.<sup>8</sup>

At one point, Heidegger lists a number of modes of Dasein's practical being-in-the-world: having to do with something, producing something, attending to something and looking after it, making sure of something, giving something up and letting it go, undertaking, accomplishing, evincing, interrogating, considering, discussing, determining, etc. All these modes of praxis are characterized as having "concern" (*Besorgen*) as their kind of being.<sup>9</sup> Other modes of being-in, such as leaving something undone, neglecting something, renouncing something, taking a rest, etc., are accordingly seen as deficient modes of such concern. The *existential* "concern" refers to that structure or matrix of possibility which all the various modes of being-in (affirmative as well as deficient) exemplify. As Heidegger's translators, Macquarrie and Robinson, point out, in Heidegger's view, "*Besorgen* stands . . . for the kind of 'concern' in which we 'concern ourselves' with activities which we perform or things which we procure."<sup>10</sup> Only because concern is one of Dasein's basic *existentialia* can it be the case that Dasein happens to be to a large extent "practical." Heidegger argues that for the most part cognition is a deficient type of concern, involving the cessation of practical dealings with entities within the world, except when cognition is itself a

practical activity, as in exploration, investigation of a crime, or, with certain reservations, scientific research.

Although it is somewhat tangential to our main concern here, which is the issue of the grounding of science in *praxis*, it is worth noting that Heidegger's conception of *praxis* is not entirely unproblematic. For example *Being and Time* lacks any discussion of technological *praxis*, although after his "reversal" Heidegger argues that technological *praxis* is radically different from the everyday *praxis* described in *Being and Time*: "machine technology is itself an autonomous transformation of *praxis*, a type of transformation wherein *praxis* first demands the employment of mathematical physical science."<sup>11</sup> *Being and Time* also omits any reference to social *praxis*, such as, for example, economic production or political action. Hence his use of the concept of *praxis* is asocial and unrelated to his description (itself hardly unproblematic) of certain structures of sociality (*Mitsein*). Rather, *praxis* is described in *Being and Time* solely in the mode of individual, asocial work, of which Heidegger's favorite example seems to be that of hammering a nail into a wall. Heidegger leaves us totally in the dark as to just who is hammering the nail into the wall, under what conditions of economic ownership and class domination the *praxis* occurs, and the like.<sup>12</sup>

Nonetheless, it is possible to argue that the existential analytic is not in principle incompatible with a rethematizing of *praxis* in these (and related) terms—but that Heidegger was motivated by other concerns, i.e., answering the question of the meaning of Being, and thus had no need to discuss *praxis* in terms of the *existentialia* of historicity and sociality. Be that as it may, Heidegger must be read as having elucidated only a rather undeveloped concept of *praxis*, one that, incidentally, takes as its paradigm case a kind of craft production (if that is what Heidegger's "hammering" is supposed to imply) that surely was historically obsolete even in 1927. His conception of *Mitsein* ignores class structuration and conflict and the fact that the equipmental significance of entities is essentially permeated with such class dynamics. As Marx has noted:

In production, men enter into relation not only with nature. They produce only by co-operating in a certain way and mutually exchanging their activities. In order to produce, they enter into definite connections and relations with one another and *only within these social connections and relations* does their relation with nature, *does production take place*.<sup>13</sup>

In short, no serious philosophy of *praxis* can ignore the work of Hegel and Marx.<sup>14</sup>

#### I.B. THEORIA: A DEFICIENT MODE OF DASEIN'S BEING-IN-THE-WORLD:

In contrast to the practical conception of Dasein's being-in-the-world elaborated by Heidegger, the ordinary common sense conception of man's relation to the world takes knowing-the-world as most primordial. Such knowing, of course, is presupposed, and rendered rigorous, by scientific method. In science, and in that classical modern philosophy which it decisively influenced, knowing-the-world and knowing-how-to-discuss-it are taken to be the primordial ways human beings are in the

world. "Man" gets defined as the "subject" of cognition and practical being-in-the-world does not even get conceived, let alone described in its primordiality.<sup>15</sup> Instead, the epistemological (and ontological) "subject-object distinction" gets promulgated dogmatically as the supposedly primordial relation of Dasein and world. But the cognitive relation of subject and object does not coincide with that of Dasein and world, for, as Heidegger's phenomenological description of being-in has shown, the world is both the *a priori* projected, ultimate horizon of meanings for Dasein and that towards which Dasein is engaged primordially through *praxis*, rather than an "object" to be perceived or "known". "Knowing" the world occurs because *praxis* is guided not by thematic cognition but by what Heidegger terms "circumspective concern" (*Umsicht*), from which, subsequently, the various forms of thematic cognition may arise through abstraction.

Cognition starts from a pre-phenomenological awareness of being-in-the-world, but typically this is interpreted uncritically by common sense, science and traditional philosophy alike as a cognitive relation of a subject to an object such that Dasein's familiar practical residing in the world becomes invisible. As the cognitive "relation" of subject and object present-at-hand becomes the allegedly self-evident point of departure, the practical behavior of a human being gets interpreted as privative or "non-theoretical."<sup>16</sup> The possible phenomenological description of Dasein's experience gets replaced by a natural science of human Thinghood in which Dasein, as "subject"--a concept which is already a distortion of concerned being-in-the-world--is fitted into the System of Nature, for example, by physiological psychology, behaviorism or similar sciences. As a result "because knowing has been given this priority, our understanding of [Dasein's] ownmost kind of being gets led astray."<sup>17</sup>

Heidegger illustrates the extent of the changeover from the practical, circumspective attitude to the theoretical by means of the example of the twofold meaning of the proposition "The hammer is heavy." In Dasein's practical dealings (hammering with a hammer), "The hammer is heavy" signifies that the hammer is not easy to manipulate, that it is difficult to use. Indeed, the entity in question *is* a hammer only because of its "involvement relationship" within the horizon of the totality of entities ready-to-hand as equipment for Dasein's *praxis*. On the other hand, "The hammer is heavy" can also mean that the entity before us has the property of heaviness, possesses mass, exerts pressure upon what lies beneath it, or would fall if the latter were removed. In this latter sense, "The hammer is heavy" "is no longer spoken within the horizon of awaiting and retaining and equipmental totality and its involvement-relationships. . . . We have now sighted something that is suitable for the hammer, not as a tool, but as a corporeal Thing subject to the law of gravity,"<sup>18</sup> as a part of the causally-interdependent system of objectified Nature. In such a revised context, to speak of the hammer as "too heavy" no longer has meaning. The hammer-entity has been altered in its being from the piece of equipment ready-to-hand which we encountered for *praxis* into a Thing present-at-hand because we are looking at it in a new way, as something present-to-hand. In this shift of perspective, or "change-over," the understanding of being by which our concerned dealings with entities within-the-world has been guided has been changed.

Symptomatic of this change-over in the being of the hammer is that "in the 'physical' assertion that 'the hammer is heavy' we overlook not only the tool-character of the entity we encounter, but also something that belongs to any ready-to-hand equipment: its place."<sup>19</sup> Now, Heidegger had analyzed the spatiality of equipment earlier in *Being and Time* and had shown that the world of *praxis* is comprised of spatial "regions" in which entities are situated in their respective "places" in accordance with their equipmental (practical) meanings. The hammer *belongs* in the workshop region, the pot's place is the kitchen region, etc.<sup>20</sup> Once the "change-over" to physical or objective Nature has taken place, however, an entity's place becomes a matter of indifference, as all "places" are replaced by the uniform, homogeneous "space" of physics. This does not mean that what is present-at-hand loses its "location" altogether; rather, an entity's place becomes a spatio-temporal position, a "co-ordinate," which is in no way distinguishable "qualitatively" from any other such co-ordinate.<sup>21</sup> In other words, in this "change-over" all qualitative or existential spatial location (in terms of "regions" and "places") is replaced by merely quantitative relations among entities.<sup>22</sup>

Together, these two change-overs make possible the apprehension of entities in their presence-at-hand, indicating that their meaningful spatial ordering in their readiness-to-hand for *Dasein's praxis* is replaced by the theoretical cognition of a mere aggregation of entities present-at-hand in the levelled, "objective" space-time of physics. The classical example of such a change-over from the equipment spatiality of entities to their merely factual location in uniform space-time was accomplished in the seventeenth century with the rise of mathematical physics. In Heidegger's view, this indicates that what is decisive for the development of science lies not in its rather high esteem for the observation of "facts" nor in its "application" of mathematics in determining the character of natural processes, but in the way in which Nature itself is mathematically projected *a priori* in that the "paradigm" of constant presence-at-hand (or "matter") is assumed beforehand, such that the horizon is opened for one to look at those properties of entities which are quantitatively determinable (e.g., motion, force, location, etc.). In this manner, the fore-concept of "mathematical nature" determines the being of entities and indeed what sort of entities are for scientific investigation:

Only in the "light" of a Nature which has been projected in this fashion, can anything like a "fact" be found and set up for an experiment regulated and delimited in terms of this projection. . . . In the mathematical projection of Nature. . . what is decisive is that this projection *discloses something that is a priori*. Thus the paradigmatic character of mathematical natural science does not lie in its exactitude nor in the fact that it is binding for "every man"; it consists rather in the fact that the entities which it takes as its theme are discovered in it in the only way in which entities can be discovered--by the prior projection of their state of being.<sup>23</sup>

Science then proceeds to "discover" objects; that is, scientific method projects "objectivity" (or "constant presence-at-hand") onto those entities encountered in everyday practical being-in-the-world. This projection, or objectification, is characterized, in Heidegger's view,



by a distinctive kind of "making-present," or "thematization," in that "above all--the kind of discovering which belongs to . . . science. . . awaits solely the discoveredness of the present-at-hand. . . [which] has its . . . basis in a resoluteness by which Dasein projects itself toward its potentiality-for-being in the 'truth'."<sup>24</sup> Now, because of this projecting of the possibility of being-in-the-truth, no matter how distorted science's conception of truth may have become under the influence of positivism, science nevertheless "has its source in authentic existence."<sup>25</sup> Heidegger's meaning here seems to be that the projection by which science undertakes to be "in the truth" can be recovered for a future valid (non-positivistic) self-understanding of science through a conception such as the one Heidegger proposes. Thus, it is important to stress that Heidegger's project is not essentially a destructive criticism of science but is directed primarily at the positivistic distortion of science's aim at truth. Like Kant, Heidegger seeks to ground science transcendently in the relevant *existentialia* of Dasein (analogous to the Kantian categories) and to secure its cognitive claims in the ontologically limited domain of "objectivity" (rather than in the world of "phenomena"). To accomplish this, Heidegger must first demonstrate the extent to which science is theory and that to which it is *praxis*.

#### I.C. SCIENCE AS A UNITY OF THEORY AND PRACTIS:

Now that we have seen how Heidegger conceives the genesis of scientific "abstraction" in the formulation of assertions assigning properties to entities viewed solely in their objective presence-at-hand, we can show that, in his view, science is *theoria* (in the sense of a degeneration of practical circumspection) *only to a first approximation*. In other words, in Heidegger's view scientific theorizing rests upon *praxis* and its accompanying circumspection, despite the positivist assumption that science is thematized *theoria* and hence unrelated to *praxis*. We shall see that Heidegger believes that scientific theorizing derives its truth not from any logical reconstruction of its concepts but from the genuine, although limited, ontological validity of viewing entities objectively.

As we have seen, Heidegger opposes *theoria* to *praxis*. But in trying to characterize scientific theorizing he argues that this dichotomy must be modified because, since all *praxeis* have their kind of "proto-theory" (circumspection), so too (scientific) theorizing is not without certain *praxeis* of its own. Thus,

in characterizing the change-over from the manipulating and using and so forth which are circumspective in a "practical" way to "theoretical" exploration, *it would be easy to suggest* [italics added--F.B.] that merely looking at entities is something which emerges when concern *holds back* from any kind of manipulation. What is decisive in the "emergence" of the theoretical attitude would then lie in the *disappearance* of *praxis*. So if one posits "practical" concern as the primary and predominant kind of being which factual Dasein possesses, the ontological possibility of "theory" will be due to the *absence* of *praxis*--that is, to a *privation*.<sup>26</sup>

This assumed dichotomy, in other words, overlooks the possibility of science's being a kind of *praxis*, not merely a theoretical "looking at"

entities present-at-hand. Heidegger notes that our everyday concern may divert itself into a practical "just-looking-around," such as those "more precise" kinds of circumspection involved in inspecting something, checking up on what has been attained so far, or looking over the operations.<sup>27</sup> Since in these ways of non-privately "looking around" we regard entities in their readiness-to-hand, these actions cannot produce "pure" *theoria*. Rather, such "holding back from the use of equipment is so far from sheer 'theory' that the kind of circumspection which tarries and 'considers' remains wholly in the grip of the ready-to-hand equipment with which one is concerned. 'Practical' dealings [such as inspecting--F.B.] have their own ways of tarrying."<sup>28</sup>

Thus far, following Heidegger, we have distinguished such practical "theorizing" (inspection, etc.) from (a) "pure" circumspective *praxis* by which entities are manipulated in their readiness-to-hand but not cognized, and (b) "pure" *theoria* in which we merely stare at entities in their presence-at-hand, or cognize them theoretically. He seems to suggest that scientific research, like the kind of holding back from the use of equipment characteristic of inspecting, etc., also has such a hybrid character. Scientific research in his view incorporates a series of *praxeis* which have as their goal the cognition of entities in their objective presence-at-hand, that is, the discovery of properties, functions, interactions, etc. Among the sorts of *praxeis* incorporated in scientific research, Heidegger mentions the following: designing experiments, reading off measurements, production of microscopic preparations, observation with a microscope, archaeological excavation, and manipulation of equipment for writing. Obviously, this list could be extended indefinitely. Scientific research, in sort, is not just a purely theoretical activity.<sup>29</sup> As a kind of *praxis*, scientific research manipulates certain items of equipment and possesses a mode of circumspection of its own, which Heidegger calls "deliberation" (*Uberlegung*), by which these properties, etc., of the entities being studied, are thematized theoretically.<sup>30</sup>

Such scientific "deliberation" takes the form of interpreting objectified entities in terms of causal interrelations, that is, in terms of the "if . . . then" schema allowing for their formalization, mathematization, and functionalization.<sup>31</sup> As a result, unlike the positivistic or "logical" conception of science as pure *theoria*, which understands science with regard only to its thematized results and defines it in terms of the accumulation of such assertions, Heidegger interprets science as the realization of certain of Dasein's practical potentialities having the creation of theory concerning objectivity as its goal. This being so, it no longer suffices to accept science's "facts," "theories," and other "findings" at face value. In Heidegger's view, science must be reconceptualized in light of the circumspective fore-structure of the *praxeis* involved in observation, experiment and theorization, and especially in view of the metaphysical fore-conceptions at work in projecting entities as objects possessing properties, functions, etc., suitable for experimental discovery. In short, Heidegger makes us aware of both the practical and theoretical context-dependence of science. In this light, positivistic notions of the induction of theories from "given" factual data must be replaced by a properly hermeneutical understanding of scientific method, which we shall see must also be guided by an equally hermeneutical understanding of the history of scientific *praxeis*, if we are to work out the ways in which the *a priori* projection of the objective being of entities assumed by scientific method has guided and/or misled the development of genuine knowledge of the being of entities.<sup>32</sup> It is thus incumbent

upon us to turn next to Heidegger's conception of the hermeneutic circle and its implications for science.

## II. THE CIRCULARITY OF HUMAN UNDERSTANDING AND INTERPRETATION

According to Heidegger, understanding derives from Dasein's ability to project possibilities for future *praxis*. Understanding is said to "throw forth" or "project" possibilities for being, making possible the significance or "worldhood" of the world, the horizontal meaning-context in relation to which those entities Dasein encounters in *praxis* acquire their meaning for such *praxis*. Such understanding, further, is said to be "circumspective." It does not grasp thematically the possibilities which it projects, but is guided instead by a pre-thematic "lighting up" of an entity's utility within the context or field of practical possibilities constituting the "totality of [equipmental] involvements," which Heidegger calls the "worldhood" of the world.

But does this not mean merely that something is cognized in the first place as an object present-at-hand and then subsequently taken as a door, as a house, etc.? Is not "understanding" merely the projection of a "value" onto something perceived present-at-hand in "neutral," factual cognition? Heidegger explicitly argues that the answer to both these questions is "No." On the contrary, "when something within-the-world is encountered as such, the thing in question already has an involvement which is disclosed in our understanding of the world."<sup>33</sup> To substantiate this claim, Heidegger offers an analysis of what he calls the "fore-structure" of that understanding which, he claims, always accompanies (and guides) *praxis*. This "fore-structure" of understanding consists of circumspective "fore-sight," "fore-having," and "fore-conception." This analysis of the fore-structure of understanding illustrates how we have already understood an entity's serviceability, usability, etc. in projecting the possibility of our using it in a certain way, in our actual use of it, such that any thematic perception or cognition of that entity must arise from this interpretation of our fore-conception of the entity. This "fore-structure" of understanding, in other words, refers to the understanding we have of an entity's usability before we interpret the entity explicitly, at which stage what Heidegger terms the entity's "as-structure" can emerge from the fore-structure and become available for cognition.

An entity, as we use it in *praxis*, is circumspectively "familiar" to us because it is located within the totality of "involvements" or potential usabilitys of all entities; this totality of involvements is Dasein's pre-existing "habitual" familiarity with the world. But the totality of possible involvements of entities ready-to-hand can be "familiar" only because the usabilitys of each of the entities-within-the-world are--or can become--familiar to us. That is, specific entities are situated within the context of significance or network of uses correlative to Dasein's possibilities, receiving their specific assignments from it. Thus, our understanding of entities has a "circular" or contextual nature. That is, we see an entity in advance of singling it out for perception, because our "fore-having" of a world as a totality-of-involvements outlines the the involvement of this (and every other) entity in advance of our actually using it. In other words, before I undertake a "concernful dealing" with this particular entity, it has already been adumbrated within the

network of meaning which comprises the "worldhood" of the world as encountered in my previous "concernful dealings" (*praxeis*) in which I have utilized other entities. Hence, I have already had some "sight" of this particular entity, although marginally and without thematization. Because of this previous "fore-sight" of the entity in question, I must have already "had" it within my world, and must have already "seen" it there, although marginally and without thematization, while engaged in *praxeis* directed toward other entities.<sup>34</sup> This is the circularity of what Heidegger calls our "fore-sighting" of entities.

Now, Heidegger says, one of understanding's possibilities is that of developing itself further. Such development of understanding Heidegger terms "interpretation" (*Auslegung*, literally: "laying out"), by which he means that conceptual appropriation and thematization of the hitherto unexamined (pre-thematic) circumspective understanding accompanying *praxis*. In this manner, interpretation as it were lifts the entity in question out of its vaguely comprehended background of meaning, so that it might become cognizable (or better, understandable) explicitly in its own meaning, i.e., in its "usability for . . ." and "serviceability as . . ."

According to Heidegger, when we use something, we use it precisely because it possesses a certain "serviceability as . . ." The entity "bears within itself the structure of possible interpretation and in so primordial a manner that just to grasp something free, as it were, of the 'as' requires a certain readjustment."<sup>35</sup> This is a crucial point, for it is tantamount to the claim that "usability for . . ." and "serviceability as . . ." constitute ontologically necessary aspects of the being of entities (their "readiness-to-hand"), rather than being mere "values" added onto an objective Thing present-at-hand. This presence of usability and serviceability in entities (defining their readiness-to-hand) implies that the mere perception of something as "when we merely stare at something, our just-having-it-before-us," is, in Heidegger's words, "a failure to understand it any more."<sup>36</sup> Such a merely cognitive grasping of an entity, allegedly free of the interpretative "as," as in "sense perception" as conceived by classical and "logical" empiricisms alike, or in science's discovery of the "primary qualities" of bodies, is not a more primordial encounter with entities than is interpretation, but is rather a privation of Dasein's characteristic kind of practical "seeing" ("circumspection"), in which Dasein already understands and interprets.

Now, anything understood in a fore-having and a fore-sighting may become recognizable through interpretation. I can say: "This entity is a . . ." by interpreting it as "a . . ." Interpretation interprets my "fore-conception" of the entity, my unthematized practical "grasp" that "this entity is a . . ." This possibility of conceptualizing my pre-thematic practical fore-having and fore-sighting of an entity is what makes cognition possible--and is precisely what dooms it to circularity. In Heidegger's words: "an interpretation is never a presuppositionless apprehending of something presented to us. . . . One finds that which 'stands there' in the first instance is nothing other than the obvious undiscussed assumption [*Vormeinung*] of the person who does the interpreting."<sup>37</sup> In just staring at ("perceiving") an object present-at-hand and cognizing it in terms of its properties, we could never read off the "as-structure" which defines its "usability for . . ." or "serviceability as . . ." When, on the other hand, entities within-the-world are properly disclosed and understood in their intelligibility for Dasein's *praxeis*,

we understand their meaning. It is this meaning which is "already understood" in *praxis* and subsequently interpreted in cognition.<sup>38</sup> That is, an entity's meaning (its "as-structure") emerges only once interpretation *circles back upon* the fore-structure of practical understanding (circumspection). Thus, interpretation in general is circular: "any interpretation which is to contribute to furthering already existent understanding, must *already* have understood what is to be interpreted."<sup>39</sup> The circularity of interpretation has far-reaching implications for research, for no mode of cognition can escape the fact that it is interpretation of Dasein's already-circular circumspective, practical understanding of entities encountered within the world. Thus,

what gets censured inappropriately as a "circle" belongs to the essence and to the distinctive character of understanding as such. . . .What common sense wishes to eliminate in avoiding the circle, on the supposition that it is measuring up to the loftiest rigor of scientific investigation, is nothing less than the basic structure of [Dasein].<sup>40</sup>

Given the structure of understanding in general, all research, whether scientific or phenomenological, must be circular, because all research involves Dasein's projecting the fore-structure of that understanding which guides research as it is carried out in practice. That is, research is circular because Dasein has that kind of being which is circular.<sup>41</sup>

Now we can see that the positivist interpretation of science errs on two levels: (a) it fails to take into account the essential circularity of the fore-structure of Dasein's practical understanding, which permeates all possible forms of interpretation (cognition) which may arise on its basis; hence (b) it fails to take into account the circularity of scientific procedure, which rests upon the presuppositions of the scientist's own research efforts.<sup>42</sup> In Heidegger's view, the existential significance of a science's findings depends upon the extent to which that science has understood itself as one possibility of Dasein's being-in-the-world and has rendered this understanding intrinsic to its methods and concepts. When one talks of the "circle" of understanding as "vicious" and tries to define scientific method through its avoidance, "one expresses a failure to recognize two things: (1) that understanding as such makes up a basic kind of Dasein's being, and (2) that this being is constituted as care. To deny the circle, to make a secret of it, or even to want to overcome it, means finally to reinforce this failure."<sup>43</sup> Such a denial of the circularity of all understanding, including that generated through the use of scientific method, has characterized positivist thought since the era of Bacon and Galileo.<sup>44</sup> As we shall see, Heidegger's "existential conception" of science attempts to rectify this "forgetting" of science's circularity by showing how science rests upon the circularity of Dasein's understanding, thereby both demonstrating science's partial validity and establishing its limits.

Further, in Heidegger's view, interpretation always takes place through assertions, that is, in language. He argues that language itself conceals an abundance of presuppositions which lend additional circularity to assertions:

When an assertion is made, some fore-conception is always implied; but it remains for the most part inconspicuous, be-

cause the language already hides in itself a developed way of conceiving. Like any interpretation whatever, assertion necessarily has a fore-having, a fore-sight, and a fore-conception as its existential foundations.<sup>45</sup>

In Heidegger's view, assertion is thus triply circular, in that it is (a) derived from interpretation and understanding, carrying with it their circularity as discussed above; (b) expressed in language, hence subject to the contextual circularity of words and sentences; and (c) structured syntactically and, therefore, metaphysically disposed in a certain manner--for example, the assertion: "The hammer is heavy" implies "This Thing--the hammer--has the property of heaviness."<sup>46</sup> This, of course, implies that scientific assertions share in this triple circularity.

It follows from this triple circularity of assertion that any interpretation of Dasein or of Dasein's practical possibilities (such as scientific assertion), must take this circularity into account. Unfortunately, such awareness of the circularity of understanding, interpretation and assertion is utterly lacking in the positivist conception of scientific knowledge. On the other hand, by making the circularity of Dasein's cognitive possibilities into a theme for phenomenological investigation, Heidegger provides a frame of reference for the development of a theory of interpretation which would enable us to conceptualize the limits of the intelligibility of any particular form of interpretation, e.g., scientific method. Heidegger writes: "What is decisive is not to get out of the circle but to come into it the right way. This circle of understanding is not an orbit in which any random kind of knowledge may move; it is the expression of the existential fore-structure of Dasein itself."<sup>47</sup> Such a "positive possibility" for developing a theory of interpretation is, of course, the task of philosophical hermeneutics, the systematic exploration of the circularity of any interpretation whatever, upon which a revised conception of scientific method can be based.

Nonetheless, it must be emphasized that Heidegger's description of the hermeneutic circle in *Being and Time* is sketchy and incomplete. In the light of the subsequent development of philosophical hermeneutics, however, we can say that, most generally, the hermeneutic circle is a model of the development of knowledge which might be expressed in the motto: "No development of knowledge without fore-knowledge!"<sup>48</sup> Like assertion in general, textual interpretation and other analogous modes of "reading" are to be understood as structurally defined by our inability to comprehend the meaning of the text except through its component parts (its words), while at the same time the meanings of the words are dependent upon their context (the work as a whole).<sup>49</sup> In addition to the circularity of our understanding of entities, it is Heidegger's contention that this circularity of all forms of "reading" determines that all assertion proceeds only on the basis of the fore-knowledge at the disposal of the interpreter (reader), by means of which the words (or analogous "meaning-elements") comprising the text (or text-analogue) acquire their initial contextual meaning from the reading of which the text as a whole acquires a revised meaning related to, but nonetheless not identical with, the fore-conception of the text's meaning with which the reading began. The process is then repeated (or is at least repeatable in principle), such that each "turn around the circle" makes possible a deepened, revised interpretation of the reader's own fore-conception while at the same time "more of the hidden assumptions of the text become known and articulated."<sup>50</sup> Each time we go around the circle we

utilize the previously-established interpretation as fore-knowledge for the production of a revised interpretation. On this model, a research paradigm or methodology may be said to "bear fruit" only to the extent that each revised interpretation enables us to see connections within the text (or text-analogue) which were unseen previously.<sup>51</sup> We shall see below that it is arguable that the change-over of entities into objective Things of nature makes scientific knowledge possible precisely on the basis of facilitating a "reading" of them as if they possessed meaning (lawfulness, within the context of objectified, mathematical Nature).

It is also worth mentioning that, as all interpretation is based upon fore-conception of that which is to undergo interpretation, one's openness to truth depends largely upon one's acquisition of an increasing awareness of one's prejudices (or "basic assumptions") as they structure one's interpretations.<sup>52</sup> Interpretation always involves a "fusion" of the meaning-horizons of interpreter and text. Thus Gadamer has argued that there can thus be no such thing as a single correct interpretation, valid for all time, since the interpreter and his meaning-horizon are always undergoing change.<sup>53</sup> Hence the interpretive process is unending, although perhaps it admits of increasing transparency. It would thus appear that the ultimate ideal of interpretation would be to make one's prejudices so self-transparent that the meaning of the text might emerge through this process of increasing clarity of interpretations.<sup>54</sup> In any event, whether the text's meaning can or cannot ever fully emerge from the interpretative fore-conception, there can be no knowledge not situated in a pre-existing knowledge-context, that is, within the horizon of the historical tradition of scientific, metaphysical or other relevant knowledge assumed by the interpreter.

This raises a major criticism of the empiricist conception of knowledge, which is said to be unmediated by the "stance" of the observer and his historically-mediated "prejudices." Insofar as there are no "data" which are not already interpreted, logical empiricism's "protocol sentences" are epistemologically no more elementary than are judgments concerning the meanings of Hamlet's soliloquies, for both presuppose on the part of the "observer" some historically-mediated contextual apprehension of the experience which is constitutive of the meaning of the experience. This holds even of so-called "simple" sense-experience allegedly reducible to descriptions of physical states. This observation, of course, does not mean that Heidegger conceives interpretation as unrelated to Dasein's sentience, as is evident from his claim that understanding, as Dasein's way of projecting possibilities for being-in-the-world, is always moodful and situated. Rather, it is this "interpenetration" of sense-experience and mood which frames the meaningfulness of even the most "elementary" sense-experience.

### III. THE HERMENEUTIC CIRCLE AND SCIENTIFIC METHOD:

Heidegger's discussion of the hermeneutic circle hearkens back to the classic paradox of knowledge as formulated by Plato in the *Meno*, in which it is claimed that it is impossible to acquire knowledge, because one either (a) would not seek what he already knows, or (b) would not know what to look for or how to recognize it when he found it.<sup>55</sup> Like Plato, whose theory of anamnesis sought to explain that we already "know" what we seek to know but do not know it conceptually, Heideg-

ger affirms the circularity of the acquisition of knowledge so as to re-define scientific method and the limits of its validity. In his view, the question of the epistemological grounding of the sciences hinges not upon whether scientific interpretation is circular--it is--but upon (a) whether or not this circle is a vicious one, adding nothing to knowledge; and (b) whether or not the circularity of scientific method is recognized and taken into account by the practitioners of science themselves. If interpretation operated in a vicious circle, one would be merely restating one's premisses in one's conclusion and the acquisition of knowledge would be impossible. In such a case, "science" could never rise above the level of subjective idiosyncrasy, the unthematized domination of tradition, or prejudice which shaped the interpreter's fore-conceptions. In short, there would be no science. Heidegger thus acknowledges that science is not rendered impossible by the hermeneutic circle, despite his holding that "in a scientific proof, we may not presuppose what it is our task to provide grounds for."<sup>56</sup> Since, as we have seen, some such "presupposition" is inherent structurally in all interpretation, including scientific interpretation, the possibility of genuine scientific knowledge must lie in transforming this circle into a non-vicious one.<sup>57</sup> It is to the question of the possibility and limits of scientific knowledge that we must now turn.

### III.A. THE CIRCULARITY OF CLASSICAL SCIENTIFIC METHOD

The circularity of scientific method can be demonstrated by referring back to its first formulation, in Descartes' *Rules for the Direction of Native Talents* and *Discourse on Method*. The salient feature of these works is the claim that there is but one method appropriate to the study of the entire world of phenomena and that this method is mathematical in its essence. Before Descartes, Galileo had already declared that the "Book of Nature" is written in the language of mathematics;<sup>58</sup> Descartes's innovation was to show that "certain and indubitable cognition" is possible "concerning everything that presents itself" only by deduction and analysis of phenomena leading to the discovery of "simple natures" that could be intuited self-evidently.<sup>59</sup> From intuition of these "simple natures" Descartes's method requires us to "ascend through these same steps" to a cognition of all [things in Nature].<sup>60</sup> This *a priori* rationalism complemented Galileo's earlier proposal that science abstract from the study of secondary to that of primary qualities, eliminating thereby any distorting contribution of the cognizing subject, on the assumption that these phenomena are reducible to the motions of bodies. As a result, nature could be conceived as a self-enclosed world of bodies characterized essentially by such simple "primary" qualities as mass and motion. Further, such bodies were taken to be mutually connected by relations of (mechanical) causality, in which all occurrences are determined. Descartes argued also that the motion of bodies was subject to a purely geometrical analysis, and that mathematics alone could provide certain knowledge of the universal laws of bodily interaction, enabling us "to demonstrate effects by causes".<sup>61</sup>

The fourth of Descartes' "Rules" encapsulates the *a priori* determining characteristic of scientific method: "method is necessary for discovering the truth of nature." This rule shows that the scientific study of nature is guided in advance, and is limited by the validity of, the idea of method. As Heidegger points out:



This rule does not intend the platitude that a science must also have its method, but it wants to say that the procedure, *i.e.*, how in general we are to pursue things (*methodos*), decides in advance what truth we shall seek out in these things. Method is not one piece of equipment of science among others but the primary component of which is first determined what can become object and how it becomes object.<sup>62</sup>

Method, in short, *determines* what science is to take as the being of those entities which it studies. The adoption of a method, in other words, far from being ontologically neutral, is decisive for the development of science, for it limits the domain of scientific research to only those entities having the kind of being accessible by its method. Science's "findings," then, are *truths relative to the context of the projection of the "paradigm" of mathematical nature*, truths about objective Things of Nature, *only in so far as the being of entities allows their being interpreted objectively.*

This basic circularity of natural science can be seen in the culminating step taken in the seventeenth century scientific revolution, Newton's supplementation of the Cartesian method with the demand for experimental verification (hence repudiating Descartes' *a priori* explanations of the motions of bodies).<sup>63</sup> Newton sums up the perfected scientific method, henceforth canonical for natural science (and the social sciences insofar as these have been interpreted positivistically), in his four "Rules for Reasoning in [Natural] Philosophy." These rules, and the ontological presuppositions of science which they express, are:

- (1) We are to admit of no more causes of natural things than such as are both true and sufficient to explain their appearances [the principle of the simplicity of nature];
- (2) To the same general effects we must, as far as possible, assign the same causes" [the principle of the homogeneity of nature];
- (3) The qualities of bodies, which admit neither intension nor remission of degrees, and which are found to belong to all bodies within the reach of our experiments, are to be esteemed the universal qualities of all bodies whatsoever" [the principle of the objectivity of only the primary qualities]; and
- (4) In experimental philosophy we are to look upon propositions collected by general induction from phenomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions [the principle of the primacy of controlled observation (experiment) over hypothesis].<sup>64</sup>

Two points need to be made about Newton's summation of scientific method. First, the role he assigns to experiment, hence to sensory observation under controlled conditions, reveals the extent to which he advanced beyond Descartes's *a priori* rationalistic physics: "We are certainly not to relinquish the evidence of experiments for the sake of

dreams and vain fictions of our own devising. . . . We no other way know the extension of bodies than by our senses."<sup>65</sup> Secondly, it must be noted that for Newton, as for Galileo (but not for Descartes) before him, the ontological foundation of science is its atomism, that "the least particles of all bodies" can be known in their extension, hardness, impenetrability, mobility, inertia, and other such "primary" qualities: that is, "in themselves," *in an allegedly non-circular way*. It is Heidegger's contribution to have demonstrated the way in which this paradigm of "positive" scientific knowledge is guided in advance by the projection of a specific set of ontological presuppositions (fore-conceptions), which not only define those entities amenable to investigation through scientific method but also mark off the limitations of scientific knowledge.

### III.B. THE LIMITATION OF SCIENTIFIC KNOWLEDGE

In Heidegger's view, any particular "ideal" of knowledge, e.g., that of scientific method, is a species of interpretation and is thereby bound by the latter's characteristic circularity. In alleging that scientific knowledge is objective (by which is meant that it is non-interpretative) and empirical (by which is meant that it is non-contextual), positivism radically misunderstands the nature of scientific knowledge. In its attempts to thematize scientific method under the rubric of verification by means of allegedly non-interpretative, non-contextual "protocol sentences," or alternatively as the method of "induction" or the application of the "hypothetical-deductive method," positivism has sought to interpret scientific method in a non-hermeneutical manner.

Heidegger, on the other hand, sees the ideal of objective knowledge as a species of interpretation which has appropriated to itself the legitimate task of grasping entities in their presence-at-hand. This is accomplished despite positivism's failure to recognize that science's claims to objectivity are vitiated by the circular structure of interpretation, i.e., that the truth of scientific knowledge depends upon a certain kind of being, "objectivity," being *projected onto* entities, such that their "properties" could be discovered relative to this projection. Science offers a true explanation of "reality" (which is itself a particular metaphysical paradigm, according to which Being in general is interpreted as *realitas*), but only at the "level" of Being's assumed objectivity; that is, only by taking objects simply as present-at-hand, ignoring the way they originally reveal themselves to practically engaged Dasein in their readiness-to-hand.

Heidegger's attitude toward the natural sciences can be summarized by noting that he accords them full legitimacy within their (self-constituted) domain. In so far as the being of entities, presumably including even "man," admits of objectification, Heidegger presumably would acknowledge that objective knowledge possesses a certain truth (discovers an aspect or aspects of the entity under examination). The projection of the "regional ontology" of objectivity is possible, further, only because the being of certain entities admits of it; and with respect to this domain, objective knowledge would be, in Heidegger's view, quite legitimate. But Heidegger would protest vehemently against any attempted totalization of objective knowledge, or of scientific method, as an entirely unjustified, naive reductionism, because scientific method itself is merely one interpretative, and in no way privileged, mode of apprehension, discovering but one aspect of the being of entities.<sup>66</sup>

Further, as an historical process of discovery, science only gradually removes aspects of the being of those entities it studies from their previous concealment. The acquisition of these truths, however, is dependent upon the theoretical presuppositions (fore-conceptions) scientifically-researching Dasein assumes so as to bring the objective being of entities out of concealment. In other words, scientific discovery is possible only as the *praxis* of Dasein and is thus limited by the existential-ontological structures of this mode of being:

Entities are un-covered only *when Dasein is*; and only as long as Dasein *is* are they disclosed. Newton's laws, the principle of contradiction, any truth whatever--these are true only as long as Dasein *is*. Before there was any Dasein, there was no truth, nor will there be any after Dasein is no more. For in such a case truth as disclosedness, uncovering and uncoveredness, *cannot be*.<sup>67</sup>

For example, through the formulation of Newton's laws, certain properties of objective being were dis-covered, removed from their previous concealment:

To say that before Newton his laws were neither true nor false, cannot signify that before him there were no such entities as have been uncovered and pointed out by these laws. Through Newton the laws become true; and with them, entities become accessible in themselves ["objectively"--F.B.] to Dasein. Once entities have been uncovered, they show themselves precisely as entities which beforehand already were. Such uncovering is the kind of being which belongs to "truth."<sup>68</sup>

Further, since all such uncovering of Being, even of objective being, rests upon Dasein's *praxis*, it is dependent upon the fore-structure of the understanding which guides such *praxis*. Scientific truths such as Newton's laws come into being only because Newton projected a certain fore-conception onto entities ordinarily encountered in their readiness-to-hand: a projection of their objective presence-at-hand in terms of the mathematical concepts of mass, motion, inertia, susceptibility to causal influence, and so on.

It is important to note here that Heidegger's criticism is directed not against science's (for example, Newton's) projection of the fore-conception of objectivity, but against the positivist refusal to see the ontological projection at work in scientific method and positivism's dogmatic restriction of the domain of truth to only that which is cognizable by scientific method (proclamation of the exclusive truth of its ideal of objective knowledge):

. . .because presence-at-hand has been equated with the meaning of Being in general, . . . the primordial phenomenon of truth has been covered by Dasein's very understanding of Being--that understanding which is proximally the one that prevails, and which even today has not been surmounted explicitly and in principle.<sup>69</sup>

That is, the objectivity of science is dependent upon the original projection of objectivity onto the domain to be studied scientifically. Kockelmans suggests that this implies that scientific method cannot naively be applied across domains, because although "every science is a true theory of the real, . . . the term 'real' has its own particular signification for each science. Each science endeavors to bring to light, faithfully and objectively, an isolated and well-defined aspect of entities encountered within-the-world."<sup>70</sup> Kockelmans then argues that such a "fragmentation" of science follows from Heidegger's notion of the projection of objectivity (presence-at-hand) within each science's object-domain. Thus, "for every science the terms 'theory' and 'objectivity' have their own specific significations. Each science projects its scientific 'world', its domain of meaning, in its own way."<sup>71</sup> It follows that another of positivism's cherished dogmas is brought into question: the presumed unity of science upon the basis of the assumed general applicability of scientific method. From the Heideggerian perspective, however, the unity of the sciences is not to be found in the application of the "same" method to various domains, for, given the hermeneutic circle, methods must be modified to fit various kinds of entities, and indeed, the being of the "same" entity (e.g., man) will manifest itself differently to different sciences (except, of course, when it is dogmatically and misleadingly asserted that all object domains are in the scientifically-relevant senses identical, i.e., reducible to the laws of physics). Rather, the commonality among the "worlds" of the various sciences "consists in the fact that all of them have been born from the world immediately lived by the community of man."<sup>72</sup> That is, the family resemblances of the methods of the various sciences can be grounded only on an understanding of Dasein's structures. It would follow that "objectivity" in the various sciences should be understood only analogously, not univocally as in the positivist conception of "unified science."<sup>73</sup>

The discovery of the unavoidability of the hermeneutic circle in science precludes any naive claim to the essential objectivity of Being in general. Rather, this discovery of the projectedness of the ontology of objectivity points the way to what Heidegger calls "the possibility of making the scientific themes secure by working out these fore-structures" of interpretation as they apply to objective knowledge.<sup>74</sup> This raises the question of the possibly distinctive grounding in the existential analytic possessed by the natural and human sciences, respectively.

### III.C. THE DIFFERENCES BETWEEN THE NATURAL AND HUMAN SCIENCES:

One consequence of Heidegger's viewing the various sciences in relation to the existential analytic of Dasein is the new light that this throws upon the question of the alleged differences between the natural and human sciences.<sup>75</sup> As we have seen, *Being and Time* offers an account of the "constitution" of objectivity (constant presence-at-hand) as resulting from the change-over from *praxis* to *theoria*. Heidegger also explores the *existentiale* of historicity, in which it is shown that, because Dasein's existence is temporal, it is also "stretched out" historically, such that Dasein's *praxis* is the actualization of potentialities which have been "handed down" through Dasein's "heritage."<sup>76</sup> That is, both the human and natural sciences share in this historicity, as do all Dasein's other *praxeis*.

This common historicity of all the sciences enables Heidegger to assign priority to those sciences which thematically study Dasein's historicity over those which study nature under the projection of the paradigm of objectivity, in two respects. First, all the "human" sciences, not only historiography, are "historical" in that they study those *praxeis* through which Dasein's potentialities have been actualized in various ways, including those involved in "doing" natural science. One implication of this view is that the human sciences are situated closer to the phenomenological interrogation of Dasein than are the natural sciences. Thus, although there may be a historiographical study of the "constitution" of objectivity in the natural sciences (a phenomenologically-grounded history of science), there cannot be a *natural* science of Dasein's *praxeis*, i.e., a "scientific" history in the positivistic sense.<sup>77</sup> Secondly, in Heidegger's view, the human sciences possess an ontological basis which "transcends in principle the idea of rigor held in the most exact natural sciences,"<sup>78</sup> whose objectivity belies in his view their lack of awareness of the circularity of understanding upon which their own method is based. This claim rests upon the assignment of a greater scientific rigor to "hermeneutical" historical knowledge, as contrasted with the lesser rigor of the natural sciences, because the former, but not the latter, are explicitly hermeneutical. As Heidegger was to express it some years after *Being and Time*:

Mathematical knowledge is not stricter than philological knowledge. It has merely the characteristic of "exactness," which is not to be identified with strictness. To demand exactitude of history or of the other human sciences would be to offend against the idea of the kind of strictness that pertains to the human sciences.<sup>79</sup>

Ordinarily in positivistic "philosophy of science," whenever the circularity of interpretation in the humanities (or social sciences) is made apparent the question arises as to whether these disciplines are (or can be) properly scientific. Typically, this circularity of interpretation is distorted by positivist philosophers of science into a call for an "empathic" understanding of the author, text or text-analogue on the part of the interpreter. Such empathy is then rejected as unscientific or, at best, receives the status of a merely heuristic device rather than that of a scientifically-valid method.<sup>80</sup> In light of his argument that the complete absence of circularity is impossible in any interpretation, Heidegger asks instead whether the *natural* sciences can be considered properly scientific if they not only depend upon, but remain unaware of, the circularity of their highly successful method? That is, the discovery of the hermeneutic circle undermines the positivist distinction between the natural and human sciences; all sciences are "human," i.e., realized potentialities of Dasein and manifestations of certain of Dasein's *existentialia*.

In Heidegger's view, the human sciences are in principle closer than the natural sciences are to the phenomenological exhibiting of Dasein's ontological structures, because they take the circularity of their own understanding thematically into account. In this sense, the human sciences are potentially more rigorous than the natural sciences. For example, in textual interpretation, any appeal to "what stands there" is recognized as "nothing other than the obvious assumption (*Vormeinung*) of the person who does the interpreting."<sup>81</sup> In other words, in such a science it is recognized that any appeal to "objectivity" masks what is

truly an appeal to the reader's "fore-having" of the meaning of the text in its entirety before it is read; "fore-sight," or purpose, in light of which the text is read; and "fore-conception," or anticipation of the text's meaning through concepts which determine (or at least "frame") the interpretation.<sup>62</sup> Similarly, philology also recognizes that the meaning of words cannot be ascertained independently of their meaning-context (the entire text), while the text's meaning, of course, cannot be ascertained independently of the meanings of its component parts (words, sentences).

Nonetheless, Heidegger's presentation of the hermeneutic circle ought not to be taken as the last word on the subject. Given its sketchy character, as incidental to the main argument of *Being and Time*, one would expect it to require further development in order to enable us adequately to conceive the need for revisions in scientific method. Bhaskar has recently articulated a more comprehensive version of circularity of scientific method, in a manner that helps clarify the differences between the natural and human sciences first exposed by Heidegger.<sup>63</sup> Bhaskar distinguishes four circles, or sources of circularity, found in different modes of interpretation. The first, C1, refers to the pre-interpreted or non-presuppositionless nature of any act of inquiry, as anticipated by Heidegger's discussion of understanding and interpretation. The second, C2, which was not noticed by Heidegger, refers to the circularity of communication, which Bhaskar exemplifies by the paradox communication is impossible unless some descriptive and practical presuppositions are shared in common but is unnecessary unless there is the possibility of discrepancy between the parties to communication. In Bhaskar's view, the circles of inquiry and communication, which, of course, appear in the natural sciences, are universal features of any interpretation and understanding whatever. The third circle, C3, whose paradigm is translation, arises when one inquires into existing societies, cultures, or traditions other than one's own, obviously effecting inquiry in the social but not in the natural sciences. C3 was apparently also not noticed by Heidegger. Finally, C4, whose paradigm is reading, is a circle of investigation into meaningful objects or products, rather than of subjects or their actions as in C3. C4 derives from the circularity of textual interpretation in general and was Heidegger's model of understanding and interpretation. C4 would apply in the historical human sciences. A weak analogue of C4, Bhaskar adds, may also be applicable in the natural sciences, on the assumption that "the highly metaphorical talk of 'reading' the object-domain, . . . as if it were meaningful, is appreciated."<sup>64</sup> If Bhaskar is correct here, it would follow that the natural sciences, social sciences and humanities all share in C1 and C2; C3 is an additional source of circularity in the social sciences only; while C4, although rigorously applicable only in the social sciences and text-interpretating humanities, is at least metaphorically applicable in the natural sciences as well. Heidegger, of course, would dissent from Bhaskar's view that only a "weak analogue" of C4 applies in the natural sciences.

It has also been suggested recently that hermeneutical criteria play a major role in the natural sciences, to the extent (a) that scientists overtly or covertly resort to the use of aesthetic criteria, such as simplicity or elegance of explanation in their choice of theories; (b) that "reading" an instrument is to some extent analogous to reading a text; and (c) that the socialization of the natural scientist into the research community demands that he appropriate its norms, usages, standards

and rules; i.e., that he appropriate the fore-structure of his science as currently practiced.<sup>85</sup>

#### IV. SCIENTIFIC CRISES AND THE RELATION OF SCIENCE TO ONTOLOGY

Although the various sciences established themselves initially through adaptation of the methodology of classical physics, in Heidegger's view their status as sciences depends upon the extent to which they have come to reject this methodology and have self-consciously incorporated the hermeneutic circle into their methods. Such a confrontation with its own circularity is normally undergone by a science only to the extent that it has experienced a "crisis" in its basic concepts. Now, we shall see that in his discussion of such scientific crises, and in his distinction between a science's "preliminary research" into its foundational concepts and its subsequent development through the accumulation of knowledge under the guidance of such concepts, Heidegger anticipates many of the main themes of Kuhn's later analysis of scientific "paradigms," his distinction between "revolutionary" and "normal" science, and his interpretation of scientific revolutions in terms of paradigm "shifts".<sup>86</sup> Furthermore, it will also be shown that Heidegger, much more explicitly than Kuhn, related such paradigm shifts to the ontological presuppositions of science.

Heidegger suggests that every science rests upon extra-scientific concepts which cannot be studied by scientific method because they are presupposed by the latter. Thus, sciences like physics and biology need to look beyond the concepts they have inherited from metaphysics, such as mechanism and vitalism, to the kind of being belonging to the entities they study.<sup>87</sup> In Heidegger's view, the experience of such crises in its basic concepts are fundamental to a science's ontological self-clarification: "The real 'movement' of the sciences takes place when their basic concepts undergo a more or less radical revision which is transparent to itself. The level which a science has reached is determined by how far it is capable of a crisis in its basic concepts."<sup>88</sup> Kuhn indicated much the same phenomenon when he writes:

Successive paradigms tell us different things about the population of the universe and about that population's behavior. . . [P]aradigms . . . are the source of the methods, problem-field, and standards of solution accepted by any mature scientific community at any given time. As a result, the reception of a new paradigm often necessitates a redefinition of the corresponding science.<sup>89</sup>

Heidegger indicates that at the time of his writing *Being and Time* such crises had already overtaken mathematics, physics, biology, the historical human sciences and theology.<sup>90</sup> Arguing that each science begins from a naive demarcation of subject matter on the basis of a pre-scientific manner of experiencing that domain, the adoption of such "rough" basic concepts eventually leads to the proliferation of so much information as to provoke inquiry into the ways in which the domain is constituted; that is, to provoke inquiry into the being of the entities uncovered in that domain: "The . . . real progress [of research] comes not so much from collecting results . . . as from inquiring into the ways in

which each particular area is basically constituted--an inquiry to which we have been driven mostly by reacting against just such an increase in information."<sup>91</sup> Now, in Kuhn's terms, Heidegger is speaking here of the origin of a crisis in a science's pre-paradigm period. Kuhn notes that

science can proceed without rules only so long as the relevant scientific community accepts without question the particular problem-solutions already achieved. . . . The pre-paradigm period, in particular, is regularly marked by frequent and deep debates over legitimate methods, problems, and standards of solution, though these serve rather to define schools than to produce agreement. . . . Furthermore, debates like these do not vanish once and for all with the appearance of a paradigm. Though almost non-existent during periods of normal science, they recur regularly when paradigms are first under attack and then subject to change.<sup>92</sup>

Once a paradigm is established, "normal" science proceeds until the accumulation of anomalies provokes a crisis and a reassessment of the accepted paradigm as the latter is confronted with alternatives. Nonetheless, all paradigms originate in an abstraction from Dasein's familiar experience of the being of those entities which science studies objectively and through these basic concepts science *interprets* this primordial ontological understanding of the entities in question. Thus, basic concepts

determine the way in which we get an understanding beforehand of the area of subject-matter underlying all the objects a science takes as its theme, and all positive investigation is guided by this understanding. . . . But since every such area is itself obtained from the domain of entities themselves, this preliminary research, from which the basic concepts are drawn, signifies nothing else than an interpretation of those entities with regard to their basic state of being.<sup>93</sup>

Kuhn, too, recognizes the way scientific paradigms limit the ontological understanding of a science. For example, concerning Descartes's contribution to the rise of modern physics, he remarks:

. . . after . . . Descartes' immensely influential scientific writings, most physical scientists assumed that the universe was composed of microscopic corpuscles and that all phenomena could be explained in terms of corpuscular shape, size, motion, and interaction. That nest of commitments proved to be both metaphysical and methodological. As metaphysical, it told scientists what sorts of entities the universe did and did not contain: there was only shaped matter in motion. . . . More important still, the corpuscular conception of the universe told scientists what many of their research problems should be.<sup>94</sup>

Nonetheless, as a "normal" science develops in the absence of major challenges to its accepted paradigm, the ontological implications of these basic concepts are lost sight of by scientific researchers themselves



and, of course, are systematically concealed by positivistic "philosophy of science." It is only at times of a crisis in its basic concepts that *some* practitioners of a science come to see that the basic concepts previously guiding research conceal more of that which needs to be understood about entities (their being) than is desirable, blocking further advance. Kuhn similarly notes the effect that the acceptance of a particular paradigm has on closing off various phenomena from scientific consideration:

. . . one of the things a scientific community acquires with a paradigm is a criterion for choosing problems that, while the paradigm is taken for granted, can be assumed to have solutions. To a great extent these are the only problems that the community will admit as scientific or encourage its members to undertake.

A paradigm can, for that matter, even insulate the community from those socially important problems that are not reducible to the puzzle form, because they cannot be stated in terms of the conceptual and instrumental tools the paradigm supplies.<sup>95</sup>

In Heidegger's view, the advance of a science from one paradigm to another is not a mere "addition" to an already existing store of knowledge, but a creative "laying-of-the-foundation" for further scientific advance under the guidance of the new set of basic concepts. In this way, subsequent scientific advance will be guided by a revised fore-structure of interpretation. Such "preliminary research" into the revision of basic concepts is an *ontological* investigation that, in Heidegger's view, must "run ahead" of the accumulation of knowledge of the positive sciences.<sup>96</sup>

Although he is in agreement with Heidegger that research into paradigms differs from the normal mode of scientific research in vogue once a paradigm has been accepted, Kuhn, unlike Heidegger, specifies that shifts from one paradigm to another take place only once the former paradigm is recognized as incapable of accounting for anomalies, aspects of objectivity discovered but hitherto left unexplained. Nonetheless, the abandonment of a paradigm meets with resistance:

Though they may begin to lose faith and then to consider alternatives, they do not renounce the paradigm that has led them into crisis. They do not, that is, treat anomalies as counter-instances. . . . The act of judgment that leads scientists to reject a previously accepted theory is always based upon more than a comparison of that theory with the world. The decision to reject one paradigm is always simultaneously the decision to accept another, and the judgment leading to that decision involves the comparison of both paradigms with nature and with each other.<sup>97</sup>

Heidegger notes in this respect that, because laying-the-foundations for science is an investigation into the being of entities propaedeutic to normal scientific research, it must differ in principle from "the kind of 'logic' which limps along after, investigating the status of some science as it chances to find it, in order to discover its 'method'."<sup>98</sup> That is, such "revolutionary" laying-the-foundation of science differs

radically from the positivist attempt to redefine scientific findings in terms of a "logical" reformulation of accepted scientific concepts and theories. Rather, laying the ontological foundations of a science "leaps ahead" of normal scientific research to disclose, as it were for the first time, a new "region" of being, which a subsequently reorganized normal scientific research might explore. Likewise, for Kuhn, "this issue of paradigm choice can never be unequivocally settled by logic and experiment alone".<sup>99</sup> Rather than being a matter of incremental change, a paradigm shift is akin to a sudden gestalt-switch:

Scientists then often speak of the "scales falling from the eyes" or of the "lightning flash" that "inundates" a previously obscure puzzle, enabling its components to be seen in a new way that for the first time permits its solution. . . . No ordinary sense of the term "interpretation" fits these flashes of intuition through which a new paradigm is born.<sup>100</sup>

Such an opening up of new horizons is, in Heidegger's terms, an ontological achievement of a sort sometimes found in the vision of a scientist of intuitive genius, such as Einstein, Bohr or Heisenberg, capable of creating new ways of posing scientific questions,<sup>101</sup> or of a sort sometimes achieved in the work of a philosopher struggling to ground science in the face of skeptical attack, for example, Kant.

Recently, Feyerabend has reiterated the decisive role played in scientific theory formation by what Heidegger calls the fore-structure of interpretation:

. . . the material which a scientist *actually* has at his disposal, his laws, his experimental results, his mathematical techniques, his epistemological prejudices, his attitude towards the absurd consequences of the theories which he accepts, is indeterminate in many ways, ambiguous, and *never fully separated from the historical background*. This material is also contaminated by principles which he does not know and which, if known, would be extremely hard to test.<sup>102</sup>

Further, according to Feyerabend, because of the indefiniteness of its historical origin, a paradigm "does not merely describe some objective state of affairs but also expresses some subjective, mythical, and long-forgotten view".<sup>103</sup> This fact forces us to take a fresh look at our conception of scientific method. Feyerabend anticipates the recurrence of older mythical and metaphysical ideas, suitably revised, as paradigms for future scientific research: we must recognize that "there is no idea, however ancient and absurd, that is not capable of improving our knowledge,"<sup>104</sup> because only the proliferation and confrontation of theories can enhance the critical power of science: "not only is the description of every single fact dependent upon *some* theory . . . but there also exist facts which cannot be unearthed except with the help of alternatives to the theory to be tested, and which become unavailable as soon as such alternatives are excluded."<sup>105</sup> In short, Feyerabend, like Heidegger, suggests that science neglects recognizing its hermeneutic character only at the cost of closing off fore-conceptions, hence access to facts, necessary for raising challenges to accepted theoretical constructions. Scientific advance through "revolutionary" shifts of paradigm

thus turns out to require the hermeneutical clarification of long discarded mythical and metaphysical ideas as well as the dominant paradigm. In this sense, Heidegger's attempt to take the question of Being as the clue with which to trace back through Kant, Descartes and Aristotle the ways in which Being has been covered up or disguised in Western metaphysics, so as to destroy the traditional content of ancient ontology and arrive at "those primordial experiences in which we achieved our first ways of determining the nature of Being,"<sup>106</sup> may, by promoting the clarification of the metaphysical roots of alternative scientific paradigms, increase their accessibility and utility for future scientific revolutions. Thus, with respect to the question of the progress of the sciences, fundamental ontology, via its interpretation of the succession of conceptions of Being--which Heidegger worked out in his studies of the history of Western metaphysics subsequent to *Being and Time*--makes possible an understanding of alternative paradigms which will be necessary for future scientific advance.

#### V. THE LATER HEIDEGGER AND THE LIMITS OF THE HERMENEUTIC-PHENOMENOLOGICAL CONCEPTION OF SCIENCE:

Heidegger has shown that investigation of the *a priori* conditions for the regional ontologies of the various kinds of entities which underlie the various normal sciences, e.g., number, living organisms, subatomic "particles," must precede normal scientific research if the latter is to revise itself successfully through successive crises. Yet, since in Heidegger's view all ontology, including such regional ontologies, "remains blind and perverted from its ownmost aim" if it has not first clarified the meaning of Being in general,<sup>107</sup> the success of fundamental ontology, which in Heidegger's view is the first step toward grasping the meaning of Being in general, is necessary for the successful ontological grounding of scientific knowledge. Seen in this light, the limited validity of science can be secured only to the extent that fundamental ontology can situate science's theoretical grasp of presence-at-hand in the larger context of an understanding of those of Dasein's structures by which science is "done," which at the same time will undermine the empirical (non-hermeneutical) conception of science. In other words, "a fully adequate existential interpretation of science cannot be carried out until the meaning of Being and the 'connection' between Being and truth have been clarified in terms of the temporality of existence."<sup>108</sup>

Unfortunately, Heidegger never completed this grounding of science envisaged in *Being and Time*. In his later philosophy, Heidegger views science primarily as an outgrowth of the modern metaphysics of the will, as a part of the degeneration of thinking which characterizes the modern (post-Cartesian) phase of the history of Western metaphysics, rather than in light of the existential analytic. Sharing in modern metaphysics' "forgetting of Being," science, in Heidegger's later view, is simply incapable of providing any original truths.<sup>109</sup>

In the "Letter on Humanism" Heidegger tells us that he held back the remainder of *Being and Time* because of the failure of phenomenological language to make possible that decisive overcoming of Western metaphysics which it had promised.<sup>110</sup> In the discussion of a seminar entitled "Time and Being," Heidegger states that he abandoned *Being and Time* after coming to believe its transcendentalism was still bound by the language of the metaphysical tradition it sought to undermine:

The fundamental experience of *Being and Time* is thus that of the oblivion of Being . . . in the Greek sense: concealment and self-concealing. . . . The thinking that begins with *Being and Time* . . . is thus, on the one hand, an awakening from the oblivion of Being . . . but on the other hand, . . . not an extinguishing of the oblivion of Being, but placing oneself in it and standing within it.<sup>111</sup>

In this light, Heidegger explains his abandonment of the view that the successful completion of fundamental ontology was necessary to grasp the meaning of Being in general:

the term "fundamental ontology" used to characterize the intention and the method of *Being and Time* . . . was then dropped. . . . When it is a matter of the question about the meaning of Being, . . . the development of Dasein's horizon of understanding is the condition for any development of an ontology which, so it seems, can only be built upon the fundamental ontology of Dasein. . . . This, however, is not true. . . . Thus, since the foundation of fundamental ontology is no foundation upon which something could be built. . . . [and] whereas the word "foundation" contradicts the preliminary character of the [existential] analytic, the term "fundamental ontology" was dropped.<sup>112</sup>

In other words, sometime rather soon after the publication of the fragment of *Being and Time*,<sup>113</sup> fundamental ontology was abandoned and along with it the very notion of its "fundamental" character and its suitability as a "base" for building, among other things, an "existential conception" of science. In this concluding section, I wish to discuss briefly what significance *Being and Time*'s hermeneutic phenomenological conception of science retains in light of Heidegger's own abandonment of the initial project of *Being and Time*.

It is important to note that Heidegger apparently did not intend that his abandonment of the original project of *Being and Time* should be taken as its complete rejection. Rather, he came to view his earlier work as having been a "half-attempt" to work out the question of Being.<sup>114</sup> Thus,

the thinking of the reversal is a change in my thought. But this change is not a consequence of altering the standpoint, much less of abandoning the fundamental issue of *Being and Time*. The thinking of the reversal results from the fact that I stayed with the matter-for-thought [of] *Being and Time*.<sup>115</sup>

At this point Heidegger detected already in *Being and Time* anticipations of his "reversal," according to which Being makes the approach to Dasein, rather than the reverse. Nonetheless, despite this "reversal", Heidegger finds a continuity in his path from *Being and Time* to "Time and Being" and other works of the period subsequent to the "reversal," Thus, "the basic question of *Being and Time* is not in any sense abandoned by reason of the reversal. . . . Contrary [to what is generally supposed], the question of *Being and Time* is decisively fulfilled in the thinking of the reversal."<sup>116</sup>

In the absence of the completion of the task set in projecting *Being and Time* as a whole, and in light of Heidegger's characterization of the essential validity of the task set in *Being and Time* (despite its phenomenological transcendentalism), the question remains as to whether the "preliminary deliberations" concerning the "central problematic" of an existential conception of science therein are an appropriate basis upon which to interpret the meaning of science.

In works such as *What is a Thing?*, "The Age of the World-As-Picture," "Science and Reflection," *What is Called Thinking?* and *Release-ment (Gelassenheit)*, Heidegger presents science and technology as dependent upon the unfolding of the destiny of Being in the history of Western metaphysics, taking up again the theme of the origins of science, but not from a transcendental ("existential") perspective as in *Being and Time*. It is clear that the later Heidegger has little interest in interpreting science in accordance with the existential analytic. The emphasis in the later works is upon the distinction between a thought which is domineering (as found in metaphysics, including both science and phenomenology), and a thought which is acquiescent, towards Being,<sup>117</sup> which allows Being to "presence itself". Yet, in his anticipation of what is most significant in our understanding of the contemporary crisis of science, and in his undermining of the positivistic distortion of science, even the early Heidegger surely has made a significant contribution to our understanding of the meaning of science and its results to date. It is important to note that Heidegger's attempt at a transcendental grounding of science which secures it while uncovering its ontological limits develops an attempt to clarify science which in principle lies beyond science itself.<sup>118</sup> Heidegger's later writings on science have a far more corrosive effect upon science. For example, in *What is Called Thinking?* Heidegger claims that science does not think, in the sense of attempting to think Being: "science . . . does not think, and cannot think--which is its good fortune, here meaning the assurance of its own appointed course."<sup>119</sup>

It is clear that the discussion of scientific research in *Being and Time* proceeds without reference to the way in which science is guided in advance by "technicity," the way in which Being manifests itself in the modern age. The shift of perspective constituting the "reversal" makes it possible for the later Heidegger to develop his conception of scientific research in a different direction than that given in *Being and Time*. Yet much of the analysis found in *Being and Time* is reiterated. For example, the *a priori* determining character of basic ontological concepts (paradigms) in science is reaffirmed:

Modern science's way of representing pursues and entraps nature as a calculable coherence of forces. Modern physics is not experimental physics because it applies apparatus to the questioning of nature. Rather the reverse is true. Because physics, indeed already as pure theory, sets nature up to exhibit itself as a coherence of forces calculable in advance, it therefore orders its experiments precisely for the purpose of asking whether and how nature reports itself when set up in this way.<sup>120</sup>

Thus, denying that the difference between Greek and modern science is merely one of their respective degrees of exactness, Heidegger notes

that the decisive difference between them lies in the fact that in the modern era cognition has established itself as a systematic procedure: the opening up of a sphere of being through the projection of a certain "basic concept" of nature which incorporates, among other notions, the definition of motion in terms of place and the absence of all qualitative distinctions among places and times.<sup>121</sup> Only in keeping with such a projection of an ontology of objectivity could science develop a methodology, which is something quite different from the acuteness of observation already established in Greek science. Modern, but not Greek, science can thus be described as "lawful": "It is only within the purview of rule and law that facts become clear as the facts that they are. Research into facts in the realm of nature is intrinsically the establishing and verifying of rule and law."<sup>122</sup>

This resolve to interpret nature in terms of facts, rule and law makes possible the investigation of nature not through mere observation, but through experiment, a topic not discussed explicitly in *Being and Time*. Heidegger points out that neither medieval *doctrina* nor Greek *episteme* were science in the sense of research, for neither projected nature in a manner as to make possible the conception of experiment:

Experiment begins with the laying down of law as a basis. To set up an experiment means to represent or conceive the conditions under which a specific series of motions can be made susceptible of being followed in its necessary progress; i.e., of being controlled in advance by calculation.<sup>123</sup>

This clearly is an extension of the conception of science found in *Being and Time*. In the same vein, in Heidegger's view, once scientific research has formulated itself as methodology, the way is open for the extension of science into domains other than the physical, making possible its specialization. Science thus takes on the character of "ongoing activity," a systematic management of research projects and the reciprocal checking and communication of results within the scientific community. As ongoing activity, science requires an orderly establishment within which to carry out its research tasks, an environment provided by the university setting, which, through its administrative structure, fosters the "striving apart" of the sciences and the enhanced specialization that belongs to their ongoing activity.

It would seem not unreasonable to suppose that, although its ontological framework has been called into question by the "reversal," *Being and Time's* hermeneutic phenomenological conception of science is substantially intact and even developed somewhat further in later works such as "The Question Concerning Technology" and "The Age of the World-As-Picture". Heidegger cannot be said to have abandoned his earlier conception of science altogether, although it may well be the case that his earlier analysis has been deepened with the working out of the destruction of history of Western metaphysics--which has required not merely one more "Part" to *Being and Time*, but its suspension and its author's setting out upon a path which was not anticipated in his earlier work.

In conclusion, I would submit that Heidegger has established that the conception of science is dependent upon the metaphysics of "forgetting Being"; that despite the limitations of *Being and Time's* analysis of

*praxis*, science does indeed originate in an unthematized "change-over" from circumspective encountering of entities in their readiness-to-hand to theorizing about them in their objectivity, as mediated by an unacknowledged metaphysics of substantiality; that the hermeneutic circle does permeate all human understanding, interpretation and communication including that of science; that paradigm-projection, not empiricism or induction, underlies scientific method; that the natural sciences, humanities, and social sciences all share in the limitations--and possibilities for extension of insight--which the hermeneutic circle imposes upon us; and that the positivistic paradigm of scientific method is both false and fundamentally misleading.

## ENDNOTES

<sup>1</sup> Leszek Kolakowski, *The Alienation of Reason* (Garden City: Doubleday, 1969), 8-9.

<sup>2</sup> Joseph J. Kockelmans, "Heidegger on the Essential Difference and Necessary Relationship between Philosophy and Science," in Joseph J. Kockelmans and Theodore J. Kisiel (eds.): *Phenomenology and the Natural Sciences* (Evanston: Northwestern University Press, 1970), 147-66.

<sup>3</sup> Hans Seigfried, "Heidegger's Longest Day: *Being and Time* and the Sciences," *Philosophy Today*, XXII (1978), 319-31.

<sup>4</sup> Seigfried, *op. cit.*, 321-22.

<sup>5</sup> Among the most interesting treatments of Heidegger's later (post-*Being and Time*) discussion of science are the following: Harold G. Alderman, "Heidegger's Critique of Science," *The Personalist*, L (1969), 549-58; Keith Hoeller, "Phenomenology, Psychology, and Science," *Review of Existential Psychology and Psychiatry* XVI (1978-79), 147-75; Don Ihde, *Technics and Praxis* (Dordrecht: Reidel, 1979), Chapter 9, "Heidegger's Philosophy of Technology"; Theodore J. Kisiel, "Science, Phenomenology and the Thinking of Being," in Kockelmans and Kisiel, *op. cit.*, 167-84; Theodore J. Kisiel, "On the Dimensions of a Phenomenology of Science in Husserl and the Young Dr. Heidegger," *Journal of the British Society for Phenomenology*, IV (1973), 217-34; Theodore J. Kisiel, "Heidegger and the New Images of Science," *Research in Phenomenology* VII (1977), 162-81; Joseph J. Kockelmans, "The Era of the World-As-Picture," Kockelmans and Kisiel, *op. cit.*, 184-201; and William J. Richardson, S.J., "Heidegger's Critique of Science," *New Scholasticism* XLII (1968), 511-36.

<sup>6</sup> Martin Heidegger, *Being and Time* (New York: Harper & Row, 1962), 54. (Page references are given to the marginal pagination provided by the translators, corresponding to the later German editions of *Sein und Zeit*).

<sup>7</sup> *Ibid.*, 55.

<sup>8</sup> *Ibid.*

<sup>9</sup> *Ibid.*, 56-57.

- <sup>10</sup> *Ibid.*, 57, n. 1.
- <sup>11</sup> Heidegger, "The Age of the World Picture," *The Question Concerning Technology and Other Essays* (New York: Harper & Row, 1977), 11.
- <sup>12</sup> A similar point concerning the necessary class character of *praxis* is made by Thomas Blakely in "Response to 'Theory and Practice'," *Cultural Hermeneutics* II (1975), 353-54.
- <sup>13</sup> Cf. Marx and Engels, *Collected Works* IX (New York: International Publishers, 1977), 211.
- <sup>14</sup> On Marx's theory of *praxis*, cf. Adolfo Sanchez Vasquez, *The Philosophy of Praxis* (London: Merlin Press, 1977). On the possible influence of Marx on Heidegger, as mediated through Lukacs, cf. Lucien Goldman, *Lukacs and Heidegger* (London: Routledge & Kegan Paul, 1977), 27-39.
- <sup>15</sup> *Being and Time*, 58-59.
- <sup>16</sup> *Ibid.*, 59.
- <sup>17</sup> *Ibid.*, 360-61.
- <sup>18</sup> *Ibid.*, 361.
- <sup>19</sup> *Ibid.*, Heidegger's italics deleted.
- <sup>20</sup> *Ibid.*, 102-04.
- <sup>21</sup> *Ibid.*, 362.
- <sup>22</sup> *Ibid.*, 421-25.
- <sup>23</sup> *Ibid.*, 362.
- <sup>24</sup> *Ibid.*, 363.
- <sup>25</sup> *Ibid.*
- <sup>26</sup> *Ibid.*, 357.
- <sup>27</sup> *Ibid.*, 358.
- <sup>28</sup> *Ibid.*
- <sup>29</sup> *Ibid.*
- <sup>30</sup> *Ibid.*, 359.
- <sup>31</sup> Kockelmans, "Heidegger on the Essential Difference and Necessary Relationship between Philosophy and Science," 161-62.
- <sup>32</sup> Heidegger, for example, attempted such a hermeneutical working out of scientific theorizing and the history of the seventeenth century scientific revolution in *What is a Thing?*



- <sup>33</sup> *Being and Time*, 150.
- <sup>34</sup> *Ibid.*
- <sup>35</sup> *Ibid.*, 149.
- <sup>36</sup> *Ibid.*
- <sup>37</sup> *Ibid.*, 150.
- <sup>38</sup> *Ibid.*, 151.
- <sup>39</sup> *Ibid.*, 152, italics added.
- <sup>40</sup> *Ibid.*, 314-15.
- <sup>41</sup> *Ibid.*, 315.
- <sup>42</sup> A strikingly similar point concerning the circularity of understanding in the natural sciences was made by Hegel in Chapter 3 of *The Phenomenology of Spirit*.
- <sup>43</sup> *Being and Time*, 315.
- <sup>44</sup> On the projection of the "paradigm" of mathematical nature in Galileo, cf. Husserl, *The Crisis of the European Sciences and Transcendental Phenomenology* (Evanston: Northwestern University Press, 1970), 23-57.
- <sup>45</sup> *Being and Time*, 157.
- <sup>46</sup> *Ibid.*, 157-58
- <sup>47</sup> *Ibid.*, 153.
- <sup>48</sup> Cf. Gerard Radnitzky, *Contemporary Schools of Metascience*, vol. II (New York: Humanities Press, 1970), 23.
- <sup>49</sup> *Ibid.*
- <sup>50</sup> *Ibid.*, 25.
- <sup>51</sup> *Ibid.* Cf. also Hans-Georg Gadamer, *Truth and Method* (New York: Seabury, 1975), 231.
- <sup>52</sup> Cf. Thomas McCarthy, "On Misunderstanding 'Understanding'," *Theory and Decision* III (1973), 364.
- <sup>53</sup> *Ibid.*, 365, paraphrasing Gadamer.
- <sup>54</sup> Gadamer, "The Problem of Historical Consciousness," *Graduate Faculty Philosophy Journal* V (1975), 3.
- <sup>55</sup> Plato, *Meno*, 80 d-e.
- <sup>56</sup> *Being and Time*, 152.
- <sup>57</sup> *Ibid.*, 153.

- <sup>58</sup> Galileo, *Opere Complete* (Florence, 1842), IV, 17.
- <sup>59</sup> Descartes, *Regulae*, I-III.
- <sup>60</sup> *Ibid.*, Rule V.
- <sup>61</sup> Descartes, *Discourse on Method*, Part V.
- <sup>62</sup> Heidegger, *What is a Thing?* (Chicago: Regnery, 1969), 102.
- <sup>63</sup> E.A. Burtt, *The Metaphysical Foundations of Modern Science* (Garden City: Doubleday, 1954), 213.
- <sup>64</sup> Isaac Newton, *Mathematical Principles of Natural Philosophy* (Berkeley: University of California Press, 1970), 398-400.
- <sup>65</sup> *Ibid.*, 398-99.
- <sup>66</sup> Cf. Radnitzky, *op. cit.*, 77.
- <sup>67</sup> *Being and Time*, 226.
- <sup>68</sup> *Ibid.*, 227.
- <sup>69</sup> *Ibid.*, 225, Heidegger's italics removed.
- <sup>70</sup> Kockelmans, "Heidegger on the Essential Difference and Necessary Relationship between Philosophy and Science," 165.
- <sup>71</sup> *Ibid.*
- <sup>72</sup> *Ibid.*
- <sup>73</sup> *Ibid.*, 165-66.
- <sup>74</sup> *Being and Time*, 153.
- <sup>75</sup> In the following discussion the term "human sciences" shall refer to the classic humanities, e.g., philology, literary (and other textual) interpretation, philosophy, historiology, comparative religion. Thus, Heidegger will be seen as contrasting the humanities with the natural sciences in various ways. The social sciences, e.g., economics, sociology, political science, ethnology, shall be ignored intentionally because of special problems they raise. It is possible that in certain respects they share characteristics of the natural sciences while, in others, share some of those of the humanities.
- <sup>76</sup> *Being and Time*, 382-97.
- <sup>77</sup> *Ibid.*, 375. Cf. also the debate over the possibility of a "scientific" history in the positivistic sense, e.g., the discussion between Hempel and Dray in Sidney Hook (ed.), *Philosophy and History* (New York: New York University Press, 1963), 108-10 and 146-58.
- <sup>78</sup> *Being and Time*, 153.

<sup>79</sup> Heidegger, "What is Metaphysics?," *Existence and Being* (Chicago: Regnery, 1965), 326.

<sup>80</sup> Typical of this positivist distortion of the circularity of interpretation into a call for "empathic" understanding (*Verstehen* in the pejorative sense) are Theodore Abel, "The Operation Called *Verstehen*," *The American Journal of Sociology*, LIV (1948), 211-18 and Richard Rudner, "On the Objectivity of Social Science," *Philosophy of Social Science* (1966), 71-83.

<sup>81</sup> *Being and Time*, 150.

<sup>82</sup> Cf. J.L. Mehta, *Martin Heidegger: The Way and the Vision* (Honolulu: The University Press of Hawaii, 1976), 160.

<sup>83</sup> Roy Bhaskar, *The Possibility of Naturalism* (Atlantic Highlands: Humanities Press, 1979), 195-97.

<sup>84</sup> *Ibid.*, 197.

<sup>85</sup> Cf. McCarthy, *op. cit.*, 367.

<sup>86</sup> Heidegger's anticipation of Kuhn has been discussed by Hoeller, *op. cit.*, 164-69 and has been mentioned by both Seigfried, *op. cit.*, 323, 329, and by Kisiel, "Heidegger and the New Images of Science," 169.

<sup>87</sup> Cf. Kisiel, "Science, Phenomenology, and the Thinking of Being," 168-70.

<sup>88</sup> *Being and Time*, 9.

<sup>89</sup> Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1977), 103.

<sup>90</sup> *Being and Time*, 9-10.

<sup>91</sup> *Ibid.*, 9.

<sup>92</sup> Kuhn, *op. cit.*, 47-48.

<sup>93</sup> *Being and Time*, 10.

<sup>94</sup> Kuhn, *op. cit.*, 41.

<sup>95</sup> *Ibid.*, 37.

<sup>96</sup> *Being and Time*, 10.

<sup>97</sup> Kuhn, *op. cit.*, 77.

<sup>98</sup> *Being and Time*, 30.

<sup>99</sup> Kuhn, *op. cit.*, 94.

<sup>100</sup> *Ibid.*, 122-23.

<sup>101</sup> Heidegger, *What is a Thing?*, 67

- <sup>102</sup> Paul Feyerabend, *Against Method* (London: Verso, 1978), 66.
- <sup>103</sup> *Ibid.*, 67.
- <sup>104</sup> *Ibid.*, 11.
- <sup>105</sup> *Ibid.*, 39.
- <sup>106</sup> *Being and Time*, 22.
- <sup>107</sup> *Ibid.*, 11.
- <sup>108</sup> *Ibid.*, 357.
- <sup>109</sup> Herbert Spiegelberg, *The Phenomenological Movement*, Vol. I (The Hague: Nijhoff, 1965), 315-16.
- <sup>110</sup> Heidegger, "Letter on Humanism," in William Barrett and Henry D. Aiken (eds.): *Philosophy in the Twentieth Century*, vol. III (New York: Random House, 1962), 274.
- <sup>111</sup> Heidegger, "Summary of a Seminar on the Lecture 'Time and Being'," in *On Time and Being* (New York: Harper & Row, 1972), 29-30.
- <sup>112</sup> *Ibid.*, 31-32.
- <sup>113</sup> Hoeller discusses Heidegger's withholding of the intended third Division of Part I of *Being and Time*, *op. cit.*, 150-51.
- <sup>114</sup> Heidegger, *op. cit.*, 44.
- <sup>115</sup> Heidegger, "Preface" to William J. Richardson, S.J., *Heidegger: Through Phenomenology to Thought* (The Hague: Nijhoff, 1963), xvi.
- <sup>116</sup> *Ibid.*, xviii.
- <sup>117</sup> Alderman, *op. cit.*, 549.
- <sup>118</sup> Kockelmans, "Heidegger on the Essential Difference and Necessary Relationship between Philosophy and Science," 148.
- <sup>119</sup> Heidegger, *What is Called Thinking?* (New York: Harper & Row, 1968), 8.
- <sup>120</sup> Heidegger, "The Question Concerning Technology," *The Question Concerning Technology and Other Essays* (New York: Harper & Row, 1977), 21.
- <sup>121</sup> Heidegger, "The Age of the World Picture," *ibid.*, 118-20.
- <sup>122</sup> *Ibid.*, 120.
- <sup>123</sup> *Ibid.*, 121.