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Heidegger on Science and Naturalism

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Heidegger's reputation in the Anglophone philosophical world suggests that he was unsympathetic to the natural sciences, and generally unconcerned with the philosophy of science. Even among those who know his work, philosophy of science is not usually considered central to Heidegger, nor is he seen as a significant contributor to philosophy of science. This dissociation is evident in the recent secondary literature: several comprehensive volumes on Heidegger's philosophy (Guignon 1993, Dreyfus and Hall 1992) include no essays about his philosophy of science, while Heidegger's views are almost never considered by Anglophone philosophers of science. Yet the dismissal of Heidegger's involvement with philosophy of science is mistaken from both directions. I shall argue not merely that Heidegger made significant contributions to philosophical understanding of the sciences, but that philosophy of science was at the center of his project and its development throughout his career. To capture this centrality, I will examine Heidegger's conception of science and its relation to philosophy at several key points in his philosophical work.

Science and Philosophy in Being and Time

Understanding Heidegger's philosophy of science requires situating his project with respect to the epistemological anti-naturalism that was central to neo-Kantianism and Husserlian phenomenology. Relations between philosophy and the sciences had taken on new urgency for many early-20th Century philosophers. The dramatic successes of physics and chemistry, and the recent emergence of rigorous scientific disciplines in the human and life sciences, gave plausibility to philosophical naturalism. Naturalists believed that the concerns and subject matter traditionally accorded to philosophy could be better served by empirical research in the relevant sciences. Heidegger's Freiburg predecessor Edmund Husserl exemplified a widespread philosophical response to the perceived threat of naturalism. Husserl (1981) argued against naturalists that the empirical sciences could not account for their own normativity. In particular, no empirical science could establish the meaning and validity of scientific claims themselves. A radically different kind of philosophical science was therefore needed, one that did not merely describe how the world is, but showed how it must or ought to be understood.

For both Husserl and the neo-Kantians (including the logical positivists), philosophical reflection on science concerned scientific knowledge. Science aspired to establish objectively valid knowledge, while philosophy sought to clarify the grounds for its validity. Initially, it might seem obvious that observational evidence is the basis for empirical knowledge. Yet it was not so obvious how empirical evidence was related to scientific judgments or statements about

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the world so as to underwrite their objective validity.² The challenge in accounting for scientific validity or objectivity was complex. First, one had to understand how scientific claims were meaningful, that is, how scientific statements or judgments described the world in one way rather than another. Second, one had to understand how empirical evidence could either justify or challenge such representations. Moreover, there were dual barriers to meeting each challenge. It was not sufficient to establish a contingent motivational or causal relation between making a claim and either having an experience or accepting other claims. Valid claims express what any rational knower ought to say, on the basis of the relationship invoked as grounds. The grounds for the meaning and justification of scientific claims thus must be normative rather than merely empirically contingent, and their grounding must be intersubjective.

Ignoring otherwise important differences, we can recognize two common features in Husserl's and the neo-Kantians' responses to these challenges. First, the grounds provided for the meaning and validity of scientific knowledge were rationally or transcendently necessary structures or relations. Second, the domain of these necessary structures or relations was independent of the contingencies of the world in which we find ourselves. No mere facts about this world determine what we ought to do or think. Hence, in seeking grounds for epistemic norms, these philosophers consigned their reflections to the "extrawordly" realms of pure logic or transcendental consciousness. Logic was not an empirical science of how people actually reason, but a study of formal structures or norms that actual thinking may not satisfy. Husserlian transcendental consciousness was likewise not a contingent psychophysical domain examined empirically, but a realm of pure meanings that become accessible only when concern with worldly existence is temporarily suspended. In each case, the actual claims made in the sciences in response to contingent empirical events were taken to be meaningful and justified because they (imperfectly) instantiated ideal structures of rational or eidetic necessity.

In his early work, Heidegger endorsed Husserl's call for philosophy as a "rigorous science" more fundamental than any empirical science could be. He nevertheless radically re-conceived the nature of this philosophical science, and its consequent relation to other disciplines. For Husserl and most of their contemporaries, the sciences sought knowledge, and philosophy was to assess and secure the sense and justification of scientific claims to knowledge. Heidegger conceived philosophy instead as "fundamental ontology." The sciences are ways of dealing with entities (beings), whereas philosophy's proper task was to inquire about being. Heidegger's distinction between being and entities has been widely misunderstood. We can first approach it as a critical response to the dominant conception of philosophy as epistemology (theory of knowledge).

Epistemologists treat knowledge as a relation among entities: a knower, an object known, and the knower's representation of the known. The task is then to understand how these entities ought to be related to achieve genuine knowledge. Heidegger thought that unexamined, erroneous presuppositions underlay any such conception of knowers as a special kind of entity (e.g., a mind, consciousness, language-speaker, or rational agent), and of knowledge as a relation

² This problem was of course central to Sellars's (1996) mid-century challenge to empiricism in "Empiricism and the Philosophy of Mind," and the problem has attained renewed prominence from McDowell's (1994) treatment in Mind and World.

between entities, insisting that “we have no right to resort to dogmatic constructions and to apply just any idea of being and actuality to this entity [that we ourselves are], no matter how ‘self-evident’ that idea may be” (1953, 16). In posing the question of being (of what it means to be, or of the intelligibility of entities as entities), Heidegger sought to circumvent unexamined assumptions about knowledge or consciousness, and engage in a more radical philosophical questioning. Drawing upon Greek and medieval philosophy, he spoke of the “being” of an entity as a way of considering its intelligibility as the entity it is. In taking over this term, Heidegger sought to avoid assuming that the intelligibility (“being”) of entities is itself an entity (a meaning, an appearance, a concept, or a thought).

Heidegger’s questioning about being made an initial move in the direction of naturalism. His philosophical contemporaries had sought philosophical grounding for the sciences in some realm of necessity independent of the contingencies of the world in which we happen to find ourselves. No facts about this world could tell us what we ought to do or think. Hence, these philosophers looked to the extra-worldly realms of pure logic or transcendental consciousness as the locus of philosophical inquiry. Logic was not an empirical science of how people actually reason, but a study of the purely formal structures or norms that actual thinking only imperfectly realizes. Husserlian transcendental consciousness was likewise not a contingent psychophysical object available to empirical psychology, but a realm of pure meanings that become accessible only when concern with worldly existence is temporarily suspended.

Heidegger rejected any such suspension of “natural” involvement in the world. Indeed, this rejection was an important motivation for his rejection of epistemology as “first philosophy,” in favor of attempting to re-awaken the question of being. Heidegger fundamentally objected to Husserl’s and the neo-Kantians’ turn away from the concrete, historical world in which human agents are situated. By locating the normativity of human activity and understanding in ideal necessities of transcendental consciousness or pure logic, Husserl and the neo-Kantians disconnected philosophical reflection from our actual worldly situation. Heidegger proposed instead to begin with our “average, everyday” activities, and “to work out the idea of a ‘natural conception of the world’” as the starting point for philosophical interpretation (1953, 43, 52)

A natural conception of the world needed working out, because philosophical preconceptions about knowledge and the mind had supposedly blocked understanding even of our most familiar, unreflective activities. Husserl, for example, assimilated everyday life and scientific knowledge as exemplifying a “natural attitude” that was antithetical to philosophy. Nor was Husserl alone in thus taking all ordinary human activities to involve cognition or knowledge. In his attempt to avoid reifying relations between knower and known by avoiding epistemological presuppositions, Heidegger was thus led to reconceive human understanding. Most philosophers take mental states or propositional attitudes (perceiving, judging, desiring) as our basic way of relating to and understanding things. Heidegger proposed instead to start philosophical reflection with our most ordinary, familiar dealings with our surroundings. He talked more encompassingly of our various dealings with or comportments toward entities, and challenged the presumption that such comportments always at least implicitly involve mental or linguistic representation or cognition. Adapting the term ‘Dasein’ for the entity we ourselves are (in part to set aside some of our philosophical prejudices about the being of this entity), Heidegger claimed that,

[Dasein] never finds itself otherwise than in the things themselves, and in fact in those things that daily surround it. It finds itself primarily and constantly in things because, tending them, distressed by them, it always in some way or other rests in things. Each one of us is what he pursues and cares for. (1982, 159)

In everyday comportment, we understand the entities we encounter, but Heidegger construed understanding as practical competence rather than cognition or mental representation (1953, 143). Cognition and knowledge were supposedly derivative from (“founded upon”) such everyday practical understanding.

Heidegger argued that this everyday practical understanding embedded in our ordinary comportments toward entities should be recognized as an unreflective understanding of the being of those entities. This everyday understanding of being was manifest as a *Seins-können*, an “ability-to-be.” Indeed, a central claim in *Being and Time* was that any understanding of entities as entities presupposes an understanding of being. This seemingly obscure claim is partially clarified by Haugeland’s (1998) parallel to chess. One cannot encounter a rook without some grasp of the game of chess. In Heidegger’s terms, the “discovery” of chess entities (pieces, positions, moves, or situations) presupposes a prior “disclosure” of chess as the context for their making sense. The “being” of rooks or knight forks is their place within the game, conferring their intelligibility as the entities they are. The game itself only makes sense, however, as a possible way for us to comport ourselves, something we “know how” to be. In any comportments toward entities, then, what we most fundamentally understand is the world as a significant configuration of possible ways for Dasein to be, and our own being-toward those possibilities:

What understanding, as an *existentiale* [(an essential structure of our way of being)], is competent over is not a “what”, but being as existing. ... Dasein is not something occurrent which possesses its competence as an add-on; it is primarily being-possible. (1953, 143).

The difficult point to grasp here is Heidegger’s claim that “world” (the situation or context) whose disclosure enables discovery of entities, is not itself an entity or a collection of entities. If we ask what there is, there is nothing but the various and sundry entities we can discover. But we can discover them only because we understand being, and thereby belong to an historically specific situation or “world,” a meaningful configuration of possible ways for us to be. The words ‘possible’ or ‘possibility’ can be misleading, however. Heidegger did not mean possible actualities (definite objects, properties and relations that might have obtained, but actually do not), but actual possibilities (an orientation toward definite but not fully determinate ways for us to be). We can comport ourselves toward possibilities without representing them as such, even implicitly.

With this quick primer on the relation between Heidegger’s conception of ontological understanding, in contrast to the predominant epistemological conception of our relations to entities, we can now ask how Heidegger (in *Being and Time*) conceived of science and its relation to philosophy. Heidegger’s early philosophy of science had three principal themes: the priority of fundamental ontology to science, the need for an “existential conception of science,” and the ontological significance of science as the discovery of the occurrent (*Vorhanden*).

Heidegger’s understanding of philosophy as fundamental ontology sharply contrasted to

traditional logical and epistemological conceptions of philosophy's contribution to science. The latter, he thought, "lag behind, investigating the standing a science happens to have" so far (1953, 10). Such approaches belie the futural orientation of scientific research, and thus utterly misunderstand what matters in science. Heidegger thought that

the authentic [*eigentlich*] 'movement' of the sciences takes place in the more or less radical and self-transparent revision of their basic concepts. The level of a science is determined by the extent to which it is capable of a crisis in its basic concepts. (1953, 9)

A philosophy of science that defines its normative task by the already accepted orientation of a particular scientific discipline aims to secure what science itself seeks to surpass. Heidegger thought philosophy could instead contribute

a productive logic, in the sense that it leaps ahead, so to speak, into a particular region of being, discloses it for the first time in the constitution of its being, and makes the structures it arrives at available to the positive sciences as guidelines for their inquiry" (1953, 10).

Heidegger thought philosophy could do this because the sciences, like any other human activities, proceed from a prior understanding of the being of the entities they encounter. Such understanding involves a practical grasp (not an articulated description) of what entities are involved, how to approach them in revealing ways, and what would amount to success in dealing with them.

The discovery and articulation of what there is in a particular scientific domain draws upon and further develops this prior disclosure of their being. Philosophical reflection upon a particular science's understanding of being (its "regional" ontology) considers the a priori conditions of the possibility of investigating entities in its domain (1953, 11), but it would not thereby seek a priori knowledge. In work leading up to Being and Time, Heidegger (1985) claimed that "the original sense of the a priori" had nothing to do with knowledge. He instead used the term 'a priori' to designate what is ontologically prior, the conditions of possibility of entities themselves (as the kind of entities they are) rather than conditions of possibility of our knowledge of entities. Heidegger's call for reflection upon the a priori conditions of possibility of entities thus directly opposed any armchair philosophy seeking a priori knowledge. Heidegger instead noted approvingly (1953: 9-10) that many contemporary scientific disciplines (specifically mathematics, physics, biology, the historical sciences, and theology) were engaged in renewed reflections upon their conceptual foundations, and that such developments were appropriately philosophical turns within those disciplines. Philosophical ontology should be continuous with such scientific developments. His explicit models for philosophical ontology were the contributions of Plato, Aristotle, and Kant. In the latter case, he thought, "the positive outcome of Kant's Critique of Pure Reason lies in its contribution to working out what belongs to any nature whatsoever, not in a 'theory' of knowledge" (1953, 10-11). Kant's work was not "prior" to Newton, but a philosophical (ontological) engagement with Newtonian physics.

Heidegger thought that philosophy could distinctively contribute to ontological reflection within any particular science for two reasons. The most important reason was that the "regional" disclosure of being within any particular scientific domain was supposedly dependent upon an understanding of being in general. Just as understanding rooks requires understanding chess, and chess is understood as a possible mode of Dasein's being-in-the-world, so Heidegger thought that

disclosing the being of entities within any scientific domain presupposes an understanding of being in general. Until this understanding of being had been clarified, any regional ontology, “no matter how rich and tightly linked a system of categories it has at its disposal, remains blind and perverted from its ownmost aim” (1953, 11).

The second reason that early Heidegger saw philosophical reflection as essential for science turned upon his proposed “existential” conception of science. Heidegger thought an “existential” conception of science was needed, because “sciences, as human comportments, have [Dasein’s] way of being” (1953, 11). Dasein’s way of being is future-oriented; it “presses forward into [its] possibilities,” and does so out of concern for its own being. Dasein’s most basic relation to itself is not self-consciousness, but care: Dasein is “the entity whose own being is at issue for it” (1953, 42), such that everything it does responds to that issue. Note that for Heidegger, terms such as ‘care’, ‘concern’, or ‘solicitude’ refer not to mental states, but to whole ways of comporting oneself. An existential conception of science would not emphasize public behavior over private mental states, however; Heidegger sought to avoid familiar distinctions between “inner” and “outer” or public and private realms. The important contrast was temporal: an existential conception of science emphasized scientific possibilities, in contrast to “the ‘logical’ conception which understands science with regard to its results and defines it as an ‘inferentially interconnected web [*Begründungszusammenhang*] of true, that is, valid propositions” (1953, 357). Heidegger thus focused upon science as something people do, rather than scientific knowledge as acquired and assessed retrospectively. Understood existentially, science is not the accumulation of established knowledge, but is always directed ahead toward possibilities it cannot yet fully grasp or articulate.

Heidegger gave philosophical priority to his existential-ontological conception of science, but also thought that the greater familiarity of logical and ontical conceptions showed something important about science. Although science always presupposes an understanding of being, the scientific project of discovering what and how entities are within its domain obscures the understanding of being that makes inquiry possible. Its determined focus upon the entities it investigates takes for granted the understanding of being that provides its focus. We can now grasp the second reason Heidegger thought that philosophy was indispensable to science, as a challenge to a “normalizing” tendency inherent in scientific research itself (Haugeland 1998, ch. 13; 2000). Thomas Kuhn’s (1970) account of normal science eloquently expresses that tendency in scientific work which Heidegger thought made it inevitably dependent upon philosophical questioning (regardless of whether it is scientists or philosophers who raise such questions). For Kuhn as for Heidegger, “normal” science avoids controversy over fundamentals in order to develop with greater detail and precision its unquestioned conceptual and practical grasp of a domain of entities. Left to their own devices, both thought, the sciences suppress any fundamental questioning of how their domains constitute fields of possible inquiry. When such questioning becomes unavoidable through the breakdown of positive research into a particular domain, scientists do not then undertake ontological inquiry for its own sake, but seek only to reconstitute their ability to attend carefully to entities without having to inquire into their being. Where Kuhn and Heidegger diverged was that Kuhn endorsed this closing off of ontological inquiry, whereas Heidegger did not.

Heidegger nevertheless saw scientific normalization as an essential ontological dimension

of science, rather than a contingent and possibly objectionable psychological tendency or social pressure. Here emerges the final theme in Heidegger's early philosophy of science, the connection between science and "occurrentness" (*Vorhandenheit*) as a mode of being. Although Heidegger insisted even in *Being and Time* that being was not itself an entity, there could still be a science of being (fundamental ontology) because there were articulable distinctions within the understanding of being. These "fundamental" distinctions did not define the regional ontologies demarcating domains of entities studied by positive sciences (nature, mathematics, language, history, and the like), but instead marked different ways of being, which are different ways in which entities can be intelligible as entities. Most basically, Heidegger distinguished the being of Dasein (being-in-the-world) from "innerworldly" ways of being. Dasein is a particular entity, but Heidegger was interested in care as the being of Dasein, and the disclosedness of entities that was integral to Dasein as care. The distinction between Dasein as an entity, and care as the being of Dasein, is crucial; Heidegger sought to understand being as the intelligibility of entities, not to do empirical anthropology.

Heidegger initially distinguished Dasein's way of being as care from the "occurrentness" of things (including the misconception of ourselves as a kind of occurrent entity, such as a mind, soul, ego, body, or person). He then argued, however, that the entities we deal with in our ordinary everyday lives are not occurrent either. Equipment is not a collection of entities with intrinsic properties. Something can only be a hammer, in his familiar example, in "relation" to nails, boards, carpentry, and ultimately those human activities for which hammering and fastening are integral. These interrelations are more ontologically basic than the relata:

Strictly speaking, there is no such thing as an equipment. ... [Equipmental] "things" never show themselves initially for themselves, so as to fill out a room as a sum of real things.

What we encounter as closest to us, although unthematically, is the room. (1953, 68)

Moreover, equipment works best when we needn't think about it at all, and can focus on the task at hand (what is ahead of us). The being of equipment is not the occurrentness of an entity with properties, but the availability of such normally tacit functionality.

One kind of equipment does call attention to itself, however. Signs only function when we notice them. Signs still have the being of equipment, signifying only within a larger practical context. Assertions, however, are signs that allow things to show up differently. Assertions point out entities and make them communicable. Heidegger thought that assertion is in this respect dependent upon everyday practical involvement. Talk about things as occurrent presupposes a practical understanding of an equipmentally interconnected "world."

The ontological significance of science for early Heidegger was bound up with linguistic assertion as a derivative mode of interpretation. To this extent, Heidegger's early philosophy of science remained quite traditional. Science describes entities, and thereby strips them of ordinary human significance. Some assertions do place entities within a local, practical situation. In science, however, we discover entities shorn of their practical involvements, as merely occurrent. We then talk about a hammer not as appropriate and available for a task at hand, but as an object with mass and spatiotemporal location. It thereby acquires a new mode of intelligibility. Its local, contextual involvements are displaced by a theoretical contextualization:

What is decisive for the development [of mathematical physics] ... lies in the mathematical projection of nature itself. This projection discovers in advance something

constantly occurrent (matter), and opens the horizon to look for guidance to its quantitatively determinable constitutive aspects (motion, force, location, and time). (1953, 362)

In talking about a “mathematical” projection, however, Heidegger was emphasizing science’s prior ontological determination of entities, not its partially quantitative character:

Ta mathēmata means for the Greeks that which man knows in advance in observing entities and dealing with things: the corporeality of bodies, the vegetable character of plants, the animality of animals, the humanness of man. (1950, 71-72)

This ontological understanding of theoretical interpretation served two roles for Heidegger. He recognized the disclosure and theoretical articulation of entities as occurrent as a genuine, truthful accomplishment of empirical science. This accomplishment, however, was doubly dependent upon its clarification through philosophical ontology.

In the most obvious dependence, science and cognition more generally are derivative modes of understanding. Assertions about occurrent entities are intelligible only through Dasein’s prior immersion in a world. Fundamental ontology then clarifies the relation between assertions in theoretical science and the understanding of being they presuppose, for example, by showing how the theoretical discovery of occurrent entities arose by modifying everyday involvement with available equipment (1953, section 69b). But scientific assertion was also supposedly derivative in a more troubling way. Assertions can correctly “point out” entities as occurrent. But assertions also thereby indispensably allow what-is-said (*das Geredete*) to be passed on in “idle talk” (*Gerede*) that obscures understanding. Assertions are “ambiguous” in that they can be uttered with or without understanding, and most important, with or without responsibility to what is being talked about. In making understanding communicable, assertion also makes possible a mere semblance of understanding.

Grasping why Heidegger thought scientific assertions relentlessly turn us away from genuine understanding requires further consideration of Heidegger’s treatment of assertion and meaning. This account of assertion and meaning further highlights the significant, but rarely noticed affinities between Heidegger’s early philosophy of science and naturalism. I have already mentioned Heidegger’s insistence upon the worldly character of human understanding, rejecting any recourse to an immaterial realm of pure logic or transcendental consciousness as the locus of thought’s accountability to norms. Heidegger’s account of assertion goes further in this direction, however. Most of his philosophical contemporaries, impressed by the need to understand error and thought about non-existent things, posited meanings as intermediaries between thought and things. We can talk and think about what does not exist, or falsely about what does exist, because our grasp of meanings is more basic than our acquaintance with things.

Heidegger rejected such appeals to semantic intermediaries. Assertions “point out” entities themselves, not meanings:

The assertion [‘the picture on the wall is hanging crookedly’] ... in its ownmost meaning is related to the real picture on the wall. What one has in mind is the real picture, and nothing else. (1953, 217)

Like advocates of causal theories of reference nowadays, Heidegger accounted for linguistic articulation by situating talk within a larger pattern of interaction, rather than within a linguistic or theoretical structure. Error is a holistic relation to the entities with which we actually interact

discursively, not a direct grasp of meanings that fail to represent anything correctly. Heidegger differed from today's advocates of a causal theory of reference in taking our more basic dealings with our surroundings to be practical-normative rather than causal. They make common cause, however, in construing language as interaction with the world rather than as a formal structure of meanings connected to the world only indirectly.

For Heidegger, however, the claim that assertion is a comportment toward entities gives heightened and ironic significance to the possibility of repeating what is asserted. By making what-is-said communicable, assertions can become distant from the entities they point out and are accountable to. Their proximate grounds then become not the entities themselves, but other assertions. There are two distinct ways in which such "idle talk" substitutes other assertions for the entities talked about as what is primarily understood. Most obviously, assertions can be grounded in testimony: I can make an assertion not from my own understanding of how things stand, but as merely passing on what others say, with the anonymous authority of what "one" says. But assertions can also be grounded inferentially upon other assertions, with their authority mediated by complex networks of other claims. These two forms of interdependence are intertwined, for developing and sustaining complex networks of belief requires sharing and passing on what others say.

The indispensability of inferential networks for scientific understanding highlights Heidegger's insistence that his account of idle talk is not altogether disparaging. He did not reject articulated theoretical understanding, but only recognized that in developing more extensively articulated theoretical networks, the sciences risk becoming more invested in their own vocabularies and theories than in the things to be understood. Contrary to the sciences' familiar fallibilist image, Heidegger worried that the development of a science closes off the possibility that entities might resist our familiar ways of encountering and talking about them. For Heidegger, science needed philosophy in order to remain "in the truth." The greatest danger in science was not error, which is more readily correctable by further inquiry, but the emptiness of assertions closed off from genuine accountability to entities (in this respect, Heidegger's concern bears interesting affinities to McDowell 1994). Thus, Heidegger insisted that truth as correct assertion was grounded in a more fundamental sense of truth as "unhiddenness": correctness alone would not yield genuine understanding unless the entities themselves were continually wrested away from burial in mere talk. We can then connect Heidegger's account of science as the discovery of entities as occurrent, and his insistence upon the need to ground science in fundamental ontology. In focusing upon the cognitive discovery of the occurrent, science inevitably pulls us away from its own "highest" possibility, a readiness for and openness to crisis in its basic concepts out of fidelity to the entities in question. Only in "philosophically" turning away from involvement with and idle talk about entities, toward the understanding of being within which entities are disclosed, could science remain open to truthful disclosure of things themselves.

The sciences' inherent tendency to obscure the entities they discover behind a veil of idle talk is recapitulated and reinforced by the dominant epistemological conception of philosophical reflection. The sciences, in their very efforts to discover and describe entities, lose sight of the entities themselves through involvement in an inferentially interconnected web of assertions. Epistemologically oriented philosophers then make explicit and deliberate this tendency to "fall"

away from understanding of entities themselves. Whereas science aims to understand the world, epistemological philosophers take scientific cognition as their own subject matter, at one remove from scientific concern. For Heidegger, by contrast, the most important philosophical task regarding the sciences was to help renew their truthful openness to “the things themselves.” Heidegger thus implicitly distinguished naturalism in philosophy from scientism. I have been arguing that he joined naturalists in arguing, against his neo-Kantian, phenomenological, and logical positivist contemporaries, that philosophy must begin from and remain within the horizon of our “natural” involvement with our surroundings in all its material and historical concreteness.³ No transcendence of this world was permissible. Yet in his early work, Heidegger argued against most naturalists that the empirical sciences were derivative from (rather than constitutive of) the requisite “natural conception of the world.” In its turn toward theoretical articulation, science itself was more akin than opposed to traditional philosophical approaches in obscuring or blocking natural understanding.

Yet despite Heidegger’s early commitment to philosophical renewal as a counter to scientism, this supposedly philosophical task of sustaining the sciences’ truthful openness to “the things themselves” was inclined toward naturalism in yet another way. Opponents of naturalism typically assign a distinctive subject matter to philosophy, such as epistemology, logic, semantics, or transcendental consciousness, whereas naturalists tend to emphasize the continuity between philosophy and the sciences. Heidegger’s conception of fundamental ontology inclined more in the latter direction. In this respect, his questioning concerning being would be seriously misunderstood were it seen as turning away from science toward something obscure and “metaphysical.” In thinking about the being of the entities discovered in the sciences, we do not think about something else. Being is not itself an entity, but only the disclosure of entities as intelligible. Philosophical reflection would not take us away from the subject matter of the sciences, but would instead aim to bring one back afresh to “the things themselves” in their essential disclosedness. For Heidegger, Aristotle’s sustained reflections upon biology or Kant’s upon mechanics were not a failure yet to distinguish philosophy clearly from science, but instead recognized philosophy’s highest calling.

There were nevertheless tensions within Heidegger’s early philosophy of science, indicating fundamental difficulties within his project as a whole. Fundamental ontology was an ahistorical, transcendental-philosophical inquiry into human existence as essentially historical and worldly. In their turn to formal structures of pure logic or transcendental consciousness, Heidegger thought his philosophical opponents had irrevocably severed their connection to the worldly phenomena they aspired to understand. Heidegger adamantly opposed any comparable formalization of his own ontological categories. The in-order-to-for-the-sake-of relations that articulate the being of what is available (Zuhanden) can, he admitted,

be grasped formally in the sense of a system of relations. But ... in such formalizations the phenomena get leveled off so much that their real phenomenal content may be lost ... The “in-order-to”, the “for-the-sake-of”, the “with-which” of involvement ... are instead

³ In this respect, Otto Neurath was an exception among the logical positivists. Rouse (2002, ch. 1) discusses the ironic parallels between Heidegger’s and Neurath’s turns toward naturalism.

relationships in which concernedful circumspection as such already dwells. (1953, 88) It was unclear, however, why the essential structures of fundamental ontology did not also evanesce into ahistorical, immaterial formal relations (Brandom 2002: ch. 9 gives a lucid account of what such a formalization of availability would look like). Heidegger aimed to show how these structures were manifest within the concrete compartments of Dasein as being-in-the-world, but at multiple points, questions arise concerning how the ontological structures connect to the concrete compartments and entities. For example, how do scientific-Dasein's concrete everyday practices of scientific theorizing (conceived "existentially") relate to the abstract ontological category of science as the theoretical discovery of the occurrent? More generally, how were the differences among ways of being (care, availability, or occurrentness) relevant to the ontological determination of scientific domains such as nature or history? How and why, for example, should the human sciences' investigations of human beings as entities be determined by an understanding of Dasein and its way of being? Likewise, what is the relation between us as cases of Dasein and us as biological or physical entities? Finally, Heidegger's account of science incorporated an ontologically decisive but concretely elusive "changeover" from "the understanding of being that guides concernedful dealings with entities" to "looking at those available entities in a 'new' way as occurrent" (1953, 361). This changeover involves both a shift from contextual communication (hammers that are "too heavy" or "misplaced") to thematic assertions about mass or location in spacetime as occurrent properties, and from everyday understanding to "the mathematical projection of nature." Yet Heidegger merely asserted such a changeover without adequately describing it. The associated changeover from Dasein's practical familiarity with linguistic signs as "equipment for indicating" to explicit, decontextualized assertion was likewise both central and obscure in Heidegger's early philosophy of language.

Art, Technoscience, and Modernity

Reflection on science was central to Heidegger's re-orientation of his philosophical project in the 1930's. His changing views of science and naturalism were central to that reconception, evident in the two lead essays in Holzwege: "Origin of the Art-Work" and "Age of the World Picture." Heidegger instead addressed how "metaphysics grounds an age ... through a specific interpretation of entities and through a specific conception of truth" (1950, 69). The centrality of science to Heidegger's rethinking is suggested by his list of "essential phenomena of modernity": it is no accident that science and technology head the list, nor that this crucial overview of his re-conceived project occurs in an essay on science.

I shall nevertheless begin with an essay ostensibly devoted to the third "equally essential modern phenomenon, [in which] the art work becomes the object of mere subjective experience, ... an expression of human life" (1950, 69). The significance of the artwork essay for understanding science is highlighted by its implicit juxtaposition with Plato's Republic. The Republic identified the "light" within which entities are disclosed as the Form of the Good, which was to be the ultimate object of knowledge. Heidegger agreed that all intelligibility is normative, but rejected both Plato's identification of this "lighting" with an entity (a Form), and its disclosure through rational intuition rather than discursive articulation.⁴ He also objected to

⁴ Heidegger used the term "Lichtung" (literally a "clearing" in the woods, but etymologically related to "Licht," light) as an analogue to what he had earlier called an

the ahistorical, formalist, and disembodied or immaterial character of Platonic intelligibility. These points of contrast came together in Plato's insistence that poetry and other arts, at two removes from the Forms, cover up the intelligibility of entities (their being or "illumination") by turning the soul in the wrong direction, toward what is sensuous, material, and merely signifying.⁵ Heidegger proposed that the poetic, discursive and sensuous working of art is what holds open the possibility of meaningful differences between "birth and death, disaster and blessing, victory and disgrace, endurance and decline" (1950, 31). Art does so not through scientific cognition of what is timeless and immaterial. Art "works" instead by holding open an historically specific, discursively articulated, material ("earthy") world, through its normative grip upon the comportments of those through whom it "worked."

The artwork essay also contained an implicit critique of Being and Time on several counts that are important for my purposes. First, Heidegger had repeatedly tried to get behind dealings with entities to show the understanding of being that guides them, but his early phenomenology of equipment, equipmental malfunction, signs, and anxiety only indicate such understanding under conditions of its breakdown. The "working" of artworks supposedly allows the clearing/lighting of entities to show itself when it works, and not just when it breaks down.⁶ Scientific discovery of entities as occurrent, by contrast, had supposedly emerged in response to such practical failures.

The second challenge to Being and Time emerged in Heidegger's emphasis upon "the conflict between world and earth" rather than "the worldhood of the world" as that wherein we understand and deal with entities. He thereby implicitly acknowledged that Being and Time failed to show why the contextual interrelatedness of worldly significance resists mathematical formalization. 'Earth' expresses both materiality and resistance to intelligibility. Concerning materiality, Heidegger asked,

What is the essence ... of that in the work that one usually calls the work material? Because it is determined by usefulness and serviceability, equipment takes into its service that of which it consists: the matter. Stone is used and used up in making equipment, e.g., an ax. It disappears in usefulness. The material is all the better and more suitable the less it resists perishing in the equipmental being of the equipment. By contrast, the temple-work, in setting up a world, does not let its material disappear, but rather lets it come forth for the very first time in the opening of the work's world. (1950, 34-35)

Art's accentuation of materiality also highlights the limits of human understanding, in ways that

"understanding of being." He retains the ontological difference between entities and the clearing as the intelligibility (being) of the entities disclosed within it.

⁵ It is surely no coincidence that in Book X, Plato develops this point about an artifact (a bed), and that Heidegger begins the artwork essay with the claim that the equipmental character of shoes is more adequately revealed in a painting than by the shoes themselves or the concept of shoes.

⁶ Even here, however, it does so only nostalgically, since Heidegger strongly suggested that artworks can no longer work in this way in modernity.

implicate scientific as well as practical intelligibility. If light (both literally and metaphorically) is that which allows entities to appear, then “earth” is the opacity that simultaneously limits and enables such appearances (for if there were only transparency, nothing could be illuminated).

If we attempt [a penetration into a stone’s heaviness] by smashing the rock, it still does not display in its pieces anything inner that has been opened up. The stone has immediately withdrawn again into the same dull pressure and bulk of its pieces. If we try to grasp this in another way, by placing the stone on a balance, we merely bring its heaviness into the form of a calculated weight. This perhaps very precise determination of the stone remains a number, but the weight’s burden has escaped us. ... Earth thus allows every penetration into it to shatter itself. (1950, 35-36)

If ‘world’ denotes the significant interrelations within which entities are understandable (whether through the practical interrelatedness of in-order-to-for-the-sake-of relations, or the inferential relations among assertions), then ‘earth’ marks the unsurpassable limits of such holistic intelligibility. As Samuel Todes once put a similar point, “what the facts are is made luminous by theory, but that these are the facts is plunged by theory into a darkness just as extraordinary as the light shed on their nature” (2001, 270). Artworks brought forth what was simultaneously the enabling condition for and the limit to any articulated understanding.

Another relevant challenge to Heidegger’s early work came in his re-conception of language. In Being and Time, language showed up first in its practical, contextual use as “equipment for indicating,” and then in assertion as a derivative form of interpretation that presupposes prior practical competence. The artwork essay claimed instead that

Language itself is poetry in the essential sense. But since language is the happening in which entities first disclose themselves for humanity as entities, therefore poesy---poetry in the narrower sense— is the most original form of poetry in the essential sense. ... Building and portraying, by contrast, always happen already and only in the opening afforded by saying and naming. (1950, 61)

Clearly, language became central to Heidegger’s account of the clearing of being within which entities can be understood, but language was also reconceived. The key point for our purposes is the shift from the transparency of assertion to the unsurpassability of language as poetic. Assertions are comportments toward a task at hand or a described entity. The specific words used matter only in pointing out the right issue or feature in the right way; any other words that would function similarly would do. In this respect, availability was the predominant way of being of linguistic signs in Being and Time. Poetry is not paraphrasable, however; like the material of other artworks, poetic language does not disappear. Much more needs to be said about this point than I can develop here, but clearly Heidegger came to believe that the historical specificity and sonorous/graphic materiality of language was integral to human understanding.

Finally, both Holzwege essays implicitly showed Heidegger’s abandonment of fundamental ontology as a successor to Husserl’s conception of philosophy as rigorous science. The attempt to articulate essential differences among ways of being, and thus to do ontology as a philosophical “science,” was supplanted by an historicized understanding of the intelligibility of entities. Attentiveness to the difference between entities and their intelligibility was no longer expressed by a philosophical classification of essentially different ways of being. Not only did Dasein’s way of being thereby lose its ontological centrality, but occurrentness and availability

also lost their standing as fundamental ontological categories. That in turn meant that science could no longer have the ontological significance of discovering entities as occurrent.

The abandonment of fundamental ontology significantly transformed Heidegger's phenomenology of science, in ways developed most extensively in "Age of the World-Picture" (1950). Having lost its fundamental-ontological significance, science was re-conceived as an essential phenomenon of modernity. Heidegger's earlier account of science as the discovery of the occurrent now seemed too reminiscent of traditional accounts of science as cognition or justified assertion. To replace this residue of traditional epistemology, Heidegger characterized modern science instead as research. Scientific research encompasses its practitioners "within the essential form of the technologist in the essential sense; only in this way can [they] remain capable of being effective" (1950, 78). Modern science thus does not suspend practical concern with entities, but intensifies it.

Heidegger retained Being and Time's claim that the "mathematical projection of nature" was decisive for modern science, but radically shifted his conception of what that projection accomplished. Previously, the "mathematical" character of physics disentangled entities from their practical involvements so as to thematize them as objects. On his revised view, the mathematical projection of physical entities instead intensified and more stringently governed scientists' dealings with them:

Every forging-ahead (*Vorgehen*) already requires a circumscribed domain in which it moves. And it is precisely the opening up of such a domain that is the fundamental process (*Grundvorgang*) in research. This is accomplished, in so far as within a region of entities, e.g., nature, a determinate configuration of natural processes (*Naturvorgänge*) has been projected. This projection sketches out beforehand the way that a cognizant forging-ahead must bind itself to the domain opened up. This binding commitment is the rigor of research. ... This projection of nature is secured, in so far as physical research binds itself to it in each step of its questioning. (1950, 71, 72-73)

Heidegger presented such a rigorously self-binding moving ahead within a projected domain of entities as the first essential characteristic of science that has been transformed into research.

A second distinctive feature of research is its guidance by a distinctive way of proceeding. In advancing further into a projected domain, research must be open to variation and novelty among the phenomena discovered, yet must also sustain the generality and objectivity of its overall conception. This dual demand accounts for the centrality of natural laws in modern scientific explanation:

Only within the purview of the incessant-otherness of change does the rich particularity of facts show itself. But the facts must become objective. The forging-ahead [of science] must therefore represent the changeable in its changing, holding it steady while nevertheless letting motion be a motion. The stasis of facts in their continuing variation is regularity (*Regel*). The constancy of change in the necessity of its course is law. Facts first become clear as the facts they are within the purview of regularity and law. Empirical research into nature is intrinsically the putting forward and confirming of regularities and laws. (1950, 73-74)

This process of unifying manifold phenomena under more general laws simultaneously extends and legitimates the projection of nature governing ongoing research:

Explanation, as a clarification on the basis of what is clear, is always ambiguous. It accounts for an unknown by means of a known, and at the same time confirms that known by means of that unknown. (1950, 74)

The facts receive their definitive determination through subsumption under law, whose authority is secured by success in accounting for a multitude of facts.

Heidegger presented the turn to experimental science as a consequence of this novel way of proceeding rather than its basis. Only with nature re-conceived as the unification of diverse events under law could the creation of new phenomena in the laboratory be thought to yield fundamental insights rather than just a proliferation of curiosities.

Experiment begins with the laying down of a law as its basis. To set up an experiment means to represent a condition under which a definite configuration of motions is trackable in the necessity of its course, i.e., of being controlled in advance by calculation. (1950, 74)

This shift is a general imperative of research, however, and not merely the projection of nature as a distinctively law-governed domain. For Heidegger, all modern research methods, from experimentation to historical source criticism, depended upon a comparable play between an explanatory scheme and the particular objects or events subsumed within it. Research inevitably forms specialized disciplines, each pursuing its characteristic explanatory scheme as far as possible.

For Heidegger, this relentless extension of its explanatory frameworks was a third fundamental characteristic of modern science, as enterprise (*Betrieb*; the standard English translations of '*Betrieb*' as "ongoing activity" or "continuing activity" miss its overtones of business enterprise and factory works). What drives scientific research is not the significance of the results sought, but the need to secure and expand the enterprise of science itself:

The way of proceeding (*Verfahren*) through which individual object-domains are conquered does not simply amass results. Rather, with the help of its results, it adapts itself for a new forging-ahead. ... This having to adapt itself to its own results as the ways and means of an onward-marching way of proceeding is the essence of research's character as enterprising. (1950, 77)

Earlier, Heidegger worried that interconnected theoretical assertions obscured the sciences' accountability to the entities they thereby discovered. In the "World-Picture" essay, an analogous tendency becomes the defining *modus operandi* of scientific research. Supplying the incessant demands of the research enterprise for new problems to work on, and new material, conceptual, and institutional resources to apply to those problems, takes precedence over the disclosure and discovery of entities:

What is taking place in this extending and consolidating of the institutional character of the sciences? Nothing less than securing the precedence of their way of proceeding (*Verfahren*) over the entities (nature and history) that are being objectified in research at that time. (1950, 78)

The enterprising character of modern science also transforms its participants. Researchers are not scholars. Their characteristic virtues are not erudition but incisiveness, not reflection but constant activity, not insight but effectiveness in getting the job done.

What is the "job" of science, however? In Being and Time, science aimed to discover

entities as occurrent. Philosophers could then guide scientific interpretations of entities with insights from fundamental ontology. The modern orientation of science as research presented in “Age of the World-Picture” undermines any philosophical governance, however. It seeks to maximize the flexibility of the research enterprise itself, unconstrained by prior accountability to a domain of entities:

The predilection imposed by the actual system of science is not for a contrived and rigidly interrelated unification of the content of object-domains, but for the greatest possible free but regulated flexibility in initiating and switching the leading task of research at any given time. The more exclusively science isolates itself for the complete conduct (*Betreibung*) and mastery of its work process, and the more unapologetically its enterprises (*Betriebe*) are transferred to research institutes and professional schools, the more irresistably do the sciences consummate their modern essence. (1950, 79)

What makes a research task important is not the intrinsic significance of its projected discoveries, but the possibility of opening new vistas for further research. Here Heidegger emphasized a kinship between modern science and technology, not simply because of technological applications of knowledge or scientific uses of technology. Rather, each relentlessly overrides any accountability that might constrain the expansion of its capacities for calculation and control. There is and can be no further “for-the-sake-of-which” for modern scientific research; it orders and calculates so as to expand the domain of research, by making entities more fully and extensively calculable. Heidegger’s characterization of the research enterprise is thus reminiscent of Plato’s vision of the tyrant’s soul, driven by an insatiable aspiration to mastery that cannot acknowledge any inherent limits or goals.

There was an important practical and political dimension to this criticism of modern science. Throughout his career, Heidegger addressed philosophical governance of the sciences (not just the natural sciences, but all academic disciplines) in terms of the need for university reform (Crowell 1997). His account of the sciences as overriding any wider normative accountability in part responded to his own disastrous attempt five years earlier to give philosophical direction to the University of Freiburg as rector under the Nazis. However one assesses the relation between Heidegger’s vision and the Nazis’ political program, Heidegger quickly found the university utterly recalcitrant to his philosophical aims.

What would Heidegger’s revised conception of modern science imply for philosophy of science, however? Despite abandoning fundamental ontology and the ahistorical conception of science as discovering entities as occurrent, Heidegger continued to place science at the center of a large philosophical story about truth and being. The convergence of science and technology was conceived as an essential phenomenon of modernity, and thereby as a focus for metaphysical reflection. Technoscience allowed entities to show themselves as calculable and orderable, and thereby revealed the impending loss of any meaningful differences in the modern world. The source of this tendency was not just a sociological drive toward professional autonomy for scientific institutions, however, but a metaphysical transformation of the intelligibility of entities.

This reconception changed the significance of epistemological conceptions of science. No longer merely philosophical errors, they supposedly express the “errancy” of the modern world itself, as the “age of the world-picture”:

World-picture, when understood essentially, does not mean a picture of the world but the

world conceived as picture. What is in its entirety [entities] is now taken to be first and only insofar as it is set in place by human representation and production. (1950, 82)

Heidegger was not thereby endorsing an idealist or constructivist thesis about entities. He was instead claiming that the being of entities (their intelligibility, the ways in which they can manifest themselves) is now determined by the demands of human thought and action, in ways that also re-conceive humans as subjects. The link between these re-conceptions is apparent in treatments of accountability to entities as “objectivity,” or correct representation. The ideal of objectivity is to allow the object to show itself as it is, unchanged by how we conceive or deal with it. But what is thereby determined is not the object, but our dealings with it. Taking the right stance toward it or employing the right methods is taken as decisive for whether it shows itself rightly. Human representation and praxis thereby seem to arbitrate what is real.

This conception apparently exalts human beings: our norms and goals govern the intelligibility of anything and everything. But Heidegger thought that sense of mastery was illusory. The relentlessly conjoined objectification of entities and subjectification of our accountability to them inevitably transformed that accountability itself into a further object (a “value”) for a subject. Values then need clarification and objective assessment in turn, but their objectification as values to be chosen undermines their authority over the choice.

Value appears to express that one is positioned toward it so as to pursue what is most valuable, and yet that very value is the impotent and threadbare disguise of the objectivity of entities having become flat and backgroundless. No one dies for mere values. (1950, 94)

This loss of accountability beyond ourselves, and hence of the possibility that what we do could make a significant difference, supposedly conjoined science and technology with the subjectivization of art and the holy as “essential phenomena of modernity.”

This historicized conception of philosophy as metaphysics retained Heidegger’s earlier negative assessment of the sciences’ capacity to understand their own significance and normativity. Science as such could not uncover its “essence,” the metaphysics of the world as picture which made the transformation of science into a research enterprise seem appropriate and inevitable. Only philosophical reflection could hold open the possibility of an alternative understanding. This claim depended upon a contentious distinction between science and philosophy, however. In lectures contemporaneous with “Age of the World-Picture,” Heidegger acknowledged that Galileo and Newton, or Heisenberg and Bohr, were doing philosophy rather than “mere” science.⁷ The need for such gerrymandering suggests difficulties with Heidegger’s claim that science inevitably closed off a more fundamental ontological understanding: the most important and influential scientific work had to count as philosophy instead, precisely because it

⁷ Heidegger 1967, p. 67. In Being and Time, (1953, 9-10) Heidegger cited relativity theory as exemplary of an ontological reawakening in physics. The omission of Einstein’s name alongside Heisenberg and Bohr ten years later inevitably invites questions about Heidegger’s deference to Nazi campaigns against “Jewish physics.”

was unquestionably insightful.

Throughout his career, Heidegger thus characterized science in ways analogous to his early association of science with curiosity, ambiguity, and idle talk. Science “as such” for Heidegger was never the opening of a genuine disclosure of how entities show themselves, but only an unreflective (“thoughtless”) effort to secure entities within a prior disclosure taken for granted. This attitude was made possible, however, by a more fundamental mistake. Science as such cannot be essentially “untruthful” in these ways without an essence in the first place, unless there is such a thing as “science as such.” Heideggerian essences are always ontological. In Being and Time, the essence of science was to discover entities as occurrent. Later, he claimed that modern science projected entities as calculable and orderable, in ways that govern any particular scientific conceptualization in advance: “Physics ... will never be able to renounce this one thing: that nature reports itself in some way or other that is identifiable through calculation and that it remains orderable as a system of information” (1977, 23). What is ontologically crucial about this way of revealing, for Heidegger, is its relentless overriding of any issues or stakes to which the demand for calculability could be held accountable. Science’s ordering and calculation of entities only expands the domain of research, making entities more fully and extensively calculable, with no further “for-the-sake-of-which.”

Heidegger’s rendition of the history of modern science as a relentless expansion of calculative control may seem initially plausible in light of the “Second Scientific Revolution.” In the 18th-19th centuries, the Baconian sciences of chemistry, heat, electricity, magnetism, and later biology and geology were gradually encompassed within mathematized, experimental science. In the 20th century, its reach has extended to ever smaller, ever larger or more distant, and even complex or chaotic phenomena. The domain of experimental manipulation and theoretical modeling seems to expand without apparent bounds. Yet Heidegger’s construal of science’s relentless expansion overlooks that only a few phenomena within these domains matter scientifically. Most truths about the natural world are of no scientific significance whatsoever; scientific research instead focuses its attention on specific phenomena, experimental systems, and theoretical concepts and models that seem to advance scientific understanding. And as Heidegger’s own views suggest, such understanding is always oriented towards a subsequent advance, not a retrospective accounting of accumulated knowledge.

Moreover, which phenomena are at issue in a given field or research program has frequently shifted over time, with accompanying shifts in what is at stake there. For example, Hans-Jörg Rheinberger (1997) noted multiple consequential occasions when experimental studies of cancer shifted fairly seamlessly into investigations of “normal” cellular processes now manifest in cancer cells. What mattered scientifically was then no longer the difference between normal and abnormal cells, but common characteristics of their structure and function. The 1973 “November Revolution” in physics marked by the discovery of weak neutral currents is another example, with both fundamental shifts in which high-energy events were worth studying (from soft hadron scattering to lepton-lepton interactions and hard scattering of hadrons), and toward symmetries and symmetry-breaking as central issues in theoretical modeling (Galison, 1987, ch 4; Pickering 1984). Such cases cannot be appropriately regarded as impositions of a pre-determined orientation toward calculative control upon nature as a plastic resource, for what it matters to understand calculatively, and what is at stake in its success, has shifted. Such shifts

instead reflect an openness within science to allowing things to show themselves intelligibly in new ways, and to do so by letting “the actual results guide the decision about what to do next” (Rheinberger 1995, 60).

Far from invariably seeking greater mastery, such shifts may sacrifice calculative precision and laboratory control to advance different concerns. Dobzhansky’s adaptation of *Drosophila* genetics to study genetic variation in natural populations deliberately sacrificed both experimental precision and mathematical tractability of inheritance (Kohler 1994, ch. 8). Similarly, attention to the semi-classical boundary phenomena characteristic of so-called “postmodern quantum mechanics” forsakes mathematical elegance and systematicity in taking advantage of multiple formally inconsistent models simultaneously, to encourage a physics of irreducible complexity (Heller and Tomsovic 1993). Such a physics of complexity seeks a deeper understanding of “chaotic” phenomena, which recognizes limits to their detailed prediction and control.

Often the stakes in such shifts are fundamental to human self-understanding. Dobzhansky’s work helped form the neo-Darwinian synthesis, which not only placed evolution by natural selection at the center of a more unified biology, but also had wider consequences ranging from the biological eclipse of “race” to classifications of intelligence and culture as evolved adaptations. Postmodern quantum mechanics rejects the quasi-theological fundamentalism governing much of recent high-energy physics, abandoning the quest for a unified “Theory of Everything” in favor of more local, situated comprehension. Similarly, the phoenix-like emergence of developmental biology from the ashes of embryology, and the concomitant eclipse of genetics by genomics, challenge the now-familiar conception of genes and DNA as the calculatively controllable “secret of life” and biological surrogate for the soul (Oyama et al., 2001, Keller 1992, Nelkin and Linde 1995).

We need to understand these far-reaching shifts in scientific significance (where “understanding” is meant not narrowly cognitively, but in Heidegger’s sense of ability to respond appropriately to possibilities). But Heidegger’s aspiration to a grand, nostalgic philosophical history of being obscures these and other cases in which meaningful differences emerge from scientific efforts to wrest phenomena from hiddenness. The point of thus speaking about science in ways more akin to Heidegger’s remarks on art is not to reverse Heidegger’s hierarchy and instead proclaim science as a privileged locus for the happening of truth. Rather, I am questioning any sharp or even significant boundaries between science and other meaningful compartments as practices that allow entities to show themselves intelligibly. My examples were chosen because they can neither be rightly described as scientific determinations of how things matter to us, nor as sociocultural determinations of scientific significance. Rather, they show how scientific understanding is integral to a larger historical disclosure of possibilities, within which scientific practices acquire and transform their issues and stakes.

Such a more sanguine naturalism might still be an unthought possibility within Heidegger’s work. In one of his last essays (1969), Heidegger moved still further in the direction of naturalism, abandoning any effort to retain philosophical authority over the sciences. He concluded that philosophy, the tradition of inquiry spanning from Plato to Nietzsche, reached its legitimate completion by developing into “independent sciences which interdependently communicate” (1969, 64). Lest we fail to get the point, Heidegger referred explicitly to

Husserl's rejection of psychologism and historicism in "Philosophy as Rigorous Science." In effect, late Heidegger endorsed Quine's naturalistic rejection of "first philosophy." Yet even here, Heidegger retained a consistent orientation. He acknowledged this convergence between science and philosophy not to allow for the possibility of understanding the normative significance of the sciences from within, but because he denied that philosophical metaphysics provided a sufficiently independent basis for such understanding.

Yet we need not follow Heidegger in his insistent prejudice that science as such cannot uncover possibilities that matter. I would argue that some of the fundamental shifts in which phenomena are at issue in a scientific field and in what is at stake in such work are driven not merely by a concern to keep the research enterprise going, but by an implicit concern for what it really matters to understand scientifically and why. In this context, one might then envision a more expansive conception of the scientific enterprise, and of the place of "philosophical" concerns within the sciences, which would incorporate serious discussion of what is at issue and at stake in competing conceptions of a scientific discipline. Moreover, such a conception would be aided by Heidegger's treatment of the futural orientation of scientific research as more basic than the retrospective assessment of knowledge. We would, of course, have to abandon Heidegger's residual essentialism about science, and especially his insistence that science can play only a derivative, or even counterproductive role in making intelligible our situation and its stakes. Ultimately, however, such a re-orientation might be encouraged by recognition of the unappreciated affinities between Heidegger's ontological conception of science and philosophical naturalism.

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