Heidegger's Critique of Rationalism and Modernity

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In the hands of Edmund Husserl and Martin Heidegger, phenomenology became a way of reflecting upon the rigor of philosophy and science. While Husserl aimed at adding rigor to philosophical investigation, Heidegger criticized scientific rationality for being overly reductionist and as having fallen under the sway of technology. In her book, *Heidegger's Philosophy of Science*, Trish Glazebrook suggests that we can read all of Heidegger's philosophy as a critique of science.[1] If we understand Heidegger as offering a Hegelian styled rejection of the reductionism of modern science, then the suggestion is fairly defensible (though Glazebrook does not herself see the need for the connection) and Heidegger's debate with Ernst Cassirer at Davos, Switzerland in 1929 helps illustrate this point. In the encounter between these two important German thinkers, Heidegger accused Cassirer and the neo-Kantians of carving up the world into domains designated by each of the natural sciences, and that each of the sciences should maintain authority on all matters concerning its domain. Heidegger then asks, "what still remains of philosophy if the totality of beings has been divided up under the sciences? It remains just knowledge of science, not of beings."[2]

This observation neatly captures the essence of Heidegger's critique of scientific reasoning. The sciences divide up the realms of the world among themselves. Each science addresses itself solely to those entities that appear within its realm, and understands those entities according to the parameters of the rational instruments it wields. Those entities must then appear according to the rubrics and parameters of the sciences that study them, and as such, these entities will manifest as objects of study: objects of physics, objects of biology, objects of chemistry, and so on. As a result, the method of the modern natural sciences transforms all of the

phenomenon of the world into objects of science, and offers us revelations, calculations and assertions about those phenomenon, validated according to the limits of the science governing the domain into which the phenomenon are relegated. Science sees the world scientifically and Heidegger contends that this method of revealing the natural world conceals non-scientific ways in which the world might appear to us, ways that might represent a more authentic encounter of the world. To understand the implications of Heidegger's accusation, we must understand his multi-layered criticism of science, and what might count as a more or less authentic encounter with the world. We begin with a fairly straight-forward characterization of the way in which objects change in accord with changes in science, to make the simple illustration of Heidegger's point. We will then look more carefully at three modes of scientific reductionism, and conclude with a brief description of the technological thinking that results from overly reductionist thinking.

The Appearance of Objects in Science

After the work of Carolus Linnæus in the 18th Century, fauna appeared to zoologist within a fixed genus and species, a genus and species that would remain unchanged forever. And because of the similarities in physical appearance and method of reproduction, Linnæus placed humans in the same order as primates. This was a controversial claim at the time because it suggested that humans were part of nature, but the scientific reasoning of the 18th Century supported this conclusion. Although the idea that species might change over time existed before Darwin's *On the Origin of Species*, it was not until Darwin's theory of evolution provided a framework for how species might change that we could begin to think of the evolution of species. Within this new scientific theory, humans appeared to zoologists as a species in a long chain of evolutionary history. In other words, the objects appear according to the accepted mode

of thinking about those objects at the time of the inquiry. Accordingly, the study of humans changed with changes in biology. Where they were once distinct from nature, Carolus Linnæus' work brought humans into the domain of biology. Humans were part of nature. Darwin's theory moved humans into direct line with other animals, and shifted the study from physical appearance and method of reproduction to genetically and environmentally determined phenotypical traits. These distinct interpretations of biological entities represent advances in biology, and as such, the natural sciences replace earlier explanations of entities with improved explanations. This is scientific progress, the constant transformation of entities in accord with the new discoveries and revelations.

At Davos, Heidegger expressed concern that the methodological formalism of neo-Kantian theories of science had contributed to a ridged scientism that, since 1850, privileged mathematical-physical theory of knowledge as the unique paradigm for all human understanding.[3] As Trish Glazebrook puts it, "natural science consists in the mathematical projection of nature."[4] So, where as humans appear to Linnæus as an unchanging species, and to Darwin as an evolving species, they are described in the Oxford Journal of *Human Molecular Genetics* as: "just 20,500 genes,"[5] described as a code or information sequence that dates back millions of years and are shared by countless other biological entities, including star fish and bananas. In 2005 the *Human Genome Project*, which had been working on isolating the human genome for 15 years, declared its task complete:

> A genome is an organism's complete set of deoxyribonucleic acid (DNA), a chemical compound that contains the genetic instructions needed to develop and direct the activities of every organism… about 20,000 different BAC clones…contain the 3 billion pairs of bases of the human genome …the gene-containing portion of the genome is complete in nearly every functional way for the purposes of scientific research.[6]

In privileging math based methodologies, humans appear to biology in discrete, measurable units of DNA. As per Thomas Kuhn, objects of scientific inquiry change according to the dominate scientific paradigm. Humans transition from spiritual beings (akin to deity), to animals (in an evolutionary history), to biochemical data.

Scientific Reductionism

The method of the modern sciences reduces our understanding of the phenomenon in the world to ideal, quantifiable modalities, and it leaves philosophy with no purpose other than to furnish a theoretical groundwork for natural-scientific knowledge. These were both conclusions that Heidegger found unattractive, the first because it obscures the world and the second because it distracts philosophy from uncovering a more authentic relationship with the world. He placed the blame for the development of this math based methodologies on a reductionist approach that I will describe here in three moves:

1. Transcendental logic: atemporal science and atemporal objects.
2. Transcendental objects: objects as purely independent entities.
3. Causation and freedom.

Transcendental Logic

Heidegger sees in natural science since 1850, an attempt to create a logic that transcends history and establishes an instrument for identifying ahistorical truth: objective truth. He points to the neo-Kantians for an interpretation of Kant's *Critique of Pure Reason* that privileges modern scientific reasoning and relegates all other modes of thinking to the role of handmaiden to the mathematical-physical sciences.[7] Where the neo-Kantians see Kant's work primarily as epistemology, providing support for the formal-methodological foundations of natural science, Heidegger views it as ontology: the study of the nature of being itself.

> I understood by neo-Kantianism that conception of the *Critique of Pure Reason* that explains the part of pure reason that leads up to the Transcendental Dialectic as a theory of knowledge with reference to natural science. For me, what matters is to show that what came to be extracted here as a theory of science was nonessential for Kant. Kant did not want to give any sort of theory of natural science, but rather wanted to point out the problematic of ontology.[8]

Heidegger sees in Kant's *Critique of Pure Reason,* not an epistemology of natural science, but a metaphysics attempting to unravel the appearance of objects. The problematic of ontology he references here is the problem of appearance itself, "is appearance [of objects] just a matter of fact that we state, or must the entire problem of reason be apprehended in such a way that we grasp from the beginning how appearance necessarily belongs to the nature of human beings?"[9] When Heidegger speaks of grasping "from the beginning," he means that we must understand how objects have appeared, from the beginning of philosophy to the present. As we saw with the appearance of humans in the history of biology, objects appear to us relative to their historical situation, and that situation includes the privileged methodologies for human understanding at that time. Setting aside the accuracy of Heidegger's account of Kant's purpose in the *Critique*, we see a striking similarity between Heidegger's account of Kant and the Hegelian passage Heidegger twice includes in his much later work, *Hegel's Concept of Experience,* "But science, in making its appearance, is an appearance itself."[10] Modern science governs the way objects and/or ideas appear to us, but modern science is itself an object/idea that appears within history, and appearance that evolves in accord with the same cultural pressures that apply to all human endeavors.

Philosophers have long sought foundations for objective truth, so the neo-Kantians took Heidegger's criticism as strange, and accused him of relativism.[11] But like Hegel, Heidegger sees the effort of natural science to extract itself from history and recognize no authority other than its own methodology as a sort of vanity.[12] It accomplishes this by portraying itself as an instrument

of knowledge, an instrument that engages a transcendental epistemology, capable of independently deciding the validity of all truth claims. Following Hegel's description in the *Phenomenology of Spirt*, Heidegger portrays this science as an appearance within history, and therefore subject to the scrutiny that its hopes to avoid: historical criticism. Natural scientific reasoning is itself part of the historical dialectic. It is not a value neutral tool for understanding reality, but is itself too an object of study in ontology, which we might now more accurately define as the study of the *appearance* of being.

Heidegger sees in Kant's effort to work out *das Problem des Scheins* (the problem of appearances, which may also be translated as the problem of illusions),[13] a quasi-Hegelian approach to ontology that not only participates in the dialectic of philosophy but considers the appearance of objects, and their truth, as part of a grand historical narrative. The neo-Kantians reading of Kant offers an ahistorical epistemology that resolves the problem of how objects appear so that they may be studied according to the standards of inquiry specific to each discipline. By ignoring its historical *situatedness*, the logic of the natural sciences engages in a mode of self-deception: imagining itself to be something that it is not. This self-deception is manifest in scientific empiricism.

Scientific reasoning asserts ahistorical validity on the basis of its empirical testing, but the logical structure of hypothesis/experiment/observation/conclusion still places the idea first (hypothesis) and last (conclusion). The hypothesis/experiment structure of scientific reasoning places the idea before nature, such that the natural/objective world serves as a confirmation or rejection of a hypothesis.[14] The observation/conclusion structure reconfigures the experimental event according to the parameters of human observation, which are themselves quite naturally governed by the historical conditions in which the observation occurs. So, not only does the

scientific method fail to transcend its historical *situatedness*, it imitates Platonic Idealism, in which nature is judged according to the extent to which it participates in an idea.[15] Heidegger concludes that ancient idealism is built into the methodology of modern scientific reasoning, the idealism that its empiricism was designed to avoid. Despite its empirical credentials, modern science begins and ends with an idea. As such, it maintains a subjective metaphysics of representation: that the natural world manifests to science as an idea, or representation.

Transcendental Objects

Heidegger argues that the special validity claimed by scientific reasoning is ultimately grounded upon the appearance of objects in nature. Scientific rationality remains indifferent to accusations of idealism by asserting the absolute certainty of objective reality: that the methodology of science allows objects to appear as they truly are, and therefore transcending historical prejudices. As such, natural science enjoys the luxury of ignoring Kant's metaphysical *das Problem des Scheins,* which questions, why do objects appear as they do? But Heidegger suggests that *das Problem des Scheins* is an ancient one, and that scientific reasoning demonstrates a metaphysical naiveté in ignoring it. In *Being and Time*, Heidegger points to two ways in which objects appear: *present at hand*, as an object observed or studied, and *ready to hand*, an object used.[16] So, the glasses sitting on my nose are *ready-to-hand*, as I use them to observe the picture on the wall, which appears *present-at-hand*.[17] That an object may appear in these different fashions, speaks to our personal and historical relationship to them. This is *das Problem des Scheins,* that objects do not simply appear in an "objective" or "true" form, but instead objectivity itself is a mode of appearance. Heidegger suggests that the appearance of objects has been the primary concern of philosophy since the pre-socratic philosophers, and that

this concern persists in ancient and medieval thought. It was the scientific revolution, and Cartesian philosophy, that conditioned us to ignore *das Problem des Scheins*.

Although the medieval "Schoolmen"[18] took *Das Problem des Scheins* seriously, the problem is subtle and closely related to theological concerns, so when Descartes ignored the problem for the sake of establishing something firm and lasting in the sciences,[19] this oversight was easily set aside and Descartes' definition of the appearance of objects became the foundation for modern scientific reasoning. For Descartes, an object is defined as exhibiting extension. Heidegger calls this substantiality. The object demonstrates extension by appearing in three dimensions. Objects are "things which 'are in need of no other entity,'"[20] and therefore stand out as a thing possessing independent existence. Objects maintain a transcendental existence, independent of human activity. Hence, the truth of an object, revealed by science, transcends its historical *situatedness*.

The difficulty with this notion of objective existence arises when Descartes asserts that 'God is' and the 'the world is.'[21] Heidegger explains that Descartes applies the same conception of being to God and the world. Both are independent, transcendental entities. But Heidegger suggests that this is a mistake; they cannot be independent in the same way. God, as infinite and perfect, creator of all things, cannot exist in the same way in which objects of creation exist. This is the distinction that the Schoolmen took seriously, that Descartes evades.[22] What is the nature of existence (of Being), such that God and objects exist? What does it mean for a created thing to exhibit independent existence? Why does a created thing reveal itself to us in a fashion distinct from its creator? Rather than address the question, Descartes suggests that the concept of extension itself is inaccessible to us, that it cannot be perceived.[23] Heidegger accuses Kant of repeating the Cartesian error of extended being when he asserts that "'Being is not a Real

predicate.'"[24] In this way, both Descartes and Kant ignore *das Problem des Scheins,* the very question Kant raised.

Operating on the Cartesian idea of an object, modern science takes that which is *present-at-hand* as the truth of being, and thereby repeats the error of Descartes and Kant: overlooking the problematic of the appearance of objects. Heidegger explains that,

> the ontological grounds for defining the 'world' as *res extensa* have been made plain: they lie in the idea of substantiality, which not only remains unclarified in the meaning of its Being, but gets passed off as something incapable of clarification, and gets represented indirectly by way of whatever substantial property belongs most pre-eminently to the particular substance."[25]

Heidegger distinguishes between "being" (the objective existence of objects) and "Being" (the event that unites the appearance of objects to humans). In scientific rationality the concept of existence (Being) is reduced to the substantial properties of that which is *present-at-hand*, which assumes that being *present-at-hand* is the real mode of being. This assumption amplifies the equivocation regarding the use of the word "is" because God does not appear as *present-at-hand*, and it cannot account for the appearance of objects as *ready-to-hand*. Modern scientific reasoning would need separate definitions of "is" or existence, to explain that which is *present-at-hand*, *ready-to-hand*, and God.

Heidegger's criticism is explained away simply enough by scientism. Scientific thinking is the process by which we consider objects (*present-at-hand*). The common characteristic of objects is extension. Therefore, objects are defined as having extension. When we turn our scientific attention to those entities that manifest as *ready-to-hand*, they become *present-at-hand*, and because there is no evidence that the entity has changed under scientific scrutiny, we may assume that the qualities it demonstrates as an object *present-at-hand*, extension, persist when it is *ready-to-hand*. As to the question of God's existence, natural scientific reasoning simply takes

a pass. Kant reminds us that it is not so extraordinary that a science should demand and expect satisfactory answers to all the questions that may arise within its own sphere,[26] and ignore those that are outside of it. Hence, we might interpret Kant to mean that if objects appear to the scientific method as *present-at-hand*, then the answers to scientific investigations should not require metaphysical solutions that exceed scientific reasoning and question other ways in which objects might appear, or why the objects appear as they do. This is more or less the position of scientism, the position Heidegger attributes to the neo-Kantians, though perhaps unfairly, but a position very much supported by the pragmatic success of the natural sciences since 1850.[27]

The remarkable results generated by the natural sciences make for a robust utilitarian argument in its favor. We may readily point to rolled toilet paper, television and microwave ovens as proof of the efficacy of modern science, but Heidegger's suspicion is difficult to dismiss because it references the foundations of scientific reasoning. Recall that Descartes himself opens his *Meditations on First Philosophy* with doubts regarding the foundations of the natural sciences, specifically, the question of whether or not objects truly exist, and if they do, whether or not they exist as we perceive them.[28] For Descartes, the veracity of our perceptions requires God's existence,[29] which Heidegger sees as an acknowledgment that objects cannot *exist* independently. In his essay, *On the Essence of Truth*, Heidegger reminds us that the correspondence theory of truth upon which modern science is based is derived from the medieval proposition: *veritas est adaequatio rei et intellectus*; truth is the approximation of thing to intellect.[30] But this medieval notion of intellect is a divine intellect, not a transcendental [human] ego. So where Kant defines truth as the conformity of objects to our perceptions, the medieval thinkers define truth as the conformity of objects to divine intellect.[31] For the medieval thinker, it is the divine that establishes a creative order such that everything in the world appears as a

unified whole that can be understood. Modern scientific rationality, proceeding from Descartes and Kant, eliminates God as an unnecessary encumbrance to modern science, which begs the question: how do we account for the unity of experience such that a proposition might meaningfully correspond to a thing?

The unity of experience cannot be explained by the existence of independent objects. If their existence is, by definition, independent, then reducing science to the experience of independently existing objects leaves it unable to explain how those objects relate to one another or to us. Nor can the transcendental ego, provide the unity of experience necessary to ground modern science. Even Kant rejects the radical idealism, fearful that such a move would destroy the existence of things, but in so doing, admits that "the predicates [of external things] may be said to belong, not to the things in themselves, but to their appearances, and to have no proper existence outside our representations."[32] Heidegger emphasizes Kant's development of a metaphysics to account for the "appearances" of things, while accusing the neo-Kantian's of ignoring Kant's metaphysics and supporting a "mathematico-physical theory of knowledge," which alone can only provide a knowledge of science, not of beings.[33]

By asserting a transcendental ego and a transcendental object, natural science creates a subjective metaphysics of representation, in which truth is expressed as a correspondence between a propositional representation of an independent object and the independent object, without explaining how the correspondence of two unlike things expresses the truth of the natural world. Thus, Heidegger re-asserts *das Problem des Scheins*, and Hegel concludes that science, having ignored the *parousia* [appearance] of the Absolute, violates most flagrantly that very claim of certainty which it pretends to meet.[34]

Causation and Freedom

The final reductionist move we will consider here is the reduction of all causation to a single mode: the efficient cause. In his *Metaphysics*, Aristotle identified four types of causation: material cause, formal cause, final cause and efficient cause. The material cause suggests that what a thing is made of causes it to behave in a particular fashion. Similarly, Aristotle suggests that things behave according to the form that they take. The final cause references the telos of a thing: what is its end. So if we accept, along with Aristotle, that the human end is happiness, we can expect humans will generally behave so as to affect happiness. In modern science, these three causes are subsumed by the efficient cause: what Kant calls the *mechanism of nature*.[35] A detailed account of how science manages this exceeds the parameters of this chapter, but this notion of causation vitiates human freedom. That is, if we understand every event (effect) as having a cause greater, and that cause must be greater than or equal to the event (effect), then we reduce all human behavior to causes that can be isolated and quantified. [36] Kant acknowledges that the *mechanism of nature* leaves no room for human creativity or free will, because every action, including an act of will, would be the product of an identifiable cause, and the causal stream would go back ad infinitum.[37] All events (animal, vegetable and mineral) will be subject to a strict determinism, a determinism that traces its lineage back to the time of the big bang.

To avoid this strict determinism while maintaining the logic of cause and effect, Kant posited, rival conceptions of the world and our relationship to it: receptivity and spontaneity.[38] Receptivity dictates that human perception conform to external laws, and therefore we may rightly perceive in the world only the unbroken causality of nature.[39] Accordingly, the human mind is merely receptive to what is given in our experience of the world, an experience that must conform to the determinism of cause and effect and leaves no room for freewill.[40] The neo-Kantians define spontaneity as a productive understanding of the world, whereby humans are

free to impose upon the world the logic of the natural sciences and thereby capable of altering the stream of causation by virtue of internal, logical reasoning.[41] The two Kantian principles appear to be at odds, but Peter Gordon suggests that Kant, "brought these two concepts into a more harmonious relation,"[42] as is demonstrated in Kant's attention to ethical reasoning, wherein Kant argues that human freedom results from a transcendental ego, "conscious of his own existence…views his existence so far as it does not stand under temporal conditions, and to himself as determinable only by laws which he gives to himself through reason."[43] Under the conditions of receptivity we are bound by the logic of material determinism; under the conditions of spontaneity we are bound by transcendental, human logic.

In contrast, Heidegger argues that by 1850, the neo-Kantian emphasis of spontaneity had bound science to a subjective metaphysics of representation that allows for neither freedom nor provides access direct access to the natural world. Under the conditions of spontaneity, truth occurs within a debate about the scientific characterization of the world. The subjective metaphysics of representation reduces that world to the strict, math-based methodologies deployed in the natural sciences, methodologies that require every effect to fall neatly within the perfectly isolatable and quantifiable string of efficient causes. Hence, the neo-Kantian understanding of *spontaneity* reaffirms a strict determinism, rather than rescuing us from it. Heidegger's reconsideration of *spontaneity* and *receptivity* offers a new conception of freedom and undermines the validity of the subjective metaphysics of representation.

Heidegger emphasizes Kant's *receptivity*, though in a form that Peter Gordon describes as transfigured beyond all recognition.[44] Heidegger understands *receptivity* as a freedom that allows us to stand back from the world and see it in all its possibilities. To be receptive to the world means to experience the world historically, to find ourselves in a place and time,

connected to every other place and time. In this encounter with *what-is-in-totality*, we experience possibility, the possibility that objects may manifest in different ways: that we may encounter divinity, the present-at-hand, the ready-to-hand, etc., and that in the "letting-be" of the world, we come in contact with the possibility of a world, which is freedom itself.[45] Thus, *receptivity*, allows for an experience of the world that transcends the limited experience offered by scientism: of objects present-at-hand.

Heidegger's notion of freedom should be distinguished from both the common sense understanding of freedom, as "the random ability to do as we please" and the Kantian approach, "a mere readiness to do something requisite and necessary."[46] Freedom is not the possibility of this or that, whether random or logically determined, but rather the receptivity to and subsequent possibility of *being-as-a-whole*, that humans do not merely react to their experiences in the world, but experience the world as a *world*, as a unified whole that can be understood. In this possibility, the possibility of propositional, scientific truth arises. But as Kant's das Problem das Scheins suggests, objects may appear as they are not. Heidegger calls this a semblance.[47] That objects appear in the world, and that they may appear one way or another, is an expression of *Being*, what Gadamer calls the *horizon*, what Husserl calls the *co-present margin*, or what we might simply call: context. Truth is not, therefore, simply a correct proposition made by a human subject about an object, i.e., the tree is an olive.[48] This sort of propositional truth, attempts an approximation between two things unlike in kind: an object (the actually tree) and a statement that the tree is an olive. The nature of the approximation is determined by the kind of relationship obtaining between the statement and the thing.[49] Hence, even the possibility of propositional truth, favored by scientific reasoning, requires the contextual truth that links objects in the world in a meaningful way, and allows for a meaningful relationship between

language and those objects. Heidegger contends that this "relationship remains indeterminate and its nature unfathomed."[50]

Heidegger describes this largely *unfathomed indeterminate* as Being, whose character is not identical to the sum of known actualities.[51]

> On the contrary, it is just where few actualities are known or where they are known hardly at all by science or only very roughly, that the manifest character of what-is-in-totality can operate far more essentially than where the Known and always Knowable has become impossible to survey and can no longer resist the activity of knowing, because the technical control of things seems limitless in its scope.[52]

Here we see a reference to Plato's notion of philosophy as wonder, [53] where freedom is a sort of attention and attunement to what-is-in-totality, and represents the starting point of philosophy. In the hands of a reductionist philosophy of science, freedom is reduced to a set of scientific hypotheses or decisions, this or that. A scientific hypotheses is detached from the object, and Heidegger suggests that it is in this detachment that we experience both security and freedom from the objective world. [54] This detachment is the freedom of spontaneity. As such, philosophy and science become fixated on making correct hypotheses and decisions, and therefore focused on the technical control of things and the standardization of knowledge. This reduction of freedom to a choices then judged, true or false, reduces our experience of the world to conditions that conform to or contradict scientific propositions, and conceals the mystery of what-is-in-totality in favor of practical concerns and calculations.

> It is precisely this proliferation and standardization of knowledge, this desire to know everything, that causes the manifest character of what-is to sink into the apparent void of indifference or, worse still, oblivion...This "in-totality" appears, in the field of vision of our daily calculations and activities, as something incalculable and incomprehensible. It cannot be understood in terms of what manifestly "is," whether this be part of nature or of history. Although ceaselessly determining all things, this "in-totality" nevertheless remains something indeterminate and undeterminable, and is thus generally confused with what is readiest at hand and most easily thought of.[55]

Technological Thinking

The affinity we developed for the revelation of what-is-in-totality unwittingly conceals what-is-in-totality, insofar as it gives precedence to a "world" humanity builds up out of the projects and plans that happen to be the most immediate, causing a continual forgetting of the mystery so that our relationship to what-is-in-totality vanishes entirely.[56] One way to understand Heidegger's critique of enlightenment reasoning is to think of it as a critique of a utilitarian logic, a science that sees the world as objects as resources, and ideas as tools, and the combination of the two as machines to satisfy needs.

Heidegger suggests that all revealing involves a concealing. That is, the process by which we come to understand nature always conceals something about it, but there are more or less authentic ways of being in the world, which involve different forms of concealing. The reductionist approach of modern, scientific reasoning, make it well suited to a utilitarian world view Heidegger calls technological thinking. To generalize in the extreme, technological thinking involves systematizing the means by which we arrive at some end, by which the systematic itself involves an *enframing*: an all-inclusive rubric designating the way in which everything appears to us. The reductionist thinking of science allows everything to appear in the light of cause and effect, and as the ends present themselves as the correct results within the calculable complex of the effects of causes,[57] *enframing* characterizes the entire system by which ends and means appear. Enframing closes off all possibilities that lie outside the system, such that thinking and objects secretly lose their independence (for Heidegger, autonomy), and what-is-in-totality appears only within the system: "the ordering of the orderable."[58] Through its fixation on the ordering of the orderable, technological thinking forces science into its service and eliminates the real possibility of freedom by closing us off from any alternative relationship

to what-is-in-totality. All possibilities independent of the scientific/technological agenda and are nonchalantly swept aside with the wave of Occam's razor.

Heidegger concludes that science is the metaphysics of modernity. Under the sway of technological thinking, a reductionist science appropriates the world in service of technology: thinking of the world as a system of means and ends. As such, we no longer stand open to, or in wonder of, nature. Rather, we perceive the natural world as *standing-in-reserve* for some purpose.[59] The metaphysics of modernity even reduces human existence to its utilitarian parameters, so that to be human means being an object of a fully mathematized technological science[60] and thereby constrained by the material determinism foist upon objects by a technological science. We need only consider our current affinity for STEM education, wedding science to technology, engineering and mathematics, in order to satisfy the needs of a community as determined by a reductionist, economic theory, and reducing the student to an economic resource. Under these conditions the truth of nature is replaced by the truth of practical experience, economic calculation, political shrewdness, scientific research, religious belief or art.[61] Everything in its place, according to its discipline, so that the wonder of Plato, needed to drive science, is lost. Technological thinking becomes not only the means, but also the end, having eliminated all other possibilities. "From these in their turn [scientific] man, having forgotten what-is-in-totality, adopts his measures."[62]

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[1] Trish Glazebrook, *Heidegger's Philosophy of Science* (Fordham University Press: New York, 2000), 4.
[2] Martin Heidegger, cited in Peter E. Gordon, *Continental Divide* (Harvard University Press: Cambridge, Massachusetts, 2010), 139.
[3] Peter E. Gordon, *Continental Divide* (Harvard University Press: Cambridge, Massachusetts, 2010), 139.
[4] Glazebrook, 14
[5] Iakes Ezkurdia et al., "Multiple evidence strands suggest that there may be as few as 19 000 human protein-coding genes," *Human Molecular Genetics*, 2014 Nov 15; 23(22): 5866–5878, accessed March 23, 2019, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4204768/
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[7] Gordon, 139.
[8] Martin Heidegger, cited by Gordon, 142.
[9] Gordon, 142.

[10] Georg Wilhelm Friedrich Hegel, cited by Martin Heidegger, *Hegel's Concept of Experience*, translation of Hegel's *Phenomenology of Spirit* by Kenley Royce Dove, (Harper & Row, Publishers, San Francisco, 1970), 12, 42.
[11] Peter Gordon, *Continental Divide* (Harvard University Press, Cambridge, 2010), 151.
[12] Hegel, cited by Heidegger, *Hegel's Concept of Experience,* 15.
[13] Gordon, 143.
[14] Glazebrook, 65.
[15] Glazebrook, 230. Although Heidegger concedes that Plato still generally conceives of nature as prior to the idea.
[16] Martin Heidegger, *Being and Time*, translated by John Macquarrie and Edward Robinson (Harper & Row, Publishers, New York, 1962), 115.
[17] Martin Heidegger, *Being and Time*, 141.
[18] Heidegger refers to the medieval scholastic philosophers, i.e. Saint Thomas Aquinas and Albertus Magnus, 125.
[19] Rene Descartes, *Meditations on First Philosophy*, 3rd Edition, translated by Donald A. Cress, (Hackett Publishing Company, Indianapolis, 1993), 13.
[20] Heidegger, 125.
[21] Heidegger, *Being and Time*, 126.
[22] Heidegger, *Being and Time,* 126.
[23] Heidegger, *Being and Time*, 127.
[24] Heidegger, *Being and Time*, 127.
[25] Heidegger, *Being and Time,* 127.
[26] Immanuel Kant, *Critique of Pure Reason*, translated by Norman Kemp Smith, (St. Martin's Press, New York, 1965), 433.
[27] Gordon, p. 139.
[28] Descartes, 14.
[29] Descartes, 52-53.
[30] Martin Heidegger, "On the Essence of Truth," translated by R. F C. Hull and Alan Crick, appearing in *Existence and Being* (Gateway Editions, LTD, South Bend, 1949), 296.
[31] Heidegger, *On the Essence of Truth*, p. 296
[32] Immanuel Kant, *Prolegomena to Any Future Metaphysics*, revision of Carus translation by Lewis White Beck (Bobbs-Merrill Educational Publishing, Indianapolis, 1950), 37.
[33] Heidegger, cited by Gordon, p. 139.
[34] Heidegger, (quoting Hegel), *Hegel's Concept of Experience*, p. 40-41.
[35] Immanuel Kant, *Critique of Practical Reason*, translated by Lewis White Beck (Macmillan Publishing Company, New York, 1956), 100.
[36] Descartes, 28.
[37] Kant, *Critique of Practical Reason,* 101.
[38] Gordon, 362.
[39] Gordon, 362.
[40] Gordon, 362.
[41] Kant, *Critique of Pure Reason*, 1998, p. A446/B474
[42] Gordon, 362.
[43] Immanuel Kant, *Critique of Practical Reason*, translated by Lewis White Beck (Macmillan Publishing Company, New York, 1956), 101.
[44] Gordon, 362.
[45] Heidegger, *"*On the Essence of Truth*,"* 306.
[46] Heidegger, *"*On the Essence of Truth*,"* 308.
[47] Heidegger, *Being and Time*, 51.
[48] Heidegger, *"*On the Essence of Truth*,"* 309.
[49] Heidegger, *"*On the Essence of Truth*,"* 300.
[50] Heidegger, *"*On the Essence of Truth*,"* 300.
[51] Heidegger, *"*On the Essence of Truth*,"* 311.
[52] Heidegger, *"*On the Essence of Truth*,"* 311-312.
[53] Plato, "Theaetetus," in *The Dialogues of Plato*, Volume IV, translated by B. Jowett (Oxford University Press, Humphrey, 1924), 210.
[54] Heidegger, *Hegel's Concept of Experience*, 39.
[55] Heidegger, *"*On the Essence of Truth*,"* 312.
[56] Heidegger, 314-315.
[57] Martin Heidegger, "The Question Concerning Technology," edited by David Farrell Krell (Harper & Row, Publishers, New York, 1977), 307-308.
[58] Heidegger, "The Question Concerning Technology," 299.
[59] Heidegger, "The Question Concerning Technology," 299.
[60] Michael Zimmerman, *Heidegger's Confrontation with Modernity: Technology, Politics, and Art* (Indiana University Press, Bloomington, 1990), 156.
[61] Heidegger, *"*On the Essence of Truth*,"* 292.

[62] Heidegger, 316.