Science is not an occupation, not a business, not a diversion, but is rather the *possibility of the existence of human beings*, and not something into which one happens by chance.

BCAP 5

[S]cience should never be equated with its results, results that are then passed from hand to hand. . ..[W]hat is essential to science does not lie in what can merely be handed down, passed along from hand to hand, but rather in that which is appropriated ever anew.

GA27 32

Texts and Method of Citation

References to Heidegger's writing are given using the following abbreviations followed by page numbers – e.g., "*BCAP* 5" refers to page 5 of *Basic Concepts of Aristotelian Philosophy*.

BCAP *Basic Concepts of Aristotelian Philosophy*. Trans. Robert D. Metcalf and Mark B. Tanzer. (Bloomington: Indiana University Press, 2009).

BFL *Bremen and Freiburg Lectures: Insight into That Which Is and Basic Principles of Thinking*. Trans. Andrew Mitchell. (Bloomington: Indiana University Press, 2012).

BH *Becoming Heidegger: On the Trail of His Early Occasional Writings, 1910–1927*. Ed. Theodore Kisiel and Thomas Sheehan. (Evanston, IL: Northwestern University Press, 2007).

BPP *The Basic Problems of Phenomenology*. Trans. Albert Hofstadter. (Bloomington: Indiana University Press, 1982). Revised edition.

BPWS *Basic Problems of Phenomenology: Winter Semester 1919/1920*. Trans. Scott M. Campbell. (New York: Bloomsbury, 2013).

CP *Contributions to Philosophy (of the Event)*. Trans. Richard Rojcewicz and Daniela Vallega-Neu. (Bloomington: Indiana University Press, 2012).

CT *The Concept of Time: The First Draft of* Being and Time. Trans. Ingo Farin. (New York: Bloomsbury, 2011).

EN *European Nihilism*. In *Nietzsche: Volume IV: Nihilism*, pp. 1–196. Trans. Frank A. Capuzzi. Ed. David Farrell Krell. (San Francisco, CA: Harper & Row, 1982).

EP *The End of Philosophy*. Trans. and ed. Joan Stambaugh. (New York: Harper & Row, 1973).

ET *The Essence of Truth: On Plato's Cave Allegory and* Theaetetus. Trans. Ted Sadler. (London: Continuum, 2002).

GA7 *Vorträge und Aufsätze*. *Gesamtausgabe*, Volume 7. Ed. Friedrich-Wilhelm von Herrmann. (Frankfurt am Main: Vittorio Klostermann, 2000).

GA23 *Geschichte der Philosophie von Thomas Aquin bis Kant*. *Gesamtausgabe*, Volume 23. Ed. Friedrich-Wilhelm von Herrmann. (Frankfurt am Main: Vittorio Klostermann, 2006).

GA27 *Einleitung in die Philosophie. Gesamtausgabe*, Volume 27. Ed. Friedrich-Wilhelm von Herrmann. (Frankfurt am Main: Vittorio Klostermann, 1996).

GA76 *Leitgedanken zur Entstehung der Metaphysik, der neuzeitlichen Wissenschaft und der modernen Technik*. Gesamtausgabe, Volume 76. Ed. Friedrich-Wilhelm von Herrmann. (Frankfurt am Main: Vittorio Klostermann, 2009).

GA90 *Zu Ernst Jünger. Gesamtausgabe*, Volume 90. Ed. Friedrich-Wilhelm von Herrmann. (Frankfurt am Main: Vittorio Klostermann, 2004).

HCCR *The Heidegger Controversy: A Critical Reader*. Ed. Richard Wolin. (Cambridge, MA: MIT Press, 1993).

HCT *History of the Concept of Time: Prolegomena*. Trans. Theodore Kisiel. (Bloomington: Indiana University Press, 1985).

IM *Introduction to Metaphysics*. Trans. Gregory Fried and Richard Polt. (New Haven, CT: Yale University Press, 2014). Second edition.

IPR *Introduction to Phenomenological Research*. Trans. Daniel O. Dahlstrom. (Bloomington: Indiana University Press, 2005).

LQT *Logic: The Question of Truth*. Trans. Thomas Sheehan. (Bloomington: Indiana University Press, 2010).

LT *Four Seminars: Le Thor 1967, 1968, 1969, Zähringen 1973*. Trans. Andrew Mitchell and François Raffoul. (Bloomington: Indiana University Press, 2003).

NDHB "Nihilism as Determined by the History of Being." In *Nietzsche: Volume IV: Nihilism*, pp. 197–250. Trans. Frank A. Capuzzi. Ed. David Farrell Krell. (San Francisco, CA: Harper & Row, 1982).

OBT *Off the Beaten Track*. Ed. and trans. Julian Young and Kenneth Haynes. (Cambridge: Cambridge University Press, 2002).

OHF *Ontology – The Hermeneutics of Facticity*. Trans. John van Buren. (Bloomington: Indiana University Press, 1999).

P *Pathmarks*. Ed. William McNeill. (Cambridge: Cambridge University Press, 1998).

PIA *Phenomenological Interpretations of Aristotle: Initiation into Phenomenological Research*. Trans. Richard Rojcewicz. (Bloomington: Indiana University Press, 2001).

PIE *Phenomenology of Intuition and Expression*. Trans. Tracy Colony. (London: Continuum, 2010).

PR *The Principle of Reason*. Trans. Reginald Lilly. (Bloomington: Indiana University Press, 1991).

PS *Plato's Sophist*. Trans. Richard Rojcewicz and André Schuwer. (Bloomington: Indiana University Press, 2003).

QCT "The Question Concerning Technology." In *The Question Concerning Technology and Other Essays*, pp. 3–35. Trans. and ed. William Lovitt. (New York: Garland, 1977).

QT *The Question Concerning the Thing: On Kant's Doctrine of the Transcendental Principles*. Trans. James D. Reid and Benjamin D. Crowe. (New York: Rowman and Littlefield International, 2018).

SR "Science and Reflection." In *The Question Concerning Technology and Other Essays*, pp. 155–82. Trans. and ed. William Lovitt. (New York: Garland, 1977).

SZ *Sein und Zeit*. (Tübingen: Max Niemeyer Verlag, 2006). English translation: *Being and Time*. Trans. John Macquarrie and Edward Robinson. (New York: Harper & Row, 1962).

TB *On Time and Being*. Trans. Joan Stambaugh. (New York: Harper & Row, 1972).

TDP *Towards the Definition of Philosophy*. Trans. Ted Sadler. (London: Continuum, 2008).

WCT *What Is Called Thinking?* Trans. J. Glenn Gray. (New York: Perennial, 1976).

Z *Zollikon Seminars: Protocols – Conversations – Letters*. Trans. Franz Mayr and Richard Askay. Ed. Medard Boss. (Evanston, IL: Northwestern University Press, 2001).

1 Introduction: Heidegger's Concept of Science

This essay is structured around a core argument. Throughout his career, Martin Heidegger criticizes the view that science's primary aim is to develop increasingly comprehensive and successful theories (taken in a broad sense) – i.e., the view that science primarily seeks to identify sets of propositions or develop models capable of explaining and predicting an ever-wider range of empirical phenomena, with the implicit aim of developing a final, complete (and, thus, maximally secure) theory. Call this the *security-oriented concept of science* (SCS). In its stead, Heidegger advances an alternative concept of science; he believes science's primary aim is to open up access to some unseen, unappreciated, or forgotten piece of reality,[1] and that such access is achieved, above all, by ontological disclosures; call this the *access-oriented concept of science* (ACS). The distinction between SCS and ACS might seem vague, and my task below is

[1] NB: throughout this work, "reality" is used in a broad sense to refer in an ontologically neutral way to individual entities and kinds of entities. This usage is distinct from the technical senses in which Heidegger sometimes uses *Realität* (to refer to the realm of the purely present-at-hand – see, e.g., *SZ* 211) or *Wirklichkeit* (to refer to a metaphysics of "objecthood" – see, e.g., SR 157–63). On the latter, see Section 5.1.

to clarify it. But the key point to bear in mind is that Heidegger thinks that access to reality must be reestablished ever anew via revolutionary ontological disclosures, and indeed, that science's epistemic virtue lies in scientists' willingness to surrender (rather than secure) their most cherished theories and concepts in order achieve this access.

I argue that in both mature phases of his career – namely, in *SZ* and surrounding works, as well as in his post-*SZ* work (henceforth, *early* and *later* Heidegger, respectively) – Heidegger criticizes SCS and advances ACS. The early Heidegger generally focuses his criticism on the philosophical tradition for advancing SCS, while increasingly in his later years, he comes to worry that SCS has come to guide scientific practice. Conversely, Heidegger defends ACS more explicitly in his early work but remains implicitly committed to it even in his later discussions.

Furthermore, I argue that these commitments about science inform Heidegger's views on the history of Western metaphysics and on the possibilities for human flourishing that modernity, and modern science specifically, affords.

1.1 Scope

More than fifty years have passed since the influential scholar William J. Richardson remarked, "On the longest day he ever lived, Heidegger could never be called a philosopher of science" (1968, p. 511). This remark speaks to how many used to view the notion of "Heidegger's philosophy of science" with suspicion. Perhaps Heidegger offers some insights about science, the thinking went, but his scattered remarks show him to be only vaguely interested, and at any rate, well out of date on the subject.[2]

Commentators like Joseph Kockelmans, Joseph Rouse, Trish Glazebrook, Adam Beck, and Jeff Kochan have shifted this picture substantially. It's no longer controversial to claim that Heidegger's philosophy of science is crucial to his overall project or that he offers the philosopher of science a worthy perspective. My work owes a debt to each of them.

Nevertheless, it's worth pausing to note another sense in which Richardson's remark is defensible after all: Heidegger doesn't approach science (or indeed, any other topic) in the manner characteristic of most contemporary academic philosophers.[3] Even in his most direct, sustained commentaries on science, a reader will find that Heidegger's chief concerns are not the specialized problems that dominate recent academic literature in philosophy of science (e.g., scientific realism or the logical structure of scientific explanations, let alone more granular issues, such as time measurement in climate science).

[2] See, e.g., Heelan (1995). [3] Thanks to an anonymous reviewer for posing this challenge.

Heidegger occasionally argues for or suggests a position on these kinds of problems; nevertheless, he generally discusses science with his central, abiding concerns in mind: the question of being (i.e., of what being "is" as opposed to what beings are), the history of metaphysics, and the difficult position of a modern intellectual age that sits at the apex of a tradition characterized by what he calls *Seinsvergessenheit* ("forgetfulness of being" – i.e., a tendency to avoid the question of being in favor of inquiry into beings). Science, for Heidegger, is the institution that embodies modernity's answers to the questions of what knowledge is and of what is true. Investigating science thus promises to reveal how we conceive of being or knowledge, and how those conceptions sit within our broader intellectual history.

This peculiar feature of Heidegger's discussions of science poses at least two challenges with regard to the scope of the present essay. First, my discussion must consider not only Heidegger's specific claims about science, but also the connections between those claims and his broader concerns. Second, in the short space of this essay, I cannot offer a comprehensive account of Heidegger's philosophy of science. Instead, I will limit my focus to a core set of issues surrounding Heidegger's *concept* of science – i.e., his view of what science as such and in general is, as well as how that view relates to his accounts of human existence, modernity, and the history of metaphysics.

To treat those issues, I must devote significant space to Heidegger's discussions of physics, because *physicalism* (which I define in a somewhat unusually broad sense – roughly, as the privileging of physics' concepts, methods, and results in science and metaphysics[4]) figures prominently in his critiques of SCS and the history of Western metaphysics. Heidegger thinks physicalism has prevented us from understanding not only the source of science's epistemic virtue but also science's promise for human flourishing, which his preferred ACS foregrounds. But Heidegger's critique of physicalism, I argue, plays a central role within his early critique of the history of Western metaphysics, a role which most scholars have overlooked. Moreover, I argue that the later Heidegger comes to believe that the emergence of quantum physics reflects a profound shift in the aims of science that only leaves SCS more entrenched and poses serious challenges for human flourishing. Indeed, Heidegger believes that the classical-quantum shift in physics depends on, and is symptomatic of, the emergence of the set of commitments in late modernity that characterize what he calls the "age of technology."

[4] See Section 3.1.

Nevertheless, many key aspects of Heidegger's views on science and physics unfortunately fall outside the scope of the present essay. A (by no means exhaustive) list of such topics includes:

- Heidegger's specific views on biology, cognitive science, academic history, and so on[5]
- Heidegger's views on science in his very early (1912–1923) writings
- How Heidegger's views fit within many recent debates in philosophy of science – e.g., the role of theories vs. models in science, scientific realism, or the autonomy of science (though Sections 5–6 touch on the two latter topics)
- How Heidegger's philosophy of science relates to critical approaches like feminism or post-colonialism or to the views of his post-Kantian predecessors or later Continental thinkers – e.g., I don't treat how Heidegger intervenes in post-Kantian debates about the distinction between the *Naturwissenschaften* and *Geisteswissenschaften* (though see note 16)
- Why the early Heidegger conceives of ontology as an independent science, and why he comes to change his mind
- Heidegger's discussions of the concept of *phusis*

One final clarification is in order. Heidegger often uses "science" as a shorthand to refer to what he calls *positive science* (e.g., *SZ* 10) – i.e., the kind of domain-specific inquiry that presupposes foundational ontological assumptions that inform various specialized issues (e.g., the "three-body problem" only arises on the basis of Newtonian gravity and mechanics) – which he distinguishes from *philosophy*, or reflection on foundational ontological assumptions themselves. The implication is that Heidegger often classifies those generally referred to as groundbreaking "scientists" (e.g., Galileo, Newton, Einstein, Bohr, Heisenberg) as "philosophers."[6] Critics like Crease (2012) claim that Heidegger thus effectively denigrates science as (to adopt a Kuhnian idiom) "mop-up work." And this criticism is seemingly invited by remarks such as his infamous slogan "science does not think" (*WCT* 8). But as Thomson (2005, pp. 104–14) demonstrates, this slogan is just a provocative formulation of the very distinction at issue here, which Heidegger always maintains, between positive research *informed by* ontological assumptions and ontological reflection itself.[7] Crucially, however,

[5] On Heidegger's philosophy of biology, see Kessel (2011). Note also that, in clear homage to Dreyfus and Heidegger, Clark (1999), an important work on cognitive science, is titled *Being There*, which is the common translation for Heidegger's *Dasein*; see Clark (1999, pp. xvii, 148, 170–73).

[6] For Heidegger's appraisals of Einstein, Bohr, and Heisenberg, see *BH* 198, *CT* 67–68, *HCT* 3–4, *SZ* 9–10, *QT* 45; see also Beck (2005 pp. 168–72) on Heidegger, Einstein, and relativity. Thomson (2005, pp. 106–14) provides an excellent treatment of this distinction and its significance in Heidegger's thought.

[7] However, see Wendland (2019) for an alternative reading.

Heidegger also thinks that positive science and philosophy are structurally related – e.g., he writes that "[i]n crisis, scientific research assumes a philosophical cast" (*HCT* 3), and suggests that ontological disclosure is science's "essential task" (*P* 95). Heidegger thinks positive science is premised on a unique kind of "forgetting of being" (it makes its characteristic progress *when* and *insofar as* it is informed by a suite of ontological commitments). But it is also premised on – and, at least until late modernity, structurally occasions – a "recollection" of being (i.e., renewed ontological reflection). He thus immediately follows his remark that "science does not think" with "science always and in its own fashion has to do with thinking" (*WCT* 8).

The upshot for this essay is as follows. I will use "science" (and "scientist") in a sense broader than that of Heidegger's "positive science," because Heidegger himself believes that what he calls "philosophy" is in fact a crucial, structural aspect of mature scientific research. Thus, a consideration of Heidegger's concept of science cannot afford to exclude this aspect from the analysis. Nevertheless, I will aim to clarify the substantive point Heidegger means this distinction to track, especially when discussing Heidegger on science's biphasic (crisis/revolution—consolidation) cycle in Section 4.

1.2 Heidegger and Twentieth-Century Philosophy of Science

Heidegger bears an ambiguous relationship to contemporary philosophers of science. He criticizes the *methodological* approach to science that was popular for much of the early twentieth century. Methodological philosophers of science like Karl Popper or Imre Lakatos ask about the method that science ideally follows; this method is supposed to explain what differentiates (and perhaps elevates) science from other kinds of inquiry. But Heidegger thinks there is no common scientific method. Nevertheless, there are some interesting parallels. Heidegger thinks science is distinguished by a characteristic *ethic*, which both guides scientific practice and undergirds its epistemic virtue: science is a project dedicated to opening up access to reality, and to doing so in a unique way. And like Popper and Lakatos, Heidegger thinks science's epistemic virtue lies in its dynamism rather than its (dubiously alleged) progressive convergence on a final, true theory.

Meanwhile, commentators often note parallels between Heidegger's approach and two significant developments in twentieth-century philosophy of science: the turns toward history (see, e.g., Thomas Kuhn and Paul Feyerabend) and practice (see, e.g., Helen Longino and Bruno Latour).[8] On the former, science is

[8] See Kuhn (2012), Feyerabend (1993), Longino (1990), and Latour and Woolgar (1979). On the connection with Heidegger, see Glazebrook (2000, Chapters 2 and 5), Kisiel (1977), Kochan (2017), Rouse (1987, pp. 26–40), and Thomson (2005, pp. 104–15).