Introduction

> [R]eason in one planet is essentially the same as in another... If I premise that my experience is not merely the production of the mental activity of my own nature; in other words, not merely a dream, in which you are my vision as I am yours, but in which the external as well as the internal has its share in my experience, then everything that is alike in our experience must bear a corresponding similitude in external circumstances.... Let us only cite a few more examples, not as a proof, but in order that we may with greater facility reach a more comprehensive truth.
>
> Hans Christian Ørsted, writing as Alfred, in "The Spiritual in the Material," *The Soul in Nature*[1]

> For the universal exists nowhere as such, and it is up to me, to the energy of my consciousness, whether I see the universal in the particular or merely the particular.
>
> Søren Kierkegaard, writing as Judge William, in "The Equilibrium between the Aesthetic and the Ethical," *Either/Or*[2]

Thought Experiments in Philosophy

While philosophers regularly use thought experiments, there is little agreement on what they are or why they work. Their use may be as old as philosophy itself. We find examples in Plato (the Ring of Gyges in *Republic*, the Aviary in *Theaetetus*) and even earlier, such as Zeno's Achilles and the tortoise. The well-known puzzle of the ship of Theseus, reexamined by Thomas Hobbes, appears first in Plutarch's *Life of Theseus*, in the first century.[3] Thought experiments have a long and well-established history in philosophy for clarifying ideas, providing counterexamples,

[1] SN, 16/AN 1, 16. [2] *Either/Or*, trans. Hannay, 587 (EO 2, 329/SKS 3, 310).
[3] For discussion of the Ship of Theseus and other ancient thought experiments, see Ierodiakonou, "The Triple Life of Ancient Thought Experiments," 31–56, especially 33 and 36–37.

establishing new conclusions, and generally doing the work that philosophers do.

Despite their long-standing use in philosophy, it is common in contemporary discussions to view the method of thought experiment in philosophy as derived from its use in the sciences.[4] Roy Sorensen even suggests that thought experiments in philosophy "evolved from ordinary [i.e., scientific] experiments by a process of attenuation."[5] Accounts of thought experiment as a method typically contextualize it in the work of Ernst Mach, Thomas Kuhn, or both. Many leading accounts of thought experiment in general, including those of James Brown and John Norton, deal primarily with thought experiments in science and then extend the discussion to include philosophical thought experiments almost as an afterthought.[6] Even Brown's "Platonic" thought experiments are "remarkable," he notes, because "they provide us with a priori knowledge *of nature*" (my emphasis).[7]

There is no doubt that scientists such as Mach and Kuhn, as well as Galileo and Einstein, have contributed significantly to our contemporary use and understanding of thought experiments, including their philosophical use. But given the long history of thought experiments in philosophy (pre-dating Mach's discussions of their role in science by hundreds of years), framing their use in philosophy as derivative of their use in the sciences cannot give us the whole story. While contemporary philosophical thought experiments about personal identity, knowledge, and justice may take scientific experiments as inspiration, they are at least as likely to find their roots in their much earlier use by Plato, Lucretius, Plutarch, Hobbes, Locke, and others, especially for canonical cases (like Locke's prince and cobbler or the ship of Theseus).

[4] I will use the term "science" to refer to the natural sciences. By contrast, the terms *Wissenschaft* (in German) and *Videnskab* (in Danish) are often translated as "science" but broadly include any rigorous and systematic pursuit of knowledge, including the humanities. In keeping with contemporary usage in English, I use "science" in the narrow sense.

[5] Sorensen, *Thought Experiments*, 186, and see also 11–13.

[6] For example, Elgin claims that fictions and thought experiments, "like real experiments . . . exemplify properties or patterns" ("Fiction as Thought Experiment," 221). She accordingly first examines "the ways standard experiments enhance understanding," and then goes on to argue experiments in science "have more in common with fiction than we ordinarily suppose" (222). De Mey takes suggestions from Nersessian that her mental modeling account has broader applications and extends her view to explain counterfactual reasoning about history ("Remodeling the Past," 27–66). Kühne likewise focuses mainly on thought experiments in the sciences, suggesting they might play a modal role in philosophy (and here he references Sorensen, *Die Methode des Gedankenexperiments*, 136–137) or protect against physicalism through appeals to common sense intuitions (385–387).

[7] Brown, "Peeking into Plato's Heaven," 1130, and see 1137. Brown also discusses mathematics, see 1130–1131 and 1133–1136.

Nevertheless, some philosophers of thought experiment consider the true history of the concept to begin with Mach (a claim I will examine in the book). I agree that there must be something significant about the introduction of the term "thought experiment" [*Gedankenexperiment* in German and the lesser-known *Tankeexperiment* in Danish], together with more sustained attention to thought experiment as a distinct method. On the other hand, the increased recognition of thought experiments as a method should illuminate rather than negate the long tradition of their use, especially in philosophy – which may differ in important ways from their use in the sciences. This book aims to accommodate both the term's scientific origins in the early 1800s and the long-standing practice of thought experiments in philosophy. To that end, I examine the earliest known uses of the term "thought experiment," but I emphasize the philosophical use of the terms "experiment" and "thought experiment" even at this key point in history. The result is a view that is informed by the importance of thought experiments for science but takes account of its plurality of uses and meanings in its earliest beginnings. Since the philosopher Søren Kierkegaard, a contemporary of Hans Christian Ørsted, is one of those to employ the term *Tankeexperiment* in this time period, a study of this key period in the history of thought experiments necessarily takes us beyond their use in the sciences.

Why Kant?

Contemporary examinations of thought experiment as a method increased markedly in the 1980s and the years after.[8] These debates, as I have noted, trace their historical roots to Mach and take place mainly within philosophy of science. Many scholars remain either unaware of, or quickly dismiss – perhaps some with good reasons due to the scope of their projects – the earlier discussions of thought experiments by Ørsted and Kierkegaard. This book fills in some of that earlier history in Copenhagen in the first half of the nineteenth century.

One reason commonly given for moving quickly past Ørsted is that his work is thought to have had little influence on Mach, and therefore little influence on the development of the concept (see Chapter 3). But as Fehige has recently noted, it is not clear Mach's view had much influence either. His name appears at the head of lists of those who have contributed

[8] Fehige and Stuart, "On the Origins of the Philosophy of Thought Experiments: The Forerun," and Fehige, "The *Annus Mirabilis* of 1986: Thought Experiments and Scientific Pluralism."

to the topic, but there is not much discussion of thought experiments beyond their use in mathematics until Kuhn, around 75 years later.[9] Einstein's use of the term *Gedankenexperiment* (which he likely learned from Mach) popularized the term. But that does not mean that Mach's discussions of thought experiment, or Einstein's use, influenced *philosophers'* understanding of thought experiments. As I have noted, Locke's prince and cobbler thought experiment is a touchstone in philosophy of personal identity and predates Mach, as does Hume's variation on Plutarch's ship of Theseus, along with countless other examples.

Although relationships of historical influence matter, what is most important in such analyses are the new interpretive possibilities they provide. In the case of thought experiments, a glance at history reveals we do not have a single concept (originating with Mach, for example) whose meaning evolves linearly over time. It is not the case, or not *simply* the case, that a new method in science makes its way over to philosophy. A more plausible account is that changes in science provided a new framework to make sense of a method philosophers were already using effectively, recognizably, and in a manner that would be hard to distinguish from its use in philosophy today. To explain why the term was so readily adopted by philosophers as well as scientists, we need to look back before Mach to earlier uses of the term and why it mattered to those who used it.

This book is both a historical examination of a little-studied time period and an original account of how thought experiments really work in philosophy. It is comprehensive in providing meaningful ways to distinguish different kinds of thought experiments, beyond referring to their subject matter or discipline (e.g., math or ethics). Alongside claims that thought experiments provide understanding (Stuart, Elgin, Wiltsche), logical proofs (Sorensen, Norton), or direct intuition of ideal objects (Brown, Chudnoff, Bengson), I argue that thought experiments provide *cognition* in Kant's sense of the term [*Erkenntnis*]. (I define "cognition" in Kant's sense in Chapter 1.)

Even though Kant himself did not use the term *Gedankenexperiment*, the question that Ørsted, Kierkegaard, and Mach all ask is a Kantian one: what makes abstract concepts meaningful? The view I put forward here

[9] Fehige, *Thought Experiments, Science, and Theology*, 56–61. Contributors to philosophy of thought experiment in this time period include Pierre Duhem, Eugenio Rignano, and Edmund Goblot. For an excellent examination, see Buzzoni, "A Neglected Chapter in the History of Philosophy of Mathematical Thought Experiments" and "Pierre Duhem and Ernst Mach on Thought Experiments."

joins other recent Kantian accounts, including those of Marco Buzzoni, Michael Stuart, Yiftach Fehige, and Michael Friedman.[10] The earliest Kantian account of thought experiments that we know of is Ørsted's own. Kant calls the antinomies "experiments of pure reason" (see Chapter 1 of this book). But when Ørsted describes thought experiments as a distinct method, he begins instead from Kant's discussions of the geometer's method of construction – for example, drawing a triangle according to strict mathematical rules. The result is a physical triangle drawn on paper, but what matters about the rigorously constructed triangle is its conformity to the ideal version of itself, as enacted through the strict process of constructing it. Here, thought Kant, was a clue as to how something concrete – such as a set of contingent empirical observations – could retain a connection to the type of necessity held by logical and mathematical forms. In *Metaphysical Foundations of Natural Science*, Kant asks what basis there can be for treating empirically observed relationships in nature as conforming to *laws*.[11] Kant wants to give "sense and meaning" to the a priori forms already established.[12] If a priori status comes only from the *form* of experience and not its matter, we cannot say the laws apply to the world. But physics, as Kant reiterates in the *Opus Postumum*, is concerned with *matter*. The very idea of a system of matter, or laws pertaining to matter, is on first look paradoxical for Kant, based on the concepts he has given himself to work with.

We might say this is a uniquely Kantian problem that need not concern most of us, especially given the contemporary consensus in philosophy of science that nature has no a priori laws. For anyone with a more pragmatist approach to science, or certainly for a fictionalist view like Hans Vaihinger's, the question of the a priori validity of scientific concepts does not arise. While we may not be sympathetic to Kant's problem, I think his

[10] It also agrees substantially with Wiltsche's phenomenological account, especially on the importance of presentational fulfillment. See especially "The Forever War: Understanding, Science Fiction, and Thought Experiments."

[11] For an excellent in-depth discussion of Kant on these topics, see Friedman, *Kant's Construction of Nature* and *Kant and the Exact Sciences*. On the importance of laws to Kant across different areas of his philosophy, see Watkins, *Kant on Laws*. For other discussions of the problem of laws for scientific observations, see Heis, "Review of Michael Friedman, *Kant's Construction of Nature*"; Everett, "A Kantian Account of Mathematical Modelling and the Rationality of Scientific Theory Change," and Förster's "Introduction" to *Opus Postumum*.

[12] Förster, "Introduction" to *Opus Postumum*, xxxiii, quoting MFNS 4:478. Förster explains that *Critique of Judgment* provides a "form" that pairs with the "matter" considered in *Metaphysical Foundations of Natural Science*, but a *transition* – a term to which Kant returns often in *Opus Postumum* – is needed to unify them as a system (xxxv). For a few of Kant's numerous references to the need for a such a "transition," see OP 22:298, 22:300–301.

underlying motivation is one that matters more widely. Kant wants to ensure that all abstract concepts, laws, and principles have a connection to experience that is appropriate for the kind of thing they are. Current Kantian accounts of thought experiment solve this problem in different ways. For philosophy of science, Marco Buzzoni argues that the requirement for intuitive fulfillment can be met through operationality. That is, theories – and also thought experiments in the natural sciences – must be empirically testable, even if only in principle. (I discuss Buzzoni's view in detail in later chapters.) In that way, Buzzoni provides a plausible explanation for how scientific theories relate to empirical observations, as well as a possible role for thought experiments in the sciences.

As Buzzoni notes, however, requiring empirical enactment is not very useful for philosophical thought experiments. As he says, "an actual empirical replication of Searle's TE, even if it confirmed the empirical intuition on which it is based, would not lead to any interesting philosophical conclusions."[13] Wiltsche suggests that in narrative contexts (including literary works), we more often aim for "existential understanding" instead of physical understanding.[14]

So what can a Kantian view offer as an account of thought experiment *in philosophy*, where there is nothing strictly "operational" other than the act of thinking itself? Buzzoni does not offer us much to go on here, as he wants to maintain that there is no "difference in kind between the particular methods of science and philosophy," though he acknowledges a difference in subject matter and direction of inquiry.[15] He also states that philosophical thought experiments must be performed by each individual, whose task is to "retrace, reconstruct, re-appropriate and evaluate in the first person the steps that led to that conclusion being asserted, or, in other words, the reasons why it should be accepted."[16] In other words, for philosophy, the "performance" of the experiment will have to do with the individual's own appropriation and re-enactment in thought.

The emphasis on individual appropriation will sound familiar to readers of Kierkegaard. In Kierkegaard's philosophy, we find explanations of

[13] Buzzoni, "Thought Experiments in Philosophy," 778, and he references Harré and Wang's empirical enactment, where they report the empirical realization was inconclusive on the relevant issues ("Setting Up a Real 'Chinese Room': An Empirical Replication of a Famous Thought Experiment"). On the irrelevance of empirical confirmation for narrative thought experiments, see also Buzzoni and Savojardo, "Thought Experiments between Theology, Empirical Science, and Fictional Narrative."

[14] Wiltsche, "The Forever War: Understanding, Science Fiction, and Thought Experiments," 3692.

[15] Buzzoni, "Thought Experiments in Philosophy," 777.

[16] Buzzoni, "Thought Experiments in Philosophy," 777.

thought experiment that – while presumably not influential for the historical development of the concept – are nonetheless in line with Ørsted's view and its Kantian beginnings, as well with Buzzoni's own emphasis on appropriation. And since Kierkegaard was already using the term *Tankeexperiment* well before Mach (presumably having heard it from Ørsted, his contemporary and friend), it is worth taking a more careful look at the role that Kierkegaard believes thought experiments play in such individual appropriation.

Tankeexperiment in Kierkegaard

Kierkegaard uses the term *Tankeexperiment* (or *Tanke-Experiment*) across his authorship and in his journals. He also uses the term "psychological experiment" [*psychologiske Experiment*], by which he means something more like a thought experiment than psychological experiments in the contemporary sense. The term *Experiment* itself was new to Danish in the early 1800s, and since Kierkegaard often uses it in a way that implies imagination or fiction, Howard and Edna Hong translate the bare term *Experiment* as "imaginary construction." *Experiment* in this sense, together with its more explicitly mental applications (*Tanke-Experiment* and *psychologiske Experiment*), is a recurring method in Kierkegaard's work as well as a topic of reflection. He contrasts "imaginary construction" [*Experiment*] as a method with more standard philosophical methods like argumentation and observation. One fictional persona (i.e., pseudonym) Johannes Climacus concludes, "This form won my complete approval" (CUP1, 264/SKS 7, 239).[17] While Kierkegaard at times raises problems for imaginary construction as a method, it is also something he relies on throughout his authorship, across different signed and unsigned (pseudonymous) works.

In this book, I will show how Ørsted and Kierkegaard extend Kant's project of clarifying the kinds of cognition appropriate to different domains. Both Ørsted and Kierkegaard think that thought experiments provide a source of cognitions, in carefully qualified ways. Since this is a method Ørsted attributes to Kant (although Kant did not use the term), it is reasonable to recognize Ørsted as having put forward an early Kantian

[17] Kierkegaard often wrote using "pseudonyms," or fictional authorial personalities. I follow the standard method in Kierkegaard scholarship of attributing ideas directly to pseudonyms rather than to Kierkegaard himself where appropriate, much as we credit dialogue in novels or plays to the characters without claiming it is the author's own view. Nevertheless, it is still possible to talk about a more encompassing Kierkegaardian view, spread across the pseudonymous and signed works.

account of thought experiments.[18] Fehige and Stuart propose Lichtenberg and Novalis as continuing that Kantian tradition with respect to thought experiments, though without adopting all of Kant's philosophy.[19] Fehige and Stuart call them both "philosopher-scientists," which I think is fitting, as they interweave the notion of experimentation in natural science with a broader conception of what Lichtenberg calls "experiments with thoughts and ideas."[20]

Kierkegaard read Lichtenberg carefully and mentions him in overwhelmingly positive terms. While he does not mention the method of thought experiment explicitly in relation to him, he appreciates Lichtenberg's distinction between thinking for oneself and parroting inherited knowledge. He finds Lichtenberg's concerns so much in convergence with his own that he becomes almost rhapsodic in a journal entry: "Thank you, Lichtenberg, Thanks! For saying there is nothing more tiresome than talking with a so-called man of letters in science who hasn't done any thinking himself yet knows 1000 historic-literary particulars . . . Thanks for this voice in the wilderness, thanks for this thirst-slaker; like the cry of a wild bird in the stillness of the night, it sets one's whole fantasy in motion" (KJN 1, 222/DD:29/SKS 17, 231).[21] The points on which Kierkegaard refers to Lichtenberg are on the difference between action and calculation (LD 269/SKS 28, 408), and the importance of what we contribute to experience ("Such works are mirrors: when an ape looks in, no apostle can look out").[22]

Although Kierkegaard uses imaginative scenarios regularly and even reflects on their use as a method, histories of the concept of thought experiment do not mention him.[23] One likely reason for the omission is that the standard translations of Kierkegaard's writings by Howard

[18] Cohnitz, "Ørsteds Gedankenexperiment: eine Kantianische Fundierung der Infinitesimalrechnung ?" 412; Buzzoni, "Kantian Accounts of Thought Experiments," 332.

[19] They write, "Kant's philosophy influenced the period of the forerun greatly, and both Lichtenberg and Novalis were strongly affected by his writings" ("On the Origins of the Philosophy of Thought Experiments: The Forerun," 198). They claim that "both philosopher-scientists [i.e., Novalis and Lichtenberg] are actually influenced by the Kantian enlightenment" (180).

[20] See Fehige and Stuart, "On the Origins of the Philosophy of Thought Experiments," 181.

[21] Other references to Lichtenberg, all positive, include KJN 1, 221/SKS 17, 235/DD 38, KJN 4, 390/SKS 20, 389-90/NB5:42a (again in the context of the inability to depend on inherited knowledge), and KJN 4, 264/SKS 20, 264/NB3:38.

[22] This is the quote on the title page of *Stages on Life's Way* (SLW 8/SKS 6, 16). See also SLW, 146/SKS 6, 138 and SLW, 229/SKS 6, 215. For discussions, see Aumann, *Art and Selfhood*, 109.

[23] Fehige does not mention him in his account of the early history of thought experiments ("The *Annus Mirabilis* of 1986: Thought Experiments and Scientific Pluralism," 222–240), which surveys the periods leading up to contemporary debates, and Kierkegaard's name does not appear in *The Routledge Companion to Thought Experiments*.

V. Hong and Edna H. Hong translate the Danish word *Experiment* as "imaginary construction" and *Tankeexperiment* as "imaginary construction in thought." This decision was well considered, and it does have some advantages (see Chapter 10 of this book for a full discussion).[24] I think there are at least three benefits to the unique translation. First, their translation prevents the casual reader from automatically projecting our contemporary use of thought experiments (e.g., Gettier problems and zombies) onto Kierkegaard. As Hong and Hong emphasize, the term *Experiment* is relatively rare in Danish in the 1800s, and *Tanke-Experiment* is even more rare (used almost exclusively by Ørsted). We should be open to idiosyncratic uses of *Experiment* and *Tankeexperiment* by Kierkegaard, and the unusual English phrase "imaginary construction" alerts readers to that peculiarity. Second, "imaginary construction" is neutral toward whether the mental activity is conducive to genuine thinking or not. In fact, Kierkegaard uses the term ambiguously: sometimes imaginary construction is a way of avoiding an issue, while in other cases (or so I argue) imaginary constructions facilitate genuine cognitions. But we should avoid building any implication of success or effectiveness into Kierkegaard's term. Third, and particularly fortunate in the context of this project, the term "construction" fortuitously invokes the Kantian context of construction in geometry, to which Ørsted appeals in introducing "thought experiment" as a method. As I will argue in this book, I think Kierkegaard does mean something like Kantian construction by *Experiment*. The translation of *Experiment* as "imaginary construction" overall points readers in a useful direction.

However, a significant disadvantage is the loss of continuity with the concept of *Tankeexperiment* in Ørsted and so to the wider history of thought experiment and experiment as a method. Currently, there is little cross-pollination between work in epistemology that examines the use of thought experiments in philosophy (such as Williamson, Chudnoff, and Bengson) and work focused primarily on their use in math and science (such as Brown, Norton, Nersessian, Elgin). This book restores that connection by showing substantial similarities, beyond the use of a common term, between Ørsted's appeals to thought experiment to link mathematical reasoning and empirical observation and Kierkegaard's use in "unscientific" [*Uvidenskabelig*] contexts. By further situating their work in relation to later developments and applications, I show that Ørsted's

[24] On their reasoning, see Howard V. Hong, "Tanke-Experiment in Kierkegaard," 39–51, and "Historical Introduction," R xx–xxxi.

and Kierkegaard's concept of *Tankeexperiment* not only remains plausible today but solves some problems in contemporary debates.

Kierkegaard and Ørsted

Given that the term *Tankeexperiment* was seldom used in the early to mid-1800s, it seems likely that Kierkegaard learned the term from Ørsted.[25] Ørsted was deeply influenced by Kant. As a student at the University of Copenhagen, it was standard to study science through Kant's philosophy. Physics and chemistry were offered primarily in the Faculty of Medicine, where he later pursued further studies.[26] Kant's philosophy fell out of favor among scientists in the following years, which often made it difficult for Ørsted to explain his reasoning to fellow scientists.[27] While firmly committed to empirical experimentation and emerging modern scientific practices, Ørsted was also occupied with human questions of beauty, goodness, and the divine. For Ørsted, experiment in science was not just a way of acquiring empirical evidence but a way of filling one's mind with the best material for thinking and living well. There is a danger that one's mind can be taken up by "empty abstractions" without "the experiences from which these maxims are taken" (SN, 226/AN 2, 111). A primary function of real experiments, proposed Ørsted, is not to acquire new knowledge for a scientific community but to address the personal uncertainty of individual learners (SN, 348-49/SES 3, 95-96). This is a problem and solution that Ørsted inherits from Kant, as I have emphasized. Thought experiments likewise, Ørsted suggests, help solve the problem of empty concepts. This book shows how Ørsted's concern about emptiness and fulfillment in an individual's mental life intersects with Kierkegaard's insistence on seeing

[25] The similarities between their views outlined in the book are philosophically and historically significant even if they both learned the term from a third source, such as Poul Møller (see Chapter 10). On Ørsted's status as part of the "forerun" of the history of thought experiments, see Cohnitz, "Ørsteds 'Gedankenexperiment,'" 407, and *Gedankenexperimente in der Philosophie*, 32; Kühne, *Die Methode des Gedankenexperiments*, 165; and Buzzoni, "Kantian Accounts," 332, and "Thought Experiments," 90. Fehige notes that the period between 1811 and 1897 remains "largely unexplored" ("The *Annus Mirabilis* of 1986: Thought Experiments and Scientific Pluralism," 223–224).

[26] See Christensen, "A University without Science," in *Hans Christian Ørsted: Reading Nature's Mind*, 25–39.

[27] Shanahan notes that for many years Ørsted's famous discovery of the relationship between electricity and magnetism was widely attributed to chance, even though Ørsted predicted such a relationship because of his commitment to Kant's idea of nature as a unified system. See "Kant, Naturphilosophie, and Ørsted's Discovery of Electromagnetism: A Reassessment," 287–305.

for oneself. Both are rooted, as I will show, in Kant's goal of cognition, or a synthesis between concepts and sensations.

Reexamining this time in the history of philosophy has implications for how we understand thought experiments today. Thomas Kuhn famously asked, "How, then, relying exclusively upon familiar data, can a thought experiment lead to new knowledge or to new understanding of nature?"[28] The question of how thought experiments provide *knowledge*, and specifically knowledge in the natural sciences, continues to structure contemporary debates. The question, in other words, is how thought experiments expand what we know. By contrast, the main question for both Ørsted and Kierkegaard is how we, as thinkers, relate to the conceptual and experiential content we already have.

Kant's question is bilateral: we need not only to fill in concepts with intuitions but also make our observations meaningful through concepts. Science must not be a "mere sensuous" affair but a way of progressing from sensory experience to rational explanations. The scientist seeks laws in nature "with all the powers of his mind, and he does not remain at the mere sensuous point of view" (SN, 287/AN 2, 190). As I have proposed, and will elaborate in later chapters, the problem of joining concepts with experience is solved for Kant through the activity of *cognition* [*Erkenntnis*]. The driving philosophical question for Kant is not how to get more knowledge of one kind or another (whether a priori or a posteriori), but how different kinds of knowledge and different faculties in a human person can be related. I propose that the Kantian problem of cognition – and not the question of getting a priori knowledge of nature – guides Ørsted's discussions of thought experiment. Since thought experiments are planned by a thought experimenter, they are less vulnerable to chaotic, unlawlike elements than physical experiments; they nevertheless provide more specific content than definitions or proofs, with the aim of expanding and refining concepts. They offer a possible bridge, therefore, between thinking and sensing.

Cognition may, but does not always, lead to knowledge. This book shows how thought experiments are an apparatus for making thought meaningful. It does not answer the epistemological question of whether or how thought experiments also provide justification. I outline some possibilities in the concluding chapter for how they might, but the epistemological question is not the main focus of the book. Part of the

[28] Kuhn, "A Function for Thought Experiments," 241. Kuhn asks a series of three questions in this essay. The one cited here is the best known and most influential.

work of the book is to show that Kuhn's epistemological question is not the only one we can (or should) ask about thought experiments. The question of cognition is, I argue, more fundamental.

Kant *and* Kierkegaard?

Someone skeptical of or unfamiliar with recent work on Kant and Kierkegaard might doubt that an account of thought experiments can be Kantian *and* Kierkegaardian. Kant's philosophy emphasizes reason and universality, after all, while Kierkegaard prioritizes subjectivity and the individual (see, e.g., CUP1, 328/SKS 7, 299).[29] To my mind, and to a number of other recent scholars, the obvious differences between Kant and Kierkegaard (as well as between Hegel and Kierkegaard, and Kierkegaard and Husserl, etc.) make the remaining similarities all the more interesting.[30] These similarities are not always points of direct influence but rather of conceptual overlap. Fremstedal lists 14 distinct points of overlap between Kant and Kierkegaard, ranging from those broadly shared within the Augustinian tradition to more idiosyncratically Kantian themes (such

[29] Scholars typically pinpoint a disagreement between Kierkegaard and the German Idealists on the role of reason. Westphal describes a dialectical tension between faith and reason in the higher stages of religiousness for Kierkegaard (*Kierkegaard's Concept of Faith*, 220). Evans likewise argues there is a "natural tension between faith and human reason as it is concretely employed" (*Faith Beyond Reason*, 114). Evans contrasts Kierkegaard's view with Kant's (*Kierkegaard's 'Fragments' and 'Postscript*,' 42–43, 85–86) but also notes points in common, such as the importance of duty and its distinction from instrumental thinking (77–78, 82–83, 141) as well as similarities between Climacus's discussion of the paradox and Kant's antinomies (222–224, with thanks to an anonymous reviewer for this reference). I have argued elsewhere that Kant's and Kierkegaard's views of reason and faith are more similar than standardly thought (Helms, "On Climacus's 'Against Reason' Thesis: A Challenge to Westphal" and "Hope and the Chaos of Imagination in Kant and Kierkegaard"). However, the Kantian-Kierkegaardian view of thought experiments I put forward in this book does not presuppose agreement between Kant and Kierkegaard on other topics, including the role of reason with respect to faith or the place of the highest good, which Fremstedal identifies (rightly, I think) as a point of significant overlap (Fremstedal, *Radical Evil and the Highest Good* and "The Moral Argument for the Existence of God and Immortality: Kierkegaard and Kant," where Fremstedal identifies points of similarity (as well as key differences) between Kant's examination of the "natural dialectic of reason" and Kierkegaard's "dialectic of understanding" (50–53)).

[30] See most prominently Green, *Kierkegaard and Kant: The Hidden Debt* and *Kant and Kierkegaard on Time and Eternity* and Fremstedal, *Kierkegaard on Self, Ethics, and Religion: Purity or Despair* and *Kierkegaard and Kant on Radical Evil and the Highest Good*: *Virtue, Happiness, and the Kingdom of God*. Some later scholars have challenged the extent of the "debt" Kierkegaard owes Kant, especially Green's suggestion that Kierkegaard went to some lengths to hide Kant's influence, perhaps due to Kant's waning status (see Verheyden, "The Ethical and the Religious as Law and Gospel," 157–158). Thanks to an anonymous reviewer for directing me to some of these points of connection and debate.

as the relation of freedom to anxiety).[31] "In any case," he concludes, "it seems clear that the framework and meaning of Kierkegaard's thought are in agreement with those of Kant's thought," comparing especially Kant's doctrine of radical evil and Kierkegaard's discussions of guilt and sin. Karl Verstrynge agrees that the idea of God as a regulative concept links the two thinkers, despite the differences.[32] Of special relevance for this book, he also notes that imagination as the "capacity *instar omnium*" for constituting the self "plays a decisive role in the willing a person has," and therefore for directing the will toward its regulative goal.[33] While differences remain (such as the relation between ethics and religion), so do a number of similarities.[34]

On the broad question of Kant's influence on Kierkegaard and the extent of their similarities, Kierkegaard's close connection with the Ørsted brothers confirms that he remained in conversation with at least these two Danish Kantians in the 1840s while doing the bulk of his

[31] See Fremstedal, *Kierkegaard and Kant on Radical Evil and the Highest Good*, 51. He concludes there is broad agreement between Kant and Kierkegaard on the points he examines, primarily pertaining to Kant's doctrine of radical evil and Kierkegaard's discussions of guilt and sin (52). For scholarship that adds depth to earlier broad contrasts between Kant and Kierkegaard, see Phillips and Tessin (eds.), *Kant and Kierkegaard on Religion*, and Kosch, *Freedom and Reason in Kant, Schelling, and Kierkegaard*, which aims to show "how close . . . the Kierkegaardian end-point is to the Kantian beginning," as their admittedly different accounts "are rooted in the same set of presuppositions" (219).

[32] Verstrynge, "The Perfection of the Kierkegaardian Self in Regulative Perspective," 489. He also mentions the centrality of will.

[33] Verstrynge, "The Perfection of the Kierkegaardian Self in Regulative Perspective," 492. Kierkegaard refers to Fichte in relation to the claim that imagination is the fundamental faculty (see discussion at Fremstedal, "Kierkegaard's Use of German Philosophy," 45). Although Kierkegaard associates this description with Fichte, it is also a Kantian idea. As Matherne puts it, the imagination for Kant is a "pervasive mental capacity that contributes to the cognitive, aesthetic, and moral aspects of our lives" (*Kant's Theory of the Imagination*, 55). Heidegger takes imagination to be the "common but to us unknown root" described by Kant in *Critique of Pure Reason* (A15/B29): "As original, pure synthesis, it forms the essential unity of pure intuition (time) and pure thinking (apperception)" (Heidegger, *Kant and the Problem of Metaphysics*, 90). The imagination is not just "an external bond which fastens together two ends. It is originally unifying, i.e., as a particular faculty it forms the unity of both of the others, which themselves have an essential structural relation to it," going on to ask: "What if this original, formative center was that 'unknown common root' of both stems?" (96). Sudan also emphasizes the similarity of Hegel's view of imagination with Kant's, as both thinkers view the imagination as a "mediator between sensible and conceptual domains" ("The Kantian Roots of Hegel's Theory of the Imagination," 129). For Kant's lengthier discussion of the role of imagination with respect to understanding and sensibility, see A115–128. My thanks to an anonymous reviewer for the suggestion to consider Heidegger's discussions of Kant.

[34] Verstrynge writes, "Kierkegaard and Kant seem to be in agreement about the way the God-problem can be dealt with," including in their ambiguity toward God as an objective truth ("The Perfection of the Kierkegaardian Self in Regulative Perspective," 494) and, in contrast with Hegel, "respect for the autonomy of the religious sphere" (495).

writing.[35] We also know that Kierkegaard attended Martensen's lectures on Kant (see Kierkegaard's notes, "Lectures on the Introduction to Speculative Dogmatics" in the Winter Semester 1837–1838). In his notes on the ninth lecture, dated December 21 [1837], Kierkegaard mentions "the well-known example of the 100 thalers," a Kantian example referenced often by Marco Buzzoni.[36] In the lecture, Martensen (or Kierkegaard in his reflections on the lecture) distinguishes thought from being: for the fictional thalers, "I may certainly think of them, but it does not at all thereby follow that they exist" (KJN 3, 139/SKS 19, 139/NB4:11). The discussion occurs in the context of a proof for God's existence challenged by Kant. The fact that we can think the concept of God, or that the universe would be unthinkable without God, does not prove that God really exists. Nevertheless, Kant argues we can conceive of the idea of God *regulatively*, "as an idea that the hum[an] being ought to realize in the whole of his life, but that he could never attain" (KJN 19, 139/SKS 19, 140/NB4:11). Yet Kierkegaard, like Kant, does not treat that limitation as the final word. Like Kant, he wonders about the extent to which regulative ideas become true, or attain existence, just in being thought. In notes on the eighth lecture, Kierkegaard writes: "Yet here K[ant] was basically not idealist enough . . . to the same degree that I think freedom—and with the same energy that I think it—I am also free" (KJN 3, 137/SKS 19, 137/NB4:10). The implication here is significant for an account of thought experiments in philosophy. Whether the view is Martensen's or Kierkegaard's gloss on it, the suggestion is that there are some kinds of ideas that are so essentially inward that merely thinking them in the right way makes them actual. While acknowledging their differences, scholars widely agree that for both Kant and Kierkegaard the idea of God is regulative.[37] They further agree this regulative concept

[35] My thanks to an anonymous reviewer for pointing out the relevance of these connections for the question of Kant's influence on Kierkegaard. For an in-depth discussion of other possible sources of Kant's ideas, see Fremstedal, *Kierkegaard and Kant on Radical Evil and the Highest Good*, 233–235 and *Kierkegaard on Self, Ethics, and Religion: Purity or Despair*, 75–77, arguing Kierkegaard was familiar with Kant's critiques of eudaimonism.

[36] Buzzoni, "Thought Experiments from a Kantian Point of View," 98–99; *Thought Experiments in the Natural Sciences*, 109–111.

[37] As Verstrynge puts it, "In Climacus' view the existential striving cannot be understood as if an actual goal, whose realization would complete existence, would be at the end of it" ("The Perfection of the Kierkegaardian Self in Regulative Perspective," 480). Fremstedal writes, "Kierkegaard also makes sporadic use of Kant's related distinction between regulative and constitutive principles (SKS 17, 270, DD: 176/KJN 1, 261; SKS 1, 311/CI, 275; SKS 4, 86/R 219; SKS 11, 226/SUD, 115)," also referencing the notes on Martensen's lectures. "Such regulative ideas," notes Fremstedal, "are transcendental, surpassing all boundaries of experience; experience cannot therefore provide objects

needs to connect in some further connection with existence, perhaps through the use of symbols.[38] I consider the role of symbol and analogy as a possible source of intuition with respect to regulative ideas later in the book. Whether or not analogy works in the way Kant hopes, there is evidence that Kant's and Kierkegaard's philosophies overlap on key topics. One of the places of significant overlap identified by Kierkegaard scholars is on the concept of regulative ideas and the need for (but difficulty of) fulfilling nonempirical concepts in experience. These points of agreement are the center of the Kantian-Kierkegaardian view of thought experiments I propose in this book.

The Defining Features of Thought Experiment

In framing thought experiments as a solution to Kant's problem of cognition, some essential characteristics of thought experiments come into clearer focus. First, Ørsted describes all experimentation as a *method of variation*. He means that experiments begin with a representation of the world as it has been observed and then make changes in order to see how different features matter. Empirical experiments make physical changes and observe the visible results. Thought experiments vary by imagination only. For Ørsted, the ability to introduce new variations that are freely chosen by the experimenter is what makes thought experiments properly "experimental." The presence or absence of empirical data in the result is not, according to him, definitive of what it means to be an experiment.

Second, because the experimenter's freedom is an essential component, it matters to Ørsted that the variations in thought experiments are deliberately designed. He reiterates Kant's distinction between everyday observation and scientific experiment as marked by a shift from passivity to *autonomy*. If experimentation were primarily a method of acquiring new knowledge (i.e., new data), it would not essentially depend on the experimenter's freedom. The autonomous element is the synthesis between

adequate for the ideas (A327/B384). Any progress towards transcendent ideas will therefore at best involve an asymptotic approximation that never reaches the transcendence as such" (*Kierkegaard on Self, Ethics, and Religion: Purity or Despair*, 188). See also Pattison, "'Before God' as a Regulative Concept," 70–86. It matters for Kierkegaard, Pattison argues, that the "image of God" is an inner transparency to (and reflection of) God rather than "a direct impress" (79)—that is, not an empirical intuition. See also Dalferth, "The Middle Term: Kierkegaard and the Contemporary Debate about Explanatory Theism," 75.

[38] On similarities between Kierkegaard and Kant on the question of symbol, see Bubbio, *Sacrifice in the Post-Kantian Tradition*, 87–116, and Fremstedal, *Kierkegaard and Kant on Radical Evil and the Highest Good*, Ch. 8.

concepts and observations, such that principles (and for physical experiments, hypotheses) govern what data we bother to collect. So while thought experiments do not result in new sensory data, since they are deliberate Ørsted thinks they exercise the same autonomy as empirical experiments.

The last core feature of thought experiments we can take from Ørsted's discussions is the focus on cognition, as I have already mentioned. He went as far as to wonder whether all the geometry that is already established according to proofs could be reestablished through thought experiments (SN, 462/GN, 468). Thought experiments would not provide new knowledge in this case but would serve to make that knowledge *genuine* – that is, actually performed by the individual learner. Such thought experiments would not be redundant, he thought, because they would provide the researcher with a new kind of direct access to the ideas that proofs present only procedurally. Deductive proofs are potentially passed on merely mechanically, as they can be learned by rote. Thought experiments, by contrast, could provide immediate access to the necessity of a principle or relationship. He describes this direct access as a "far brighter and more immediate insight into the actual source of each truth, and a much closer amalgamation between it and natural philosophy would thus be gained than formerly existed" (SN, 462/GN, 468). In other words, thought experiments provide a distinct, more direct reason for thinking that something is true, and in such a way as to reduce the gap between mathematical proofs and physical observations. He does not imply (as I discuss later in more detail) that it is possible to do physics a priori.

In setting forward these key features of Ørsted's view, the book also highlights their similarities with Mach's descriptions of experiment and thought experiment. The continuity between the two thinkers' views is strong enough, I suggest, to make it likely that Mach was familiar with and influenced by Ørsted's account. If so, then Ørsted's contributions in fact had a substantial causal influence on our modern understanding of thought experiment as a method, even if most readers of Mach's essay were unaware of Ørsted's prior work. However, even if there is no direct historical influence, there is no basis given their similarities to separate Mach's view definitively from Ørsted's. Both thinkers characterize thought experiments as (1) variations that are (2) free and (3) genuine as a solution to the Kantian problem of empty abstractions and meaningless sensations.

In clarifying Kierkegaard's view of thought experiments, I show how he retains these three core features of Ørsted's view. Like Ørsted, he takes the value of thought experiments to be their ability to identify non-sensory continuities that underlie visible changes. Kierkegaard similarly teaches his

readers to track essential wholes that survive outward variations. Such abilities matter when identifying selves, recognizing acts of love, and appreciating the changelessness of the divine. Like Ørsted, Kierkegaard argues that recognizing underlying wholes requires activity on the part of the learner. And just as for Ørsted, the *genuineness* of that recognition matters. It must be enacted as a synthesis of thought with concrete content, not entertained as merely thought, any more than it can be merely an observation in the sensory world. In these ways, understanding the core features of Ørsted's Kantian account of thought experiment provides new insights into Kierkegaard's use of imaginary constructions.

Outline of the Book

The book is divided into three main parts. Part I defines the core Kantian notion of cognition [*Erkenntnis*], examines similarities between Ørsted's account and Mach's, and situates the view within contemporary debates on thought experiment. Recent research includes work in philosophy of science, where the debate between James Brown's Platonism and John Norton's empiricism has long set the stage, as well as on the epistemology of intuitions, where leading voices include Timothy Williamson, Ernest Sosa, and Elijah Chudnoff. There is currently little overlap between these two contemporary philosophical subfields. This book shows how Ørsted's and Kierkegaard's Kantian accounts avoid problems in both sets of views. Additionally, Part I provides the first focused study of the 1811–1897 time period that Yiftach Fehige has called the "inauguration" of the concept of thought experiment.[39]

For Kant, the most immediate goal of cognition is not certainty but shared attention: cognition enables thinkers to have ideas in common, whether true or false. Chapter 1 of the book introduces core Kantian concepts as well as the main claim of the book: Thought experiments provide a tool for cognition. Chapter 2 situates this main claim in relation to contemporary views of thought experiment. Chapter 3 engages rigorously with Ørsted's writings on thought experiments. Chapters 4 and 5 bring the details of Ørsted's Kantian account into contemporary debates, first in philosophy of science (Chapter 4) and then for epistemology (Chapter 5). I show how most views in philosophy of science are committed to empirical approaches, and the work on intellectual intuitions in epistemology is susceptible to Kantian critiques of rationalism. These

[39] Fehige, "The *Annus Mirabilis* of 1986," 223–224.

chapters show how Ørsted's development of Kant's philosophy offers a way out of the dilemma posed by empiricism and rationalism in contemporary debates.[40]

Part II of the book examines some core Kantian ideas to further elucidate the view outlined by Ørsted. In these chapters, I go beyond what Kant and Ørsted explicitly say about thought experiments to develop an original but historically rooted explanation of what thought experiments do. Chapter 6 outlines Kant's different proposals for achieving cognition outside sensory perception, including (1) through practical action, (2) by analogy, and (3) through construction. Chapter 7 explores why cognition matters even in cases like math and geometry where we already have knowledge and constructing a model seems superfluous. It also clarifies how the core characteristics of variation, freedom, and genuineness help achieve cognition in thought experiments. The rest of Part II examines implications of the claim that thought experiments are an apparatus for cognition. Chapter 8 sets forward the unique advantages of a Kantian approach, including the ability to distinguish between constitutive and regulative concepts. The distinction matters most for the concepts Kant calls "ideas of reason," such as the universe as a whole and the idea of the self, or personal identity. Chapter 9 shows how a Kantian approach, as modeled by Ørsted, solves the contemporary problem of bizarre cases: How can strange and implausible cases teach us about reality, even though we lack a familiar bank of experiences on which to draw in evaluating them? Kant's distinctions between constitutive and regulative concepts and between determining and reflecting judgments strengthen existing Kantian accounts and reorient them toward the problem of cognition. Overall, the chapters in Part II show the continuing value of Kant's philosophy for understanding thought experiments.

Part III turns more directly to Kierkegaard. Chapter 10 shows how Kierkegaard's discussions of thought experiment as a method incorporate the Kantian insights outlined in Part II. Like Ørsted, Kierkegaard takes thought experiments to be a method of variation, a type of free and active constitution, and a useful means of facilitating genuine thought. Part III examines several works by Kierkegaard, including *The Concept of Irony*, *Either/Or*, and *Stages on Life's Way* (Chapter 11), *Repetition* (Chapter 12),

[40] While there could be advantages in moving beyond the empiricist-rationalist dichotomy (see Fehige, *Thought Experiments, Science, and Theology*, 82), the focus in philosophy of science on the importance of empirical confirmation and the recent resurgence of self-described rationalist accounts of (intellectual) intuition in epistemology means that these traditional categories remain relevant for labeling contemporary approaches, at least for now.

and *Stages on Life's Way* (Chapter 13), as well as *Concluding Unscientific Postscript*, *Two Ages*, and *Works of Love* (Chapter 14). These chapters also refer occasionally to Kierkegaard's journals, where he often emphasizes the need for thought to have guidance but also to wander freely. Kierkegaard writes, "No matter how different knights were from scholastics, they had in common that they went on adventures; for thinking also has a way of going on adventures that is just as stimulating, just as noble, just as heaven-sent as that of the knights" (KJN 2, 25/EE:71/SKS 18, 29, translation modified). Across Kierkegaard's authorship, we find a confidence that thought can be made more concrete, and that such work is valuable for the individual thinker, as Kant and Ørsted claim.

The Kantian strains in Kierkegaard's philosophy of thought experiment have so far been overlooked because of a standard association of "imaginary construction" (i.e., *Experiment*) with aesthetics and creativity. Like Kant, however, Kierkegaard wants to make sure that thinking has an anchor (origin) and trajectory (destination) in the concrete world. He finds such connections in slowing down the workings of mental life and embodying them in the thoughts of different pseudonyms. Voicing this need for visibility, Judge William writes: "I require eyes that see in secret, that do not weary of watching, that see the struggle and see the danger. I require ears that hear the workings of thoughts . . ." (EO 2, 289/SKS 3, 272). While a divine being more obviously has such a view of inner life, perhaps humans can achieve it through effort, with the help of a reliable method. Fictional scenarios, for Kierkegaard, situate the reader in her own life but also, in the other direction, make the abstract world accessible. Kierkegaard remarks in an early journal, "Abstract concepts are as invisible as a straight line, they are only visible when they are made concrete" (KJN 2, 42/EE:127/SKS 18, 46). While thought experiments do not guarantee such fulfillment, Kierkegaard agrees with Ørsted that thought experiments provide a promising method for connecting the form of thought with the matter of sensory observation.