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Helmholtz and Philosophy

Gary Hatfield

This article considers Helmholtz's relation to philosophy, including Fichte's philosophy. Recent interpreters find Fichtean influence on Helmholtz, especially concerning the role of voluntary movement in distinguishing subject from object, or "I" from "not-I." After examining Helmholtz's statements about Fichte, the article describes Fichte's ego-doctrine and asks whether Helmholtz could accept it into his sensory psychology. He could not accept Fichte's core position, that an intrinsically active I intellectually intuits its own activity and posits the not-I as limiting and determining that activity, because that account requires cognitive abilities that conflict with Helmholtz's claim that the development of spatial perception relies primarily on associative memory and involves no direct awareness of the ego's activity as such. Helmholtz would have known various accounts of the distinction between subject and object, or self and world, from sensory physiology, including associative accounts invoking voluntary motor movements and accounts describing checks on the perceiver's activity. Some of the accounts cite Fichte on the I and not-I, but most do not, and none adopt Fichte's Idealism. Finally, the article examines Helmholtz's relation to metaphysics, finding that in all periods he rejected Fichtean Idealism and that the modest metaphysics of his mature period is a version of structural realism.

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Helmholtz and Philosophy

Science, Perception, and Metaphysics, with Variations on Some Fichtean Themes

Gary Hatfield

1. Introduction

Helmholtz was a physiologist of the first rank who also had an interest in physics. He trained as a physician for financial reasons. Having been interested in physics in Gymnasium (during the 1830s), he later acknowledged that his training in physiology, in Berlin under Johannes Müller, had broadened his intellectual horizons (1886, *VR*⁴, 314–15; 1887, *SW*, 342).¹ His knowledge of physics facilitated his physiological investigations, including studies of animal heat (resulting in his *Über die Erhaltung der Kraft*, 1847), his work on nerve conduction, his discovery of the ophthalmoscope, and his extensive research on visual and auditory sensory physiology in the 1850s and 1860s, as professor of physiology at Königsberg (1849–55), anatomy and physiology at Bonn (1855–58), and physiology at Heidelberg (1858–71). This research resulted in *Die Lehre von den Tonempfindungen als physiologische Grundlage für die Theorie der Musik* (1863) and the *Handbuch der physiologischen Optik* (published in sections, 1856–66; reissued in 1867), masterpieces that guided work in the physiology and psychology of auditory and visual perception for decades. In 1871, Helmholtz was called to Berlin as professor of physics, where he was active until his death in 1894. From 1888, he also served as founding president of the *Physikalisch-*

Technische Reichsanstalt, a Prussian national institute partly supported by private funds. Even as a physics professor, he continued publishing in the physiology and psychology of vision, especially on binocular vision and color vision, and brought out new editions of his *Tonempfindungen* (fourth edition, 1877) and *Physiologische Optik* (second edition, 1885–96). Throughout his career he published popular lectures on various scientific topics, on the philosophy of science, and on epistemology.

From 1866 to 1878, Helmholtz published eight papers on geometry, some technical, some popular. These papers influenced members of the Vienna circle, especially Moritz Schlick, who, on the centenary of Helmholtz's birth (1921), republished two of them, along with a paper on counting and measuring and Helmholtz's most extensive epistemological writing, *Die Tatsachen in der Wahrnehmung* (The Facts in Perception) (1878). The reception of Helmholtz's work on geometry, together with the fundamental character of his physical thought, have generated a growing body of scholarship.² These are important topics, but they are not my focus here. Rather, I want to look at Helmholtz's philosophical thought in two areas: his account of sensory perception and his attitude toward metaphysics.

Michael Heidelberger (1995, 835–36) has described the “traditional image” of Helmholtz as a philosopher. Helmholtz is known: (1) for his stance against some previous philosophy, namely, German Idealism; (2) for newly forging a philosophy grounded in natural science, avoiding all metaphysics; (3) as a friend of materialism, without embracing naïve materialism; and (4) as limiting philosophy to epistemology, with no bearing on the content of natural science. Heidelberger proposes a counter-picture in which Helmholtz's philosophy was grounded in metaphysical realism of an idealist sort, derived from the German Idealist Johann Gottlieb Fichte and incorporating the

¹The abbreviations used to cite works by and on Helmholtz are explained at the head of the References.

²On geometry and physical space in Helmholtz, with additional references: Neuber (2012), Patton (2009); on his physics: Krüger (1994), Schiemann (2009).

notion of an active ego. The argument contends that Helmholtz drew upon Fichte's notion of an active self to construct a parallel between human action (volitional activity) and scientific experimentation. Accordingly, Helmholtz did not reject German Idealism as a whole, he did not avoid all metaphysics, he rejected materialism for idealism, and he considered his metaphysics to have implications for his theory of cognition (and vice versa).

Heidelberger is not the first to link Helmholtz to Fichte, nor the last. Turner (1977) and De Kock (2011, 2014) have argued that Helmholtz took much from Fichte's conception of the self as active and that he built the distinction between self and world, or subject and object, on Fichte's distinction between *Ich* and *Nicht-Ich*.³ They find parallels between Fichte's notion that we perceive ourselves as active and posit the world as limiting that activity (his "ego-doctrine") and Helmholtz's account of the development of spatial perception and his distinction between subject and object. However, they doubt that Helmholtz adopted Fichte's idealist metaphysics.

I grant Heidelberger, Turner, and De Kock that there are some (very general) similarities between Fichte's active self and Helmholtz's appeal to the will's voluntary activity in the genesis of spatial perception. But I doubt that Helmholtz adopted core

³Fichte invoked this distinction often in his Jena period (to 1800), and continued to speak of it afterwards, sometimes using other terms. In discussing Fichte, I emphasize works that Helmholtz or his colleagues may have read. These include a work that Helmholtz cited (*PO*², 248–49), *Die Thatsachen des Bewusstseyns* (Fichte 1817); and a popular work that he likely knew, *Die Bestimmung des Menschen* (The Vocation of Man) (1800/1956). Because Fichte considered them to be clear statements of his Jena-period views, I draw on the two "Introductions" of 1797 (1797a/1845–46, vol. 1, and, on transcendental idealism and eliding the distinction between subject and object, 1797b; trans. 1994); also, the widely circulated *Wissenschaftslehre* of 1794 (1970), acknowledged to be obscure. Fortunately, we need not track Fichte's changing attitudes toward the supersensible across the 1800 division of his works, and we can attend to the Introductions more closely than the 1794 work. On the reception of *Vocation*, see Breazeale (2013).

features of Fichte's position, including that, in this genesis, an intrinsically active I intuit its own activity *a priori* and, realizing its limitation, posits the not-I as limiting or determining the I. Any plausibility for this attribution comes from Helmholtz's apparent appeal to a simple model of testing the will's intentions in comparing aspects of spatial vision with the performance of scientific experiments. However, it is important to distinguish Helmholtz's references to active testing (experimental or otherwise) by a mature perceiver or investigator from his account of the origin of spatial perception. He claims that the latter account relies exclusively on associative mechanisms. He would reject that the ego originally intuit its own activity *a priori* and posits a "not-I" as limiting that activity. That position requires what Fichte called an "intellectual intuition" (or a similar cognitive power) that posits a phenomenally present external (spatial) world; it thereby conflicts with Helmholtz's strict *empirism* about the genesis of visual spatial representation, which derives spatial perception through mere associative learning (Hatfield 1990, 199–208, 271–80). I examine the role of voluntary movements in Helmholtz in §3.2. Finally, I agree with Heidelberger that Helmholtz does not totally reject metaphysics, even in his mature period after 1855. I find a more modest metaphysics in Helmholtz than does he, but we agree that his metaphysics informs his understanding of perception and that it avoids materialist reduction.

My purpose here is not to assess in detail the interpretations of Turner, Heidelberger, and De Kock. Rather, I want to do four things. First (§2), survey Helmholtz's relation to philosophy. Second (§3), examine his relation to Fichte, by considering the evidence that he actually read and understood Fichte's work and then comparing his core account of the development of spatial perception with Fichte's ego-doctrine. Third (§4), show how Fichte's views, or other views on the genesis of the subject-object relation, might have come to Helmholtz through the

large body of German writings on sensory physiology. These writings contained a physiological-psychological Kantianism, which borrowed terms and ideas from Kant but need not have fully adopted his philosophical aims or positions. A few major physiological and psychological authors explicitly mentioned Fichte; these include Johannes Müller (1826, 1833–40), Theodor Waitz (1849), and Wilhelm Wundt (1862), who each discussed Fichte’s active I in relation to his Idealism, which they, along with the other sensory physiologists mentioned herein, rejected. Even if not derived from Fichte, the distinction between self and world, or subject and object, was a prominent topic of discussion in sensory physiology. Helmholtz would have been aware of various accounts, including many invoking voluntary motor movements. This extensive discussion reveals that, prior to the rise of “mechanical objectivity” after mid-century as chronicled by Daston and Galison (2007), a related (but not precisely equivalent) distinction between subjectivity and objectivity was articulated in a large physiological literature. Finally (§5), I examine Helmholtz’s relation to metaphysics and characterize the modest metaphysics of his mature period, which I find to be a form of structural realism.

I should mention some framing assumptions. Helmholtz’s thought developed. Although he retained a life-long interest in the law of cause, his attitude toward that law changed. At first, he accepted it as an *a priori* principle that allows us to infer a real (material) world from its effects on our sense organs. Later, he treats the assumption of causality, and lawlikeness, as a presupposition for the comprehensibility of nature—a position considered more closely in §5. There were constants in his thinking about perception: from early on he treated sensations as “symbols” or “signs” that must be interpreted by thought. But his views changed on how the content of perception relates to an external world. Early on (to 1855, at least), Helmholtz was a metaphysical realist about physical processes in space and held

that we infer spatial objects in perception, using an *a priori* law of cause in a manner that he understood to be Kantian. Subsequently, he conceded that we cannot determine the spatiality of a world apart from our perceptions (1867, §26). The law of cause no longer supports a robust spatial realism. His final take on “a world of actuality” and its relation to a causal law is also examined in §5.

2. Helmholtz’s Attitudes Toward Philosophy

Helmholtz is known as a scientist-philosopher, a label that accurately portrays his self-conception: he viewed himself as a natural scientist who sometimes did philosophy, by which he meant that some portions of his writing and some of his public lectures were contributions to philosophy and, especially, the theory of knowledge (1891, *SW*, 473, 475). But, we may ask, what did Helmholtz consider philosophy to be?

Let us first consider what conceptions of philosophy were available in Germany from about 1840 on. Historians agree that philosophy was undergoing an identity crisis (Schnädelbach 1984, 5; also, Beiser 2014a, chap. 1), which resulted from the widespread belief that the Idealism of Fichte, Schelling, and Hegel had failed. This belief partly stemmed from the charge that German Idealism engaged in *a priori* metaphysical speculation that ignored an ever-growing body of natural scientific knowledge.⁴ Although metaphysical philosophy continued to be produced, for example, by Hermann Lotze (1852; 1856–64), this work was informed by current natural science. Many sought a role for philosophy that didn’t engage in metaphysics. Accordingly, philosophy might examine the structure and basis of the various sciences, either as handmaiden or as independent au-

⁴The relation between natural science and the German Idealists, especially Schelling, was more nuanced (see, e.g., Richards 2002).

ditor, under the title of the “logic” of the sciences.⁵ Or it might consider the theory of knowledge more generally, especially in connection with sense perception.

Helmholtz affirmed the identity crisis and also recognized the value of philosophy in these two roles. In his 1855 lecture, *Über das Sehen des Menschen* (On Human Vision), he acknowledged that philosophers and natural scientists were not, at present, “good friends” in relation to their respective enterprises, but were indeed enemies. This enmity, he explained, should extend only to the excesses of the schools of Schelling and Hegel, which, he claimed, proceeded independently of the findings of natural science. Helmholtz warned that one should not “confuse the recent systems of philosophy with philosophy in general” (VR⁴, 1: 89). Indeed, Kant points the way to a legitimate philosophy. For, not only did Kant himself contribute to the Newtonian explanation of the formation of the planetary system (through the nebular hypothesis), but he also held that “the number of our cognitions cannot be increased through pure thought, for his highest principle was that all cognition of actuality must be created out of experience” (1: 88).⁶ Helmholtz approvingly characterized Kant as investigating “the sources of our knowledge [*Wissen*] and the degree of its justification” (1: 88).⁷ His lecture

⁵The philosophy of the special sciences, including their fundamental concepts, was a part of the philosophy of science at this time. In Mill’s *Logic* (1843), he discussed the concepts of the special sciences, including, in Book 3, mechanical, electrical, and chemical, and, in Book 6, the various moral sciences. Wundt’s *Logik* (1880–83) also examines the methods and concepts of the special sciences.

⁶Kant indeed held that cognition of actuality cannot arise from thought alone, or, in his terms, from the understanding operating apart from sensory perception; but he also maintained that knowledge of the conditions of experience as provided by his critical philosophy could yield synthetic *a priori* propositions, including the law of cause and a geometrical description of physical space, which apply to experience but are not themselves obtained from experience.

⁷Helmholtz invoked Kant much more frequently than Fichte. He read Kant on his own during 1838–39, his first year at University (in the medical

was intended to show that philosophy and natural science converge in the theory of human sense perception, especially vision, and to relate recent scientific findings to philosophy.

We may note three ways in which the lecture related natural science to philosophy. The first was the law of specific nerve energies, a principle credited to Johannes Müller. The principle states that the specific types of qualitative experience, such as color for vision and heat for touch, arise not from the characteristics of external stimuli but from the characteristics of the subject. Stimulation of the eye by light, or (artificially) by pressure or by electric spark, yields the experience of a flash of light having a color. But if the same physical light that yields an experience of color in the eye is directed onto the skin, it creates a feeling of warmth. Physical light is therefore neither necessary nor sufficient for producing a color sensation (1: 94–99). Second, Helmholtz invoked the Kantian law of cause as underlying our perception of the items in our field of vision as *objects*, that is, as initiators of the effects that we experience as sensations (1: 115–16). Third, in the lecture, these points and others, including a distinction between sensations and representations (or ideas [*Vorstellungen*];⁸ 1: 99–100), are examples of engaging in the logic of the special sciences by examining the fundamental concepts of visual physiology and psychology, including an early discussion of underlying “inferences” that are not fully conscious⁹ and that, as processes of sense perception as opposed

and surgical institute) (*Kö*, 1: 30; *WK*, 18). Further, he lists Friedrich Eduard Beneke as his instructor for logic and psychology (*Helmholtz* 1842, *vita*). If *Beneke* (1842) is indicative of the lectures, Helmholtz would have heard several detailed expositions of Kant’s theory of cognition and its elements (sensibility, intuition, concepts, synthetic *a priori* principles). As mentioned, his attitude toward Kant changed over the years.

⁸I have not attempted to translate the German “*Vorstellung*” consistently. It is rendered as “representation” and “idea”; also, more rarely, as “presentation” (its root meaning being “a placing before”).

⁹Although Helmholtz did not use the term “*unbewusster Schluss*” prior to Wundt’s use in the first (1858) installment of his *Beiträge* (1862, 65), he used the concept; see *Richards* (1980) and *Hatfield* (1990, 198).

to object-cognition, may be nothing more than a “mechanically drilled . . . association of ideas [*Ideenverbindung*]” (1: 112, 115). (As discussed below, the lecture also mentions Fichte.)

Helmholtz often returned to this theme of the emptiness of recent philosophical systems and the ongoing validity of philosophy as epistemology and logic of the sciences. In 1857, he wrote to his father, Ferdinand Helmholtz (a Gymnasium teacher):

The philosophical vapping and consequent hysteria of the nature-philosophical systems of Hegel and Schelling seem to be over, and people are beginning to interest themselves in philosophy again. . . . Philosophy . . . finds its great significance among the sciences as the theory of the sources of knowledge [*Wissensquelle*] and the activities of knowing [*Wissen*]. (**WK*, 159; *Kö*, 1: 284)

In a lecture from 1862, he considered the excesses of previous philosophy, which led men of science to reject philosophy altogether; consequently, “not only were the illegitimate pretensions of the [Hegelian] identity-philosophy—to subordinate all other studies to itself—rejected, but no attention was paid to the legitimate aims of philosophy: the critical analysis of the sources of cognition and the establishment of standards for intellectual endeavors” (**SW*, 126; *VR*⁴, 1: 164). In a letter to the physiologist Adolph Fick from about 1875, he wrote:

I believe that philosophy will only be reinstated when it turns with zeal and energy to investigating the processes of cognition [*Erkenntnisprozesse*] and the methods of science [*wissenschaftliche Methoden*]. Here it has a real and legitimate task. The construction of metaphysical hypotheses is pure humbug. (**WK*, 139; *Kö*, 1: 243)

And in an autobiographical sketch late in life, he recalled that his “investigation of sensation and sensory perception” led him into “the theory of knowledge [*Erkenntnistheorie*],” where his principal results were “that sensory impressions are only signs for the constitution of the external world, the meaning of which must be learned through experience” (1891, **SW*, 475; *VR*⁴, 1: 16).

In his various attacks on metaphysics as a branch of philosophy, Helmholtz understood by the term “metaphysics” the “so-called science whose goal is to establish, by pure thought, conclusions concerning the ultimate principles of the universe,” an endeavor he explicitly distinguished from philosophy (1874, **SW*, 338; *VR*⁴, 2: 432–33). Yet on at least one occasion, he extended the term “metaphysics” more broadly, to include fundamental hypotheses about reality that cannot be refuted empirically but which nonetheless are admissible into learned discussion, as long as they are taken for hypotheses and not dogma (*FP*, 138; *VR*⁴, 2: 239; *PO*², 596).¹⁰ We return to this notion of metaphysics in §5.

3. Helmholtz and Fichte

Let us first consider Helmholtz’s statements about Fichte and then examine any analogy between his theory of spatial perception and Fichte’s ego-doctrine.

3.1. Helmholtz’s attitudes toward Fichte

Helmholtz mentioned Johann Gottlob Fichte several times over his career, sometimes favorably and sometimes not, sometimes by way of allusion and only in later years with articulated substance. His father was close friends with Fichte’s son, Immanuel Hermann Fichte, and Helmholtz recalled discussions, at his childhood home, of the elder Fichte’s merits in relation to Kant and Hegel (1891, *SW*, 475–76; also, 1886, *VR*⁴, 2: 314).

In correspondence from 1852,¹¹ Helmholtz’s father strongly

¹⁰Helmholtz transposed several portions of the 1878 essay *FP* into *PO*² (into §26, first published in 1894), altering the sequence of the passages and revising some of them. I track these mirror passages (as is done here).

¹¹The first evidence of Helmholtz reading Fichte is in a letter of 1841 to the younger Fichte, in which Helmholtz says that he would like to meet with the son to get some help reading the father (Cahan 1993, 86 n 6). Despite being

praised Fichte, and Helmholtz subsequently presented himself as favorable toward Fichte, grouping him with Kant. On 28 June 1852, Helmholtz gave his Inaugural Lecture as ordinary professor in physiology at Königsberg, “Über die Natur der menschlichen Sinnesempfindungen” (On the Nature of Human Sense Impressions). His father, to whom he sent a copy, praised its clarity and observed that its “mathematical-empirical method of investigation” bode well for drawing out philosophical implications, which might eventually “establish and elucidate the ego-doctrine of Fichte as the only possible mode of philosophical thought” (*WK, 93; Kö, 1: 168)—even though the lecture does not actually mention Fichte. Subsequently, Helmholtz (as Königsberger puts it) “gratified his father” by acknowledging that he wanted the lecture “to give an empirical statement of Fichte’s fundamental views of sense-perception” (WK, 93; Kö, 1: 169). Which aspects of Fichte’s philosophy does Helmholtz here explicate and endorse? Not only does the lecture fail to mention Fichte by name, it also does not address the activity of the will or the role of voluntary motion in distinguishing subject and object—topical positions that are sometimes attributed to Helmholtz in connection with Fichte’s ego-doctrine (De Kock 2011, 8; Heidelberger 1993, 490–91; Turner 1977). The lecture does discuss the subjectivity of color sensations and the grouping of such sensations, in accordance with Müller’s specific nerve energies, into what Helmholtz subsequently called “quality ranges” (PO, 2: 5)—the latter notion being one that Helmholtz would, years later (1878), attribute to Fichte (FP, 119; VR⁴, 2: 119; PO², 248–49). Perhaps Helmholtz intended to say that he was affirming this aspect of Fichte’s views, which might still be seen as part of Fichte’s ego-doctrine inasmuch as it affirms a phenomenal division between subject and object. But this would not be a close similarity with Fichte specifically.

invited to visit (along with his father), Helmholtz did not make the trip from Berlin to Bonn.

In relation to his 1855 lecture, *On Human Vision*, Helmholtz again corresponded with his father about Fichte. In the lecture, he mentions Fichte explicitly, aligns him with Kant in opposition to Schelling and Hegel, and describes Fichte’s views as corresponding to recent findings in sensory physiology. He portrays Kant as furthering natural philosophy (the point about the nebular hypothesis). He then notes that Fichte, although “setting himself against the common way of seeing things, did not, as far as I can judge, find himself in any principal opposition to the natural sciences; rather, there is a presentation of sensory perception in the most exact agreement with the conclusions that the physiology of the sense organs later drew from the facts of experience” (VR⁴, 1: 89). Fichte is not explicitly mentioned again, although Helmholtz told his father that he had intended the lecture “to put forward the correspondence between the empirical facts of the physiology of the sense organs and the philosophical attitude of Kant, and also of Fichte” (WK, 138; Kö, 1: 242). Which aspects of the lecture—which discusses sensation and perception and returns to Kant by invoking the law of cause to undergird reference to objects—targets Fichte’s views? The lecture discusses the subjectivity of sensations, which is hardly specific to Fichte. It also mentions the role of the will, or of voluntary movements of the eyes, in spatial perception. That might remind us of Fichte’s active I, and so of (a part of) his ego-doctrine. However, the analogy is at best weak, since the activity of the will and the distinction between *Ich* and *Nicht-Ich* are not highlighted in this passage, which focuses on the fact that voluntary control of the eye muscles allows perception of visual direction and that this relation can be altered by learning, as when one watches the landscape pass-by while looking out the window of a train and then experiences motion aftereffects (movement in the opposite direction) when focusing on fixtures inside the train cabin (VR⁴, 1: 106–07).

In the next fifteen years, Helmholtz tendered both positive and negative statements about Fichte. Just before the remark on

the “vaporizing” of Hegel and Schelling quoted above (in the 1857 letter), Helmholtz wrote: “It seems to me a favorable moment for voices of the old school of Kant and the elder Fichte to obtain a hearing once more” (*WK*, 159; *Kö*, 1: 284). And the passage about the significance of philosophy reads in full: “Philosophy, in the sense in which Kant and, so far as I have understood him, the elder Fichte, took it, finds its great significance among the sciences as the theory of the sources of knowledge and the activities of knowing” (**WK*, 159; *Kö*, 1: 284).¹² He has now connected Kant and Fichte for his father twice in two years, and both times he ends up characterizing them as interested more in epistemology than in metaphysics (though we may doubt that Helmholtz actually considered Fichte to do the type of epistemology that he favored).

In print, he downplayed the significance of Fichte for perceptual theory. In an historical overview of theories of visual perception (§26 of *PO*), after praising Müller on specific sense energies, he wrote: “The subsequent idealistic systems of philosophy of J. G. Fichte, Schelling, and Hegel all emphasized the theory that the idea is essentially dependent on the nature of the mind; thus neglecting the influence that the thing causing the effect has on the effect. Consequently, their views have had slight influence on the theory of the sense-perceptions” (**PO*, 3: 32).¹³

¹²This is the third time we have seen Helmholtz express a lack of confidence about whether he understands Fichte: the 1842 letter to I. H. Fichte, the 1855 lecture, and now here.

¹³Helmholtz here reflects Fichte’s view that feelings (sensations) are subjective, and that, in empirical consciousness, they are projected onto a world of extension initially created through intuition of the self. In this, the self is active in positing the not-I within itself (there is no real external object involved). See *Fichte* (1797a, 1994, 75–76). Further: *Vocation*, “all knowledge is merely knowledge of yourself; and that what you assume to be consciousness of the object is nothing but a consciousness of the fact that you have posited the object” (1956, 57). Also, *Thatsachen* (1845–46, 2: 553, 562, 566–67), on outer objects being posited in the *Ich* and set outside by the imagination. There is no causation between outer objects and the *Ich*.

The final work to discuss Fichte in any detail is the *Facts in Perception* of 1878, Helmholtz’s address as rector celebrating the founding of the Frederick William University (now, the Humboldt University). It is the first recorded instance of explicit, substantive engagement with Fichte’s ideas. It exhibits both positive and negative attitudes.

The negative statements in *FP* disparage Fichte’s Idealism. In his discussion of the “idealist” and “realist” hypotheses as both metaphysical, Helmholtz characterizes the idealist hypothesis as equating life with a dream, a purely mental flow of experiences. He then describes how Fichte’s position goes beyond mere dreaming idealism. They start out alike: “Fichte too assumes that the ‘I’ posits the ‘not-I’—i.e., the world as it appears—for itself, because it needs it for developing its own thought-activity” (*FP*, 137; *VR*⁴, 2: 238; *PO*², 595).¹⁴ Fichte’s famous distinction does not posit a not-I (or *Nicht-Ich*) independent of all thought. Rather, it embraces a philosophy of identity: experience as of a world of objects is grounded in the activity of the I itself. He continues by noting that Fichte does not embrace radical solipsism but accepts the existence of other I’s, all dependent on an absolute I:

Since, however, the images whereby they each represent the “non-I” must themselves all agree with one another, he conceives of all of the individual “I’s” as parts or emanations of the absolute “I”. The world in which they found themselves was then that world of representations which the worldmind [*Weltgeist*] posited for itself, and which could again receive the concept of reality, as happened with Hegel.¹⁵ (*FP*, 137; *VR*⁴, 2: 238; *PO*², 595)

¹⁴Helmholtz here gives a general description that might characterize the positions found in all of Fichte’s works that we are tracking (see note 3).

¹⁵This description bears similarity with Fichte’s discussion of other I’s and “Absolute Thinking” in *Thatsachen* (1845–46, 2: 603). In *Vocation* (1956, Book III, pt. 4, 132–42, 152), Fichte examines at length the role of a supersensible spirit or “Infinite Will” in coordinating among the various I’s; this spirit is presumably the *Weltgeist* mentioned in Book III, pt. 3 (117). Helmholtz’s comparison of Fichte to Hegel probably stems from this work (though of course

Helmholtz describes a Fichtean Absolute Idealism and connects it with the oft-disparaged Hegel. A few pages later, in a passage that praises Fichte's terminological distinction between *Ich* and *Nicht-Ich* (as noted below), he again connects the *Nicht-Ich* with the *Weltgeist*, a disparaging remark (*FP*, 140; *VR*⁴, 2: 241; *PO*², 592). Further, in the historical appendix to §26 (*PO*², 612), Helmholtz retained the negative comments about Fichte, Schelling, and Hegel quoted above, even though, as we will see, he sometimes revised such histories.

The positive statements in *FP* fall into three groups. First, at the beginning of the lecture, Helmholtz notes that Fichte was the first rector of the university and quotes his *Die Grundzüge des gegenwärtigen Zeitalters* on the character of that time (*Fichte 1806b*; Helmholtz cites the edition of 1845–46, 7: 40). We might put this down to historical nicety, allowing Helmholtz as rector to connect back to one of the intellectual founders of the university; but this nicety also prepared the audience to hear more about Fichte. Second, in his discussion of sensory modalities and the experiential differences among the senses such as vision, hearing, and touch (*FP*, 119; *VR*⁴, 2: 219; *PO*², 584), he praises Fichte for having introduced the notion of a “quality range” (*Qualitätskreise*). He does not here cite a specific work, but subsequently in *PO*² he raises the same point: “Much that is correct, sharply expressed, is found also with J. G. Fichte in the Facts of Consciousness, namely, the grouping of sensations into quality ranges, corresponding to the five senses” (*PO*², 248–49).¹⁶ In *Thatsachen*, Fichte groups the “affections” of the outer senses by sense: color for vision, tones for hearing, and so on (*Fichte 1845–46*, 1: 542), but doesn't, that I've found, here use the

Hegel was highly critical of *Vocation*, *Breazeale 2013*, 2). In Fichte's Jena-period *Wissenschaftslehre*, the “Absolute I” might best be thought of as immanent in and abstracted from individual I's.

¹⁶This revised historical appendix to §17 appeared in 1887; see *PO*², ix–x (König's preface) and *WK*, 363 (*Kö*, 2: 335). It is not part of the material transposed from *FP* into *PO*², §26.

term *Qualitätskreise*.¹⁷ Third, Helmholtz discusses the distinction between subject and object, including the role of voluntary motion in creating this distinction within consciousness, and says something positive about Fichte.

The substantive discussions of the second and third instances are framed by the central problem of *FP*, which Helmholtz formulates in the questions: “What is true in our intuition and thought? In what sense do our representations correspond to actuality?” (*FP*, 117; *VR*⁴, 2: 218; *PO*², 583). These questions concern the relation between the corporeal world of “actuality” and what is a product of the “activity of the mind.” Helmholtz first considers sensations in relation to their causes and, second, the ordering of these sensations spatially.

In *FP*, Helmholtz's account of sensation repeats themes that he has stressed throughout his career. He rehearses the notion that the experience of color as opposed to sound or warmth is not merely a matter of the external stimulus, but of how the nervous apparatus “reacts” to stimuli such as light or sound (*FP*, 121; *VR*⁴, 2: 222; *PO*², 586). As he has before, he characterizes sensations of color and sound as “forms of intuition” in the Kantian sense. As usual, he notes that the physiology of the senses, through Müller's experimental work in formulating the law of specific sense energies, has confirmed that each sense contributes a “subjective form” of sensation (*FP*, 118–19; *VR*⁴, 2: 218–19; *PO*², 584). He then tips his hat to Fichte's organization of

¹⁷*Die Thatsachen des Bewusstseyns* is the second of Fichte's works that Helmholtz cites. First published in 1817, Helmholtz presumably knew it from the 1845–46 edition. The grouping of sensations by sense is found at (1845–46, 1: 542). Wundt had referred to this passage (in the 1845–46 edition) in part of his *Beiträge* originally published in 1859 (1862, chap. 2, 97). Prior to the lecture, Helmholtz wrote to his wife (*WK*, 312; *Kö*, 2: 246) that he had not yet found a title (offering several, the closest to the actual being the “dry” “Principles of Perception”). The final title, *Die Thatsachen in der Wahrnehmung*, parallels Fichte's; perhaps, in perusing Fichte's works for his homage to the first rector, he was reminded of Fichte's title and adapted it, and also found other writings that bore on his theme.

the sensations into quality ranges, which adds nothing essential to the point from Müller. Finally, he returns to a recurring theme in his writings on the senses, that sensations are not “images” of their causes (do not portray them as they are in themselves) but are mere “symbols” or “signs” for them, the meanings of which must be learned (*PO*, 3: 17–23; *FP*, 121–22, *VR*⁴, 2: 222–23; *PO*², 586; see also 1852, 2: 608; and 1891, *SW*, 475).

Helmholtz then turns to the Kantian notion of space and time as “transcendental forms” of intuition that characterize our perceptions of the external world (*FP*, 122; *PO*², 587). Here again, he finds that the natural-scientific approach in the physiology of the senses can agree with Kant “up to a certain limit” (*FP*, 123; *PO*², 587). This is his well-known “physiological Kantianism,” in which he allows that spatiality must arise in our experience given the nature of our sensory apparatus, rendering space as a “subjective form of intuition” (*FP*, 124; *VR*⁴, 2: 224; *PO*², 588). He endorses a physiological version of the notion that space is given “prior to all experience.” He maintains, however, that the specific geometry of this space (Euclidean or non-Euclidean) must be determined empirically (*FP*, 128–30, 149–52; *VR*⁴, 2: 229–31, 391–93).

According to Helmholtz, the intuition of space, of things “one beside another” at a given time, arises through voluntary motion. That we take action, or generate “an impulse to motion . . . is something immediately perceivable” (*FP*, 123; *VR*⁴, 2: 223; *PO*², 587). But, importantly, as initially experienced, these “impulses” have no spatial or external meaning; they do not foresee an expected spatial effect. Rather, the effects of our motor impulses must be learned. He focuses on the situation of a person without prior experience, who therefore is “without spatial intuition” (Helmholtz’s radical empirism). Such a person would learn the effects of voluntary innervation only through changes in the presence of nonspatial sensations. Helmholtz continues:

Let the situation of the observer initially be that he is faced with an environment of objects at rest. This will make itself known to him in

the first place by the fact that as long as he gives no motor impulse his sensations remain unaltered. If he gives such an impulse (e.g., if he moves his eyes or hands, or steps forward), the sensations alter; and if he then, by remission or the appropriate counterimpulse, returns to the earlier state, all his sensation will again be the earlier ones. (*FP*, 125; *VR*⁴, 2: 225–26)

On the assumption that the environment is constant and unchanging, so that all changes arise from observer motions, the individual may notice—or his visual system may record as an associative regularity (see *PO*, 3: 439–40)—that he is at any time able to re-experience previous sensations by reversing or changing his motor actions. Accordingly, he comes to perceive these sensations as ordered “one beside another” at a given time, since they are potentially accessible in relation to motions of the eyes to the right or left (or the body going forward and back, or turning) at any given time. Such potentially accessible sensations Helmholtz terms “presentables” (*Präsentabilien*) (*FP*, 125; *VR*⁴, 2: 226).

If the observer now moves to a different environment, the constellation of sensations will be different and will offer new patterns of change and recurrence in relation to motor impulses:

Now at other times the range of presentables, for the same group of impulses of the will, is going to be a different one. This range, with the individuals it contains, will therefore confront us as something given, as an “objectum.” Those alterations which we can produce and revoke by conscious impulses of the will, are distinct from ones which are not consequences of such impulses and cannot be eliminated by them. The latter specification is negative. Fichte’s appropriate expression for this is that the “I” is faced with a “not-I” which exacts recognition. (*FP*, 126; *VR*⁴, 2: 226–27)

Here Helmholtz directly credits Fichte only with providing an appropriate terminology for the role of the motor impulses in developing a distinction between subject and object. A few pages later, he again praises the terminology but also connects the

Nicht-Ich with the *Weltgeist*. Accordingly, any similarities between Helmholtz and Fichte must be tempered with the fact that, in *FP* and *PO*², Helmholtz repeats his criticism of Fichte's Idealism, placing the distinction between I and not-I in that context, and again aligns Fichte with Hegel (*FP*, 137; *VR*⁴, 2: 238; *PO*², 595). This makes it hard to accept that Helmholtz embraced Fichtean Idealism.¹⁸ But what about the more modest proposal, that he drew upon selected aspects (short of idealism) within Fichte's ego-doctrine? The above quotation mentions "impulses of the will." Does this reveal a crucial reliance on a Fichtean direct perception of the self as active?

These questions are best approached by articulating core aspects of Fichte's ego-doctrine and comparing them with Helmholtz's account of the role of voluntary motion in the development of spatial perception and a subject-object distinction. Indeed, Helmholtz had already discussed his theory of the motor basis for spatiality with some care in *PO* (in sections first published in 1866) without invoking Fichte or his terminology. Accordingly, we can begin by articulating Fichte's ego-doctrine and comparing it first with *PO* and then *FP*.

3.2. The relation between Helmholtz's theory and Fichte's ego-doctrine

The strongest case for linking Helmholtz with Fichte lies in the motor theory of space perception. The subjectivity of sensation and the notion of quality ranges can easily be derived from Helmholtz's acquaintance with Kant and Müller, whom he repeatedly cites on those topics. Assessing the strength of a parallel with the motor theory requires comparing Fichte's notion of an active I with Helmholtz's developmental story reprised above, together with Helmholtz's account of perceiving objects as ex-

¹⁸Whether of the Jena-period, which founds philosophy upon the subject or pure I (with no Kantian thing in itself), or the later period Idealism that includes, as Helmholtz understood it, Fichte's positing of a world spirit.

ternal. Other relevant factors include Helmholtz's mentions of freedom and of the ego as an object of perception.

Fichte considered himself to be carrying out Kant's project more consistently, especially as regards investigation of the I. This included an account of the formation of the concept of the I, which Fichte reprised many times. A basic element of this story, present in 1794, is that the self is aware of its own activity and also of its finiteness or limitation; accordingly: "The self posits itself as determined by the not self" (where "determination" is a form of limitation) (Fichte 1970, 130, 195). In attempting to simultaneously represent the self as both infinite and limited, it forms an intuition that generates the intuition of space and time (201). All of this can, in principle, be known *a priori*, but is awakened by experience (224).

The *Second Introduction to the Wissenschaftslehre* describes how the concept of the I arises from the limitation (*Beschränktheit*) of the activity of the I (Fichte 1994, 74–75). That the I acts is present to consciousness through what Fichte calls "intellectual intuition" (46).¹⁹ This awareness of the I as a freely acting being is confronted with the limitation of this activity through the feeling of sensory qualities, which, by an act of thinking, are attributed to outer objects as posited by the I (74–75). From this arises the concepts of *Ich* and *Nicht-Ich*, and only here does self-consciousness of the *Ich* occur (42–43). The I intuits its free activity and, upon intuiting limitations of its activity, posits an external world as Not-I that nonetheless exists within itself. The process unfolds through experience but should be regarded by the philosopher as determined *a priori* (76). The notion that a not-self is posited by the self as lying within the self remains an element of Fichte's position, and it precludes external agency or

¹⁹In this work, Fichte makes clear that intellectual intuition does not produce a phenomenal awareness of the pure I and its activity; there is always an admixture of sensory and conceptual materials. But the philosopher can show that an intuition of the I as active is present in all consciousness (Fichte 1994, 46–47).

activity on the part of the not-self or, in the case of outer sense, the object (Fichte 1794/1970, 195–96; 1797a/1994, 74; 1800/1956, 63–76; 1817/1845–46, 2: 562–67).

In the earlier discussions, Fichte has little to say about the details of how spatiality enters into the intuition of what are taken to be external objects. In 1794, he affirms the ideality of space (based in the ideality of objects) and the subjective origin of intuition. Spatial intuition arises in the attempt to synthesize in inner thought the opposed notions of self and not-self (Fichte 1970, 171, 201). The *Second Introduction* says little more. It mentions that the I “creates for itself, by means of intuition, a realm of extended matter; and then, by means of thinking, it transfers its merely subjective feelings to this material realm” (1994, 75).

The later works, which Helmholtz presumably knew, say more. The *Vocation* is especially thorough on the matter of spatial intuition. It starts from the standpoint of someone who believes that external objects are genuinely external things that cause sensory experience (1956, 7, 35, 48–53). But, upon further explanation, it is found that external objects are not externally existent things that causally affect us, but are our own productions. Sensations arise in us, and we project them into a space. This space does not arise from the experience of spatial things, but develops as we intuit the (inner) intelligent activity of the self and come to represent it as having multiple dimensions of variation (63). This space is created by our intelligence and is prior to the seeing of space (65). It is inherited (*angestammt*), not produced (63). In it, subject (as experiencer) and object (as experienced) are joined, and both are located in the self (63–67). We then project objects into our intuited space, and treat them as the causes of our sensations (71–74). But in the end, “all knowledge is a knowledge of yourself” (57).

In *Thatsachen*, Fichte again affirms a Kantian view of the status of space, as not sensation but intuition. We are aware of the infinite divisibility of objects, which arises not from objects but from our capacity for dividing them. Accordingly, “extension in

space is nothing other than the self-intuition of the intuer in his capacity of infinitude” (i.e., ability to infinitely divide) (1845–46, 2: 545). Awareness of the I arises through a synthesis of inner and outer perception (1845–46, 2: 602). The activity of the I as perceived innerly is checked or limited, leading the I to posit objects of outer perception. The I itself is directly intuited, and so is what it does, including the consequences of its actions:

[T]he I must appear purely *a priori*. That one acts is not experienced; there occurs no perception of our activity as of a state that exists without our effort. Activity presupposes a concept that is free and is projected through absolute self activity. This concept and the possible activity toward it are intuited innerly . . . even as a mere ability, indeed before the actual completion of the projected causality. (1845–46, 2: 596)

Although the concept of the I requires the Not-I, the activity of the I as free is not perceived by experience (which would be a passive act, in Fichte’s terminology), but is intuited directly. Crucial within this account is (1) that the I is aware of itself as freely active, (2) is aware of what it does, (3) is aware of limitations, (4) from which arises self-consciousness and a (phenomenal) mind–world distinction.

Turning to Helmholtz’s account of perceptual development, I contend that he found it implausible that the learner is aware of the ego and its activity *per se*; that he did not, at the outset, posit an awareness of the I as active, but that the awareness of active control of the muscles arises through experience; that he held that the I initially doesn’t know what it does; and that awareness of limitation plays only a secondary role in the development of spatial perception and the eventual distinction between subject and object. All of this is consistent with Helmholtz allowing that adult perceivers and adult scientists are self-consciously aware of acting and can test to see what effects follow from their acts.

A key element of Helmholtz’s thought on perception is his radical empirism. The preface to *PO* (written in 1866) describes

the third part of the work, on “The Theory of Visual Perception,” as seeking to unify visual theories through the “empiristic theory” as laid out in §26 and §33. The core of this theory is that the perceiver originally is given only non-spatial sensations, which are mere signs of their causes, and that all spatial perception arises through the association of these sensations. The theory runs through all sections (§26 to §33). In summing up (§33), Helmholtz characterizes the “signs” (*Zeichen*) available for the development of spatial vision as: (1) color sensations varying in quality and intensity, (2) local signs, and (3) the degree of innervation of the ocular muscles—here treated on par with a sensation (3: 433).²⁰ It is left to our “intelligence” (*Verstand*) to comprehend the meaning of these. But, in the development of spatial vision, “[t]he only psychic activity” required “is the regularly recurrent association between two ideas which have been connected before” (3: 434; also 3: 439–40). Local signs and degrees of innervation become associated through contiguity or co-occurrence; these associations sort out qualitatively similar (but initially spatially meaningless) sensations of muscle innervation into a spatial extent. As we saw in §3.1, voluntary motions are simply producers of uninterpreted sensations. The processes of association require felt sensations, but they are not governed by awareness of an active self or the expected outcomes of impulses of the will. Rather, the ability to foresee the outcome of willing depends on prior experience and association.

As regards Fichte’s claim to have “intellectual intuition” (direct awareness) of the activity of the I, even as qualified (self-consciousness only arises by contrast with the *Nicht-Ich*), this position is not in Helmholtz. As he explains (3: 439–40), in the adult perceiver, the associations that yield spatial perception are not available for introspection (not available to

²⁰See also (*PO*, 3: 130, 433–34). “Local signs” are sensation qualities arising from each retinal nerve; each has a peculiar character, but originally they have no spatial meaning. Their spatial meaning must be learned.

“self-consciousness”), and the flow of ideas (including motor-influenced ideas) is experienced as involuntary, except in cases in which self-consciousness and the will purposefully intervene (as happens in an experiment). We know of innervation feelings and motor nerves only from what science teaches (3: 25), not via phenomenology or intellectual intuition. At the same time, we are forced to discuss these processes using terminology that originates in describing conscious perception (3: 446). Accordingly, Helmholtz says that we have “immediate perception” of the impulses of the will. “Immediate perception” occurs without connection to memory and concepts (3: 11). “Immediate perception” of sensations is consistent with their being unconscious, as are the processes of association by which spatial perceptions are formed (3: 24, 28).

As Helmholtz explains:

Natural consciousness, which is entirely absorbed in the interest of observing the external world, and has little inducement to direct its attention to the Ego that appears always the same amid the multicolored variations of outside objects, is not in the habit of noticing that the *properties* of the objects that are seen and touched are their effects, partly on other natural bodies, but mainly on our senses. (*PO*, 3: 29)

Natural consciousness has little interest in the ego. Nor does Helmholtz, as a scientist, express interest in intuiting the ego and noting its powers—indeed, his invocations of Fichte’s distinction in *FP* focus on the *Nicht-Ich*, not the *Ich*. Further, natural consciousness doesn’t realize that sensations are effects. This point is, again, learned from natural science, not (in the first instance) from awareness of the “limitations” placed on the ego (as if?) by an empirical world.

Still, Helmholtz does compare the situation of the perceiver who tests his or her expectations in relation to subsequent sensations to that of an experimenter. Doesn’t this require an awareness of one’s activity, of the will as directing the muscles to do

this or that? The discussion of this point in *PO* §26 is from the point of view of an experienced perceiver, who already has spatial perception and is able to anticipate differing views of a table while walking around it (3: 28). Even so, Helmholtz tells us that the formation of rules underlying spatial perception is achieved “by the unconscious processes of the association of ideas going on in the dark background of our memory” (3: 24); and, in articulating the analogy with experiment, on the perceptual side he speaks of “unconscious induction” (3: 28).

As Helmholtz noted in *FP* (125; *VR*⁴, 2: 225–26), for understanding the genesis of spatial perceptions the relevant case is that of the infant who lacks spatial perception. This case is taken up in *PO* §§27–28, concerning eye movements and the development of perceived directions within the visual field, and is discussed further in §33. In §28, Helmholtz describes how the ability to experience a two-dimensional array of directions within the visual field, or, equivalently, the ability to learn the positions of the local signs of retinal points, is explained by “the known capacities of sensory memory” (*3: 135), that is, by (unconscious) processes of association.²¹ As we saw in §3.1, in *PO* §33 Helmholtz treats the feelings of innervation as originally meaningless sensations. The fact that they are voluntary is relevant to the learning process, because voluntary innervation of the muscles generates a source of change in the overall pattern of sensations that does not come from the world but from the perceiver. But the perceiver is not originally aware of these sensations as being motor impulses or as having motor effects; that, too, must be learned.²² As he puts it in *FP*:

²¹Helmholtz frequently allies association with memory (e.g., *PO*, 3: 24). In *FP* (131, 134; *VR*⁴, 2: 232, 235), again it is (associative) memory that retains the lawlike rules found in the regularities among the phenomena, including those phenomena initiated by voluntary movements of the eyes (132–33; *VR*⁴, 2: 233–34). McDonald (2003, 188–91) discusses the analogy between perception and experiment in Helmholtz; he carefully notes that an infant’s initial learning yields unconscious responses that track the lawlike in experience.

²²In *PO* (3: 48, 57, 436, 453), Helmholtz explains that we must learn to

[T]he impulse to motion, which we give through an innervation of our motor nerves, is something immediately perceivable. That we do something, when we give such an impulse, is felt by us. What we do, we do not know in an immediate manner. Only physiology teaches us that we put into an excited state—or *innervate*—the motor nerves, that their stimulation is passed on to the muscles, that these consequently contract and move the limbs. (*FP*, 123; *VR*⁴, 2: 223–24; *PO*², 587)

There is no direct awareness of the intentions of the will as motor intentions (as intentions to move a bodily part). Moreover, there is no direct awareness of free activity in this case. In fact, I find no emphasis on freedom *per se* in this developmental story,²³ but only appeal to feelings involved in the voluntary motor impulses. The adult perceiver can form conscious intentions to move and then note whether the expected changes occur (the

expect that bodily motions and changes in external sensations follow from motor impulses. Once the relations among sensations from the retina (color, local signs) and sensations of motor impulses have been learned, Helmholtz describes what was later termed an “outflow” theory of proprioception: the developed perceiver is able to detect whether the voluntary intention (*Willensimpuls*) to move the eyes (or other bodily parts) has succeeded by noting whether expected changes in sensations occur (*PO*, 3: 204–05, and *FP*, 136 [*VR*⁴, 2: 237; *PO*², 593–94]). On the history of (especially) nineteenth-century outflow theories, see Scheerer (1987, 171–71, 186–90).

²³Helmholtz mentions freedom several times in his career, typically anent whether we can consider the law of cause to be inviolable: his (1847, *SW*, 4) raises that question but doesn’t answer it; (1855, *VR*⁴, 1: 116) cites freedom as experienced in self-consciousness as a hindrance to grounding the law of cause in “inner experience”; *PO* (3: 30) cites our belief in free will as a problem for establishing the law of cause inductively. These instances do not tie the reality of freedom to a discussion of experiment or spatial learning. Just before this discussion of the causal law, he characterizes experimentation as a varying of conditions “spontaneously” and “by our own power” and describes changes in sensory perception as “due to our own will” (*PO* 3: 28–29); but his appeal to these voluntary impulses in the developmental story can, consistently with *PO* (3: 433), only be to the impulse of the will as a sensory sign that enters into the filter of association (which is how I read “Goethe’s Anticipation,” 1971, 498). He does not describe a direct intuition of the will as a power. (My reading of these passages differs from De Kock 2016, 30.)

adult perceiver has learned to anticipate the outcome of a motor impulse). In this way, there is a comparison between the conscious intentions of the perceiver and those of the experimenter, as described in *FP*.²⁴ But not so for the primal case of learning. In that case, there is no *a priori* awareness of the power of the will to effect changes in the pattern of sensations. Any awareness of this sort must be learned.

In learning the meaning of our motor ideas, we learn to perceive a spatial world of things with sizes and shapes at various distances. This process of learning yields the experience of a spatially articulated field of objects, clothed in sensory qualities, such as color for vision (*FP*, 127–28; *VR*⁴, 2: 228). Portions of the sensation complex that don't change if the eye is stationary are treated as signs of an object distinct from us. Changes that don't covary with our own movements are then changes in the world, as when the bushes move in the wind or a fellow being moves through our visual field (*FP*, 125–26; *VR*⁴, 2: 226–27).

In *PO*, Helmholtz treats externalization in two ways. First, perception naturally tracks the stable properties of objects and treats those objects as separate from us as a result of our voluntary interactions with them, including differentiation between what can be moved by our will and what is “urged upon us”

²⁴The passage at *FP* 136 (*VR*⁴, 2: 237; partly inserted into *PO*², 594) reads: “The chief reason, however, why the power of any experiment to convince is so much greater than that of observing a process going on without our assistance, is that with the experiment the chain of causes runs through our own self-consciousness. We are acquainted with one member of the chain of these causes—the impulse of our will [*Willensimpuls*]—from inner intuition, and know through what motives it came about.” Helmholtz adds that the experimental arrangement requires that the act of will was not influenced by the very physical process that yields the observed physical causal chain. Rather than an appeal to arbitrary free will, I see this as a notation that in an experiment the independent variable (the one varied by the experimenter) must indeed be independent, that is, must be a genuine intervention that alters the physical process so that the result differs from what otherwise would have occurred.

and cannot be altered just as we like (3: 29).²⁵ Second, we apply a law of cause to recognize something external as the cause of our sensations (3: 29–30). *FP* (125–26, 139–40; *VR*⁴, 2: 226–27, 241) also invokes associative winnowing of the sources of stimulation that allows us to learn the spatial meanings of motor intentions. But a second aspect is added. In what I call Helmholtz's modest metaphysics, we posit a “force” as the cause of our sensations, which we recognize, in our conscious perception, as not controlled by our will; here Helmholtz explicitly invokes the Not-I (*FP*, 139–40; *VR*⁴, 2: 241). In §5, I return to these two sides of the story in *FP* (association, and consciousness of force).

In sum, we have at best a weak analogy between Helmholtz and Fichte: both invoke the activity of the perceiver in the formation of a concept of an external world, a *Nicht-Ich*. The primary stories differ, since Helmholtz requires that the meaning of voluntary impulses must be learned during the development of spatial perception. Helmholtz does, in *PO* and *FP*, briefly acknowledge a role for what is and isn't subject to the will, and in *FP* he connects this point with Fichte. But the core features of Fichte's position, including original intellectual intuition of the self's activity and its meaning, are not found in Helmholtz. He has no direct intuition of the self as freely active. Moreover, in early development, there is no basis for expecting a spatial outcome or for testing those expectations. This suggests looking elsewhere for the primary inspiration for Helmholtz's assigning a role to motor activity in the development of spatial perception and a subject–object distinction. And in *PO* (3: 33, 453–54), Helmholtz indicates that theories of the motor origins of spatial perception had been previously developed by Steinbuch,

²⁵He does say that, in doing so, “we recognize something independent of our will and imagination” (3: 29), which offers a weak analogy to Fichte. Weak, because if we are speaking of an adult perceiver, the case is not relevant to the development of spatial perception and externalization; if we are speaking of an infant learner, the processes are unconscious and associative. In either case, we have not found a role for the will as a power that is directly intuited.

Nagel, Wundt, and Classen among the physiologists, and by Herbart, Lotze, Waitz, and Cornelius among the philosophers. The next section considers sources for Helmholtz's motor theory, including a role for the activity of the will, in previous sensory physiology.

4. Physiological Subject–Object and “I” vs. “Not-I”

There were ample sources for Helmholtz's motor theory of spatial perception and for the distinction between subject and object (and I and not-I) in a literature that he knew well.

Discussions of nineteenth-century German sensory physiology make easy mention of a physiological (neo-)Kantianism. Beiser (2014b, 198) traces its origin to Helmholtz's 1855 address.²⁶ In fact, the historical genesis of a “physiological Kantianism” lies early in the century. It arose in part from a physiological response to Kant advanced by Steinbuch, who sought to show that spatial intuition conforms to things in themselves (and who was cited by Helmholtz, *PO*, 3: 33, 194). Tourtual, also cited by Helmholtz,²⁷ subtitled his book on human sense perception “a contribution to physiological aesthetics” to show that it incorporated Kantian ideas. The idea of a physiological, or psychological, basis for Kant was also present in Jakob Friedrich Fries and Friedrich Eduard Beneke (Hatfield 1990, chap. 4).

This “physiological Kantianism” made use of Kant as a source of theoretical conceptions, such as, in Tourtual (1827, I, lx, 24), notions of the *form* and *matter of intuition*, of intuitions as ac-

²⁶Reed (1982, 749–50) associates a “physiological neo-Kantianism” with Müller, but claims that it really “was an unintended resurrection of Descartes' theory of perception,” especially as regards secondary-quality sensations.

²⁷Helmholtz cited Tourtual's *Die Sinne des Menschen* (1827) several times in *PO* (3: 191, 194, 396), along with other works on the optics of the eye (1: 158), the light seen when the optic nerve is severed (2: 11, 21), the subjective colors in shadows (2: 251, 253), eye movements (3: 103, 104), and depth perception and stereopsis (3: 304).

tively formed, and of *sensation* and *representation* (*Vorstellung*). For these purposes, it was not required to have a fully adequate grasp of, nor a desire to follow, Kant's own philosophical intentions. Kant can be invoked without thereby invoking the full philosophical background and conceptual nuances of his writings.

The same thing should go, not only for Fichte, but for the philosophical distinction between subject and object that recent interpreters believe reveals the influence of Fichte on Helmholtz. Accordingly, I want first to show that the distinction between subject and object, and subjectivity and objectivity, developed within the physiological literature in a way that owes little to Fichte, but that may be beholden to Kant in the manner just mentioned: as the opportunistic use of the terminology of subject and object to mean the experiencing subject and the object of that experience (whether absolutely mind-independent or merely independent of variations among individual minds).²⁸ Hence, a subject–object distinction was a commonplace in this literature, well prior to the birth of “mechanical objectivity” as charted by Daston and Galison (2007).²⁹ Second, I want to show

²⁸The contrast between the subject as the ultimate “I” and bearer of thoughts, and objects as things to be known in an external (or “outer”) world, runs through Kant's *Critique of Pure Reason* (1781, 1787) and *Prolegomena* (1783). His distinction is philosophically intricate, as he has subjective forms of intuition (space and time) grounding objective judgments about things in space, which are inter-subjectively valid (1781, 28; 1787, 44; 1783, §§17–19). In tracking uses of “subject” and “object” and their kin, I am not presupposing exact agreement on what they meant, only that the many uses form family resemblances that could have informed Helmholtz's thinking.

²⁹Daston and Galison (2007, 27) date the birth of “mechanical objectivity” (as scientific objectivity) to about 1860. This objectivity comprises: emotional detachment, automatic data recording, quantification, and belief in a reality independent of human observers. The first three are not much found in the physiological literature scouted here (which includes the beginnings of automatic recording and quantification); our focus is on discussions of perceiving a mind-independent reality. This large literature could explain why, in the 1820s and 1830s, German and French dictionaries began to define the terms in

that the distinction between *Ich* and *Nicht-Ich* was mentioned and described in the physiological literature, but in ways that don't seem to be built upon an acceptance of—or even a concern with or knowledge of—Fichte's Idealism, his active self, and the self-positing of a *Nicht-Ich*. Helmholtz could have become familiar with this distinction from his teacher Müller or his assistant and colleague Wundt, and from many other physiological sources. He may have sharpened his understanding of Fichte's specific ideas through his late perusal (in 1878) of his writings for his address as rector. But that engagement with Fichte came after his motor theory had been worked out in *PO*.

If one finds in a figure such as Helmholtz discussions that raise philosophical-looking questions using philosophical-looking terminology, one needn't suppose that the questions and terminology were derived directly—or, when derived, were derived accurately—from figures now recognized as philosophers. Sensory physiology at this time regularly discussed problems such as the origin of the distinction between subject and object from a standpoint within physiology that is, as Müller says (cited below), *philosophical*. It is philosophical in the way that philosophy of the special sciences is: it engages in critical examination of fundamental concepts. It may borrow terms and distinctions from mainstream philosophy, while making these its own.

4.1. Sensory physiology and the subject-object or subject-world distinction

In 1811, the German physician Johann Georg Steinbuch published a path-breaking work entitled *Beytrag zur Physiologie der Sinne*, focusing on spatial perception. He wanted to redress the lack of attention to what he termed the “psychological side” (*psychologische Seite*) of the theory of the senses (vi). His theory

“our” sense (Daston and Galison 2007, 31). “Our sense” for me links “objective” with external objects and “subjective” with the perceiving subject (with other variations and twists).

would emphasize the role of motor activity (voluntary muscle movements) in the construction of a subjective space, and it would explain both how this subjective space is taken to be equivalent to objective space and how this process shows, contrary to Kant, that we can know the spatial properties of things in themselves. It would also explain the origin of a distinction between a self-aware I and external objects.

Steinbuch used the distinction between subject and object, or subjective and objective, in the post-Kantian sense.³⁰ He sought to show how a subjective space arises from “the simple ideas of our simple spontaneity in the movement of our sense organs” (ix–x). Indeed: “The simple fact that, parallel to the outer movements of the sense organs there run inner ideas of will, is the principle upon which our sensory intuition is based, and out of which our *subjective space* (the space in our intuition) arises through successive development” (x). His theory would show how interaction between ideas of will and sensations from the sense organs produce ideas of lines, surfaces, and bodies (spatial ideas). He sought to show

. . . why the senses, all in the same manner, give their inner products to intuition in such a way that the objects of sensation *necessarily must* appear as existing outside us, and why we feel compelled to take our ideas of objects in the outer world for the objects themselves. We will also examine what the actual basis of the distinction of the self from the thing without us is, . . . In this way also will the so infamous, and in the recent times the so much abused, I [*Ich*] of man obtain its one true definition.³¹ (Steinbuch 1811, xi)

Steinbuch is promising to explain the relation between subjective space, or space that is found in the mental states or ideas of the

³⁰Steinbuch adopted other terminology from Kant, distinguishing the *form* and *matter* of sensory representations or ideas (*Vorstellung*) (ix); on his relation to Kant and to his own time, see Hatfield (1990, chap. 4.2).

³¹Perhaps this reference to the “much abused” *Ich* alludes to Fichte; if so, it is not a sign of positive influence. Steinbuch trained at Erlangen and was associated with the physical-medical society there when Fichte visited the University in 1805.

subject, and the space of objects, which ultimately is the world of things in themselves (mind-independent objects) (264–69).

Steinbuch starts from the original working of the human body upon the representational power of the mind. He introduces the term “motor-idea” (*Bewegidee*), which is the mental expression of an act of will that innervates the muscles. The initial acts of innervation and motion occur *in utero*. Through a process of association, fetal motor-ideas, which originally have no spatial meaning, are organized into spatial ideas. After birth, these spatial ideas become associated with other sensory qualities. Considering touch first (as fundamental to spatial perception), he explains how tactile ideas come to be taken as ideas of an external world:

Before we are able to represent the objects of our external world known to us through touch as *present outside us*, we must understandably, in addition to these objects, represent *us*. We must have consciousness of ourselves, a *self-consciousness* must be present in our mind, if we want to bring the *outside us* of any object to clarity of consciousness. (Steinbuch 1811, 106)

As adults, we consider the external world to be outside us. During development, we distinguish our body from other bodies by the fact that, when we touch our body, we get a corresponding sensation; our fingers both feel our arm and arouse sensations in that arm. We recognize this special region in space as our body, as an I: “I am the very thing that my finger tips actively touch. Here is true self-consciousness” (113). By actively exploring things that are impenetrable to the hand, touch learns to perceive the spatial structure of an external world (67, 89).

Steinbuch has developed a physiological, bodily concept of self-consciousness. The subject–object distinction, or the distinction between subjective space and objective space, does not fully line up with the distinction between I and world, since the I as embodied is part of the world. Nonetheless, both distinctions are explicitly invoked and explicated within his theory.

These distinctions became standard topics for discussion within sensory physiology.

Caspar Theobald Tourtual, a surgeon and anatomy teacher in Münster, was a well-known sensory physiologist. In his *Die Sinne des Menschen in den wechselseitigen Beziehungen ihres psychischen und organischen Lebens; ein Beitrag zur physiologischen Aesthetik* (1827), he praised Steinbuch’s discussion of the relation between touch and vision as especially insightful and helpful, even if he didn’t agree with him (xix, 223–28). Tourtual organized the history of philosophical work on perception into objective, subjective, and intermediate phases (xxxiv–lx). The objective phase has external objects acting on the sense organs to produce sensory ideas, with little regard for the contribution of the subject. In the subjective phase, including Descartes, Malebranche, Kant, and Müller, the activity of the subject in projecting a world comes to the fore. The intermediate phase, which Tourtual prefers, recognizes the contributions of both subject and object. When an object affects the senses, the sense organ provides subjective forms of experience (space and time) and subjective matter (color, tastes, and the like). We live in a subjective world of intuition but refer our sensory ideas to the external world from the outset (6–9). Human beings have an “inborn drive, or rather a necessity of our mental nature,” to synthesize the sensations from disparate sense organs (e.g., those of touch and sight) into the sensory representation of a single external object with various (especially spatial) properties (14). Tourtual is a realist and thinks that the senses give us a good representation of the world (lx, 20).

Late in his book, Tourtual describes how we come to perceive sensory objects as external and to separate *Ich* from *Nicht-Ich* (using that terminology). Recalling that in sensory perception we are both passive and active, he finds that initially we perceive only the sensation.

We perceive therefore in consciousness only the inner activity of sensing and presenting; but even this activity is not free but be-

comes determined in its individuality through the mode of sensory impression. . . . This determination of the self-active reaction is however a limitation [*Beschränkung*] of our psychical life, and in the process of intuiting we become aware of that fact more or less with each of the outer senses. Our consciousness is therefore here twofold: that of our self in its activity, and that of a limitation, which this activity experiences from a something that doesn't belong to the self. Now this limitation the mind almost instinctively identifies with the spatial appearances as the immediate object that it encounters, and thus, in the most determinate manner, is the original opposition between I and not-I, subject and object, pronounced. Since, in this manner, inner perception designates the object as something outside of and completely heterogeneous from the subject, the understanding thus goes along with this pronouncement, and thinks of the two as absolutely distinct autonomous beings. (Tourtual 1827, 319–20)

Unlike Steinbuch, Tourtual aligns the distinction between subject and object with that between I and not-I. Although it can't be excluded that he knew of Fichte or at least of his terminology, he does not mention Fichte in his detailed history and claims that, among the many philosophers named (mainly pre-Kantian), only Kant influenced his thinking (lx). More importantly, he distinguishes between a subject and an actually mind-independent object, which is far removed from Fichte's thought.

Helmholtz justifiably considered his teacher Johannes Müller to be the foremost physiologist in Germany in the period before mid-century. Müller worked in several areas, including on the senses. He held that medicine should rely on physiology and that physiology should be philosophical (1826, 35–36). By this he did not mean the wholesale importation of a known philosophical system into physiology—he reviewed several philosophical systems in his *Handbuch der Physiologie des menschen für Vorlesungen* (1833–40, Book 6) without giving a blanket endorsement to any. Rather, he meant that physiology should engage in the kind of reflection on methods and fundamental concepts that he undertook in his works, including *Zur vergleichenden Physiologie des*

Gesichtssinnes des Menschen und der Thiere (1826) and the *Handbuch*. This sort of reflection belongs to the logic of the special sciences. Helmholtz engaged in such reflection (in some of his philosophical works). Müller differed in that he knowledgeably discussed a wider range of philosophers than did Helmholtz, over longer stretches of text.

The second chapter of Müller's comparative physiology of sight, entitled "On the Mediation of Subject and Object through the Sense of Sight," examines how individual animals come "to intuit their sense-energies as a sensory world apart from themselves" (1826, 39). Initially, individual self-consciousness knows only its own sensations and their spatial arrangement, which, in vision, is originally two dimensional and consists in an intuitive awareness of the retina itself. The positing of an external world as a cause of these sensations requires judgment; hence, animals can't experience a world as external through sense perception alone but must rely on their intellectual faculties as developed.

In the *Handbuch*, Müller explained this operation in connection with his ninth law of the senses, which says: "That sensations are referred from their proper seat towards the exterior, is owing, not to anything in the nature of the nerves themselves, but to the accompanying idea derived from experience" (1843, 716).³² Unable to remember the initial acquisition of these ideas, we must infer them by analyzing our current sensations and ideas.

Doing this, we find, in the act of the mind which accompanies sensation, opposed to each other, the *percipient conscious subject*, or self, of the sentient body whose conditions, whether internal or determined from without, are objects for this "conscious self," and the *external world*, with which the sentient body is brought into collision. . . . The "self" of the individual opposes itself as a free "subject" to the most intense sensations,—to the most tormenting

³²Where I cite Müller (1833–40), the translation is mine. Otherwise, I follow Müller (1843). It is abridged, leaving out much of the philosophical discussion in Book 6 (Book 7 in the translation).

pains. The limb which gives us pain can be removed without the integrity of the individual spirit being diminished . . . (Müller 1843, 716–17)

Two factors lead one to oppose one's body to one's self, and the external world to both:

In the first place, the child governs the movements of its limbs, and thus perceives that they are instruments subject to the use and government of its internal "self," while the resistance [*Widerstand*] which it meets with around is not subject to its will, and therefore gives it the idea of an absolute exterior. Secondly, the child will perceive a difference in the sensations produced, according as two parts of its own body touch each other, or as one part of its body only meets with resistance from without. (Müller 1843, 717; 1833–40, 2: 269)

As the child touches its own body and other things, it finds that its own limbs are subject to its will and that they meet with resistances (an account superficially similar to Fichte's). Further, the child finds a difference in touching parts of its body as opposed to other things, as described by Steinbuch, which leads to the awareness of some objects as fully external to it, opposed not only to the self but also separate from its sentient body (1833–40, 2: 536). Conceivably, Fichte may have influenced Müller's giving a role to the active self in the formation of the distinction between self and world.³³ But he does not mention Fichte here.³⁴

³³Writing to Johannes Schulze in 1823, Müller mentioned that he had undertaken "private study of the writings of Kant, Fichte, and Schelling" (1992, 25).

³⁴I have found three mentions of Fichte in Müller's published work: in 1826 (271), endorsing an observation about double vision by "Fichte" (without a reference); and twice in 1833–40, noting Fichte's joyful surrender of his personal spirit to the universal spirit (2: 511) and his characterization of the beatific life (2: 551; citing Fichte 1806a). He observes that Fichte's self is grounded in the activity of a "universal spirit [*allgemein Geist*]," a position that he does not endorse (1833–40, 2: 511, 551). His references suggest acquaintance with a post-Jena Fichte.

Müller's views on the role of motor activity and touching one's body in developing the subject–object distinction clearly parallel discussions in Steinbuch, whom he cited frequently.³⁵

Wilhelm Wundt, Helmholtz's assistant and junior colleague at Heidelberg, was already publishing sections of his *Beiträge zur Theorie des Sinneswahrnehmung* when Helmholtz arrived in 1858.³⁶ The second chapter of the *Beiträge*, "Toward a History of Theories of Vision," appeared in 1859. It finds a recurrent historical movement between objective theories and subjective theories. Such episodes start from a naïvely objective position, which does not distinguish between "being" and "appearance," and end up at a subjective pole, which at its extreme derives everything from the subject (1862, 66). His survey touches on major theorists, including Plato, Aristotle, Kepler, Newton, Descartes, Locke, Kant, Kant as received in sensory physiology (emphasizing Müller), Tourtual, Volkman, Goethe, and Kant's philosophical successors, including Fichte, Schelling, Herbart, and Lotze. Wundt interprets Fichte as holding that experiences of qualities (such as color) and of spatial extension impose a limitation on the senses (to experience a particular color; to experience extension but without achieving infinite divisibility). He sums up Fichte's position: "Accordingly, sensation consists in this, that there occurs a resistance [*Anstoss*] of the activity of the I, which is reflected in the I; and what we call an object is nothing other than the various breakings of the activity of the I by a resistance, which does not arise from an inexplicable 'thing in itself', but is already located in the I itself" (1862, 97). Wundt understands Fichte's Idealism as including a distinction between subject and object that is ultimately grounded in the I as subject.

³⁵Müller cites Steinbuch: 1826, xv, xix (as foregrounding the relation of subjective to objective), 52, 53, 76 (his empiristic theory, which Müller rejects); 1833–40, 2: 275 (one of four general references on sensory physiology).

³⁶I focus on Wundt's *Beiträge* (1862) because Helmholtz read at least some portions with care. Wundt mentioned Fichte briefly in his *Vorlesungen* (1863), but there is no evidence Helmholtz read that work.

In the final installment, “On the Psychological Process of Perception,” Wundt elaborates his notion of unconscious inferences in perception and advances a distinction between subjective self-consciousness, in which we come to acknowledge the self or I as distinct from the world, and objective consciousness, in which we come to recognize the presence of various objects in the world as separate from one another and from us (1862, 447–49). His account contains now familiar elements. The subjective self learns that it can control parts of the environment (its own body) and that other parts resist its movements. Here there is no mention of Fichte, presumably because Wundt has rejected his Idealism and doesn’t see his position as derived from Fichte’s. When the self first realizes that portions of the body can be removed without diminishing itself, it seeks to free the concept of the self from the body; unable to do so completely, it comes to a position in which self and body are an integrated whole. As part of this process, we become aware of objects that are separate from our body, and, with development, we learn to distinguish these external objects into ever finer categories. For many people, two trees may look alike, but the botanist can distinguish them into separate kinds at a glance (443).

Here are four authors who discussed the separation between self and world or between *Ich* and *Nicht-Ich*, two of whom explicitly referenced Fichte. None embraced Fichte’s intellectual intuition of the self’s activity. All four emphasize the importance of experiencing limitation (Tourtual, Müller, and Wundt) or impenetrability (Steinbuch) in separating self from world. Steinbuch’s associative theory is closest to Helmholtz’s primary account of associative learning. Müller and Tournatal prominently mention Steinbuch’s motor theory. Further, Wundt devoted an entire section (1863, 376–400) to examining Müller’s account of the role of sensation in self-consciousness.

4.2. Physiological Fichteanism, or not

In seeking to address more broadly the question of Fichte’s presence in the physiological literature on distinguishing I from not-I and subjective experience from objective world, let us review three types of authors: (1) those that cite Fichte; (2) those that use the terminology “I” vs. “not-I” without naming Fichte; and (3) those that develop the distinction between subject and object through a process that includes voluntary motions, without mentioning Fichte.

Müller and Wundt cite Fichte and draw attention to the role of motor activity, and its limitation or checking, in developing the distinction between subject and object (#1). They reject his Idealism. Theodor Waitz, a professor of philosophy at Marburg and an advocate of a new psychology (and mentioned by Helmholtz, above), names Fichte in his *Lehrbuch der Psychologie als Naturwissenschaft* (1849). He describes how spatial perception first arises in vision through simultaneous sensations that “force” themselves into a spatial appearance (166–79), the locations of which are mapped by motor activity (197–206). When the retina is stimulated, several non-spatial ideas strive to enter consciousness at once. In order to be represented simultaneously, they form a spatial representation (an account similar to Herbart’s; see Hatfield 1990, chap. 4.1.2). There is no appeal to felt limitation and a *Nicht-Ich*. Fichte is mentioned as an adherent of the sort of idealism that Waitz hopes to avoid (6, 46–48).

Tournatal used the terminology of “I” and “not-I” without mentioning Fichte (#2). The distinction arises, in his view, through the way in which the things that impinge upon the senses limit the activity of the self. Steinbuch holds that the distinction between subject and object develops through voluntary motions, without mentioning Fichte (#3).

Alfred Wilhelm Volkmann (1836),³⁷ professor of physiology

³⁷In *PO*, Helmholtz cited Volkmann even more frequently than he did Müller or Wundt.

in Leipzig, Dorpat, and Halle, wrote a book reviewing recent work on the theory of vision. It examines Müller's theory that the distinction between *Ich* and *Nicht-Ich* is learned and that it depends on the mind rather than the faculty of sense (citing Müller 1826, 39–43). Volkmann agrees with Tourtual's counterclaim that externalization is a sensory, not an intellectual or judgmental accomplishment, and that the tendency to externalize is innate. There is no hint of Fichte (#2).

These writings show that the problem of distinguishing self from world arose in the physiological literature in connection with the problem of "externalizing" the objects of sense, that is, of referring sensations to an external cause. This problem was particularly acute because nearly all parties agreed that perception of the third dimension, and hence of objects located away from the observer, was learned. Further, Müller had taught that sensations originally are perceived and localized in the bodily sense organ: on the retina, or in the hand as it touches the table (1843, 717, 738). Others, such as Steinbuch, taught that all spatial intuition is the product of learning, and that the distinction between self and world and the externalization of objects arise from exploratory touching of one's body and other objects.

The problem of distinguishing self from world, subjective sensation from external cause, was pervasive and many faceted in the literature of sensory physiology, and not specifically tied to Fichte or his terminology. Consider a book by Carl M. N. Bartels (1834), a practicing physician in St. Petersburg, on the physiology of vision.³⁸ He was familiar with the recent literature, including the work of Steinbuch, Müller, and Tourtual, among others (v). He did not use the expression "*Nicht-Ich*." But he characterized the problem of accounting for the distinction between subject and object. In a section entitled "On the Externalization or Objectification [*Objectiviren*] of Sensory Objects," he explained that subject and object are reciprocal notions (a position reminiscent

of Fichte, but also of Steinbuch and Müller). Without objectivity, no being can become aware of itself: "Only through awareness of external things and its own embodiment is a being given its feeling of existence, for the sensitive being cognizes itself and the sensed only in the sensation, and, conversely, in each sensation there is cognized itself and a thing sensed" (10). On the origin of spatial perception, Bartels supports Steinbuch's learning account over Tourtual's nativism, while not following what he characterizes as Steinbuch's exclusive appeal to muscle sensations in the process of externalization (14).

We could follow the theme of subject and object, spatial externalization, and the role of voluntary (sometimes, "free") muscle motion through many more iterations.³⁹ But it should be clear that the physiological literature itself used and developed the various terms and concepts, including the distinction between *Ich* and *Nicht-Ich* and the role of voluntary motion in drawing it, and the distinctions between subject and object and between subjectivity and objectivity. While these usages may have appropriated terms and ideas from more purely philosophical discussions in Kant and even Fichte, they did not carry the aims, purposes, or full conceptual schemes of those sources along with them. Aside from any contact with Fichte's writings, Helmholtz would have found extensive discussion of the role of active voluntary motion in the development of spatial perception in sources known well to him, including associative accounts (Steinbuch and Waitz) that do not adopt the vocabulary of a "limitation" set up by the *Nicht-Ich* and accounts that do so refer (Müller, Tourtual, and Wundt), as well as nativist accounts of externalization (Tourtual and Volkmann).

Accordingly, we may conclude that, historically, Helmholtz is more likely to have drawn his understanding of the role of motor

³⁹To this partial overview we can immediately add Lotze (1852), Nagel (1861), and Classen (1863), as works Helmholtz read and cited that examined spatial perception and externalization and assigned a prominent role to motor activity.

³⁸Helmholtz cites Bartels (1834) in *PO* (3: 191, 194, 224, 225).

activity in the separation of not-I and I from the physiological literature. Several physiologists (or psychologists) emphasized the role of motor activity in the development of spatial perception and the felt separation of one's body from the world (Steinbuch, Müller, Bartels, and Wundt). The connection of this literature to Fichte is either weak or non-existent (depending on the author). Further, the conceptual distinction between subject and object, and subjectivity and objectivity, is initially drawn from Kant (as in Steinbuch, Müller, and Tourtual). But this distinction, too, takes on a life of its own in the physiological literature, in connection with the problem of externalization: taking sensory experiences to be of an external thing (Steinbuch, Tourtual, Müller, Volkman, Bartels). In short, there is much evidence in favor of a physiological Kantianism, which in fact did not accept all of Kant's own position (e.g., rejecting transcendental idealism) but which adopted his terminology, including the distinction between subject and object. There are only hints of a physiological Fichteanism (perhaps a touch in Tourtual or Müller), which, in any case, would exhibit only a general similarity with Fichte's actual thought.

5. Helmholtz and Metaphysics

I have mentioned that Helmholtz's attitude toward metaphysics changed over time. He started from a position of metaphysical realism in his 1847 memoir and the Kant lecture of 1855. In this phase, he was a realist about the spatial structure of objects and forces. His views changed in the 1860s, and he adopted a more modest form of realism in *PO* §26 (1867). No longer did he claim to be able to know that things beyond the pale of experience—the causes of the experience—have a spatial structure. He did claim to know that sensations are caused and that the relations among the causes are mirrored in the structure of experience. But, as he put it, we cannot infer from experienced spatiality

to the spatiality of external things (*PO*, 3: 18). We must rest content with accepting that our spatial perceptions predict, as a practical matter, subsequent patterns of sensations. Our spatial perceptions do not reveal "the true essence of things" but are images (patterns) whose significance we must learn to interpret (3: 21–22).

As it happens, Heidelberger and I agree on Helmholtz's early spatial realism and on the weakening of this realism in the late 1860s (see also [Edgar 2015](#)). After that, we part company. Heidelberger attributes Fichtean Idealism to Helmholtz. I find that Helmholtz adopted a modest form of realism, a kind of structural realism,⁴⁰ in 1867, and that, in 1878, he consolidated this position in a way that renders it metaphysical.

The notion that Helmholtz had a metaphysics may seem unlikely. In §2, I quoted some of his anti-metaphysical pronouncements, directed at speculative metaphysics as found in German Idealism. Indeed, because he understood "metaphysics" to have this connotation, Helmholtz presumably would not have characterized his position in 1847 and 1855 as a "metaphysics," nor did he so characterize his more modest metaphysics in *PO* §26 (1867). Indeed, in §33 (3: 432), he observed that natural science provides no basis (at present) for choosing between the only (so-described) metaphysical hypotheses that he found on offer: materialism and spiritualism (or idealism).⁴¹ But he al-

⁴⁰[Hatfield \(1990, 209\)](#) characterizes Helmholtz's position as one in which sensations such as color have regular external causes (no difference in sensation without a difference in light, similar lights yield similar sensations), to which they are related as arbitrary signs, and that he treated spatial perception as producing relations isomorphic to those among the causes of sensations. This fits the notion of Indirect Epistemic Structural Realism described by [Frigg and Votsis \(2011\)](#). It is a type of metaphysical realism (about causal efficacy and actual relations) but is not a version of Ontic Structural Realism ([Frigg and Votsis 2011](#), §4), because it does not assert that structure is all there is.

⁴¹In *PO* (3: 32), Helmholtz used "idealist philosophy" in relation to Fichte, Schelling, and Hegel. He also spoke of "spiritualist" philosophy, in relation to idealism but also extending to dualism as discussed in the *Spiritualismus*

lowed that one may be inclined toward one or the other in the absence of a factual basis for that inclination. Heidelberger and I have taken historical license in describing Helmholtz's early position as a "metaphysical realism" even though he didn't. The license is warranted because, by some standards of his day, it is "metaphysical" to infer a really spatial world from spatial perceptions.⁴² For me, the term "metaphysics" is appropriately applied, in historical context, both to the early spatial realism and to the structural isomorphism of *PO*.

In previous work, I interpreted Helmholtz in *FP* as withdrawing from the causal realism of 1867 to a position in which science is only committed to regularities in the phenomena and cannot push beyond that (Hatfield 1990, 213–14). While metaphysicians

controversy, in which, e.g., Ulrici (1866, 166–71) defended dualism of mind and body by appealing to scientific support from Helmholtz and reasoning that only an immaterial substance can perform judgments, even unconscious ones. On the materialism controversy, see also Beiser (2014a, chap. 2).

⁴²Mill's *Logic* instances "metaphysics" as concerned with a reality beyond appearances: "To this science [metaphysics] appertain the great and much debated questions of the existence of matter; of the existence of spirit, and the distinction between it and matter; of the reality of time and space, as things without the mind, and distinguishable from the objects which are said to exist in them" (1843, 9; the German edition of 1862–63 translates this passage). Helmholtz knew the translated work; even if he did not read this specific passage, it provides a contemporary take on "metaphysics." Another view is offered by Siebeck (1878, 175–87), who, in surveying historical metaphysical systems, finds that the common theme is to "get behind" the appearances. Although finally equating metaphysics with dogmatic metaphysical systems, he acknowledged that it had been and was engaged with empirical science. One might say that Helmholtz posits the "actual" as underlying or behind experience. By contrast, Wundt (1862, xii–xiii, xvii–xx) reserves "metaphysics" for investigations into the "nature of the soul" and for deductive systems that derive their first principles neither inductively nor from scientific psychology but from metaphysical hypotheses. Wundt proposed basing a new metaphysics on psychology (not vice versa). Müller (1826, 32–33) used "metaphysical" as a term of opprobrium (to include "false nature-philosophy") and contrasted it with genuinely philosophical investigation of the type he believed was fundamental for physiology.

might speculate about a reality beyond the phenomena, such speculations would have no place in natural science. I now think that matters are more complicated, and that Helmholtz offered two positions as legitimate. First, a minimalist position, that science only investigates regularities in the phenomena without inferring anything outside the phenomena as a causal basis. Second, a moderate metaphysical realism that infers a domain of "the actual" that is outside the phenomena and is the basis for the regularities in the phenomena. This is the structural realism of 1867 continued.⁴³

The textual basis for these two positions is somewhat fraught. Interpreting the law of cause as bare regularity fits many texts and seems to be called for by Helmholtz's proclamation that "what we can find unambiguously, and as a fact without anything being insinuated hypothetically, is the lawlike in the phenomena" (*FP*, 138; *VR*⁴, 2: 240; *PO*², 591). In moving about, our movements coincide with an unconscious flow of sensations. The relation between motions and sensations could be regularized through association. The law of cause would then be given a Humean or Millian interpretation, as bare regularity. The regularities are among perceptions, making Helmholtz's account similar to Mill's permanent possibilities of sensation. Sensations are "signs" for further sequences of sensations, but not for anything outside the domain of sensations.

But Helmholtz pushes further. He moves beyond this phenomenalist position, to speak of causes as the enduring basis of the lawlikeness in the phenomena. He posits something beyond our perceptions, as their cause:

The first product of our thoughtful comprehension of the phenomena is the *lawlike*. If we have separated it out sufficiently purely, de-

⁴³I agree with McDonald (2002) that after 1867 Helmholtz continued to espouse a moderately realist position (by comparison with the more robust realism of 1847 and 1855). I also continue to affirm that he offered the more phenomenalist position as a legitimate stopping point for avoiding all metaphysical hypotheses.

limited its conditions with sufficient completeness and assurance and also grasped it with sufficient generality that the outcome is unambiguously specific for all possibly occurring cases, and if we at the same time gain the conviction that it has proved true and will prove true at all times and in every case: then we acknowledge it as an existence enduring independent of the way in which we form representations and call it the *cause*, i.e., that which primarily remains and endures behind what changes. (**FP*, 139; *VR*⁴, 2: 240–41; *PO* 2: 592)

The “first product” of our comprehension describes a purely phenomenal lawlikeness. But if we carefully evaluate its generality with precision, we may go further and posit what he subsequently characterizes as the enduring “actual,” as something behind these appearances. If this cause is independent of our will (our voluntary motions), we posit it as an independent “force.”⁴⁴ But, I suggest, in going beyond the phenomena this posit is a metaphysical hypothesis.

Helmholtz now formulates a terminology for describing causes or forces that go beyond and underlie the appearances, while avoiding the metaphysically loaded concept of “substance”:

In our language, we have a very fortunate way of characterizing that which lies behind the change of appearances and acts upon us, namely, as “the actual” [*das Wirkliche*]. Here only action [*das Wirken*] is predicated. Absent is that secondary reference to what endures as substance which is included in the concept of the real [*das Reelle*], i.e., of the thinglike [*das Sachliche*]. (*FP*, 140; *VR*⁴, 2: 241; *PO*², 592)

⁴⁴This mention of willing as an apparent force takes place as Helmholtz discusses (*FP*, 137–41; *VR*⁴, 2: 238–42; *PO*, 2: 595–96, 591–92) various metaphysical hypotheses (realism, idealism). In this context, he consciously reflects on the place of the will in the scheme of reality. This reflection draws on the developed (adult) ability to will something and to anticipate the result, and hence to feel “checked” or “limited” if the result doesn’t occur. This sort of engagement with Fichte-like ideas, amidst a discussion of metaphysics that includes Fichte, is far removed from the original formulation of his motor theory of the genesis of spatial perception.

Helmholtz here explicitly posits something lying behind the appearances, an unknown cause, not specified except by the manner in which it affects the subject and causes various sensations (and their relations).⁴⁵ “The actual” is cognized only as a structural system of causes and relations, and is explicitly distinguished from the “real” or the “thing in itself”—“*das Reelle*, oder Kant’s ‘Ding an Sich’” (*FP*, 140; *VR*⁴, 2: 242; *PO*², 593)—to which Helmholtz attaches the metaphysical concept of a substance (as a substrate for spatial properties, as in the realist hypothesis).

So far so good. But the text says more. Helmholtz says at various points: “realism” and “idealism” are acceptable as metaphysical hypotheses, as long as they are treated as hypotheses and not dogma (*FP*, 138; *VR*⁴, 2: 239; *PO*², 595–96); that idealism can’t be refuted if it takes life as a dream (*FP*, 137–38; *PO*², 595–96); that the realist metaphysical hypothesis, “of a world of material things” with which we interact,⁴⁶ is “the simplest we can form” (*FP*, 137; *PO*², 595); that we are transcendently driven to seek causes beyond the appearances as the ultimate basis of the lawlike (*FP*, 142; *PO*², 593–94); that hypotheses having no factual sense are “worthless talk” (*FP*, 141; *VR*⁴, 2: 243; *PO*², 593); that we should follow the physicist Gustav Kirchhoff and the poet-scientist Goethe in seeking simple or aesthetically pleasing organizations of the facts, without applying abstract concepts that go beyond those facts (*FP*, 141); and that substances may be posited as what is permanent if one chooses (*FP*, 139; *PO*², 591). What to do with this?

Here, we should take a hint from Helmholtz’s seemingly off-hand remark that idealist and realist metaphysical hypotheses

⁴⁵In line with *PO* (3: 17–21, 433) and elsewhere in *FP* (125; *VR*⁴, 2: 225–26), these relations are originally differences in quality, intensity, and temporal order; from these, our spatial representations arise.

⁴⁶I take this “realist hypothesis” to be realist about spatial matter but not to assert reductive materialism; it leaves open whether the cognizing subject is material. (Helmholtz endorsed reductive materialism about metabolic and other vital processes, but not about the mind.)

come in “various gradations” (*FP*, 138; *VR*⁴, 2: 239; *PO*², 595). In fact, I think Helmholtz is offering us, without noting it explicitly, a gradation of positions as regards going beyond the facts (or the appearances) in science, some of which he finds more acceptable (or comfortable, or pleasing) than others. I offer a range:

- (1) Seeking the lawfulness in the appearances, without going beyond the appearances (predictions of future appearances allowed)
- (2) Positing otherwise unknown causes in the form of forces as enduring, mind-independent structures (“the actual”) that cause sensations in a subject and that we describe only as causal powers with structural relations among them
- (3) Positing spatial substances as permanent things that underlie lawful appearances (“the real,” the “things in itself”); this is to accept the realist hypothesis of a world of material things with which we interact
- (4) Accepting the materialist hypothesis that the world consists only of material things (again, as things in themselves)
- (5) Accepting the “consistent dream” idealist hypothesis that our sensations are produced by our own psychic activity
- (6) Accepting the Fichtean hypothesis of an Absolute I as affecting our I so as to produce the Not-I.

The least simple metaphysical hypothesis is (6). Presumably, if treated merely as a hypothesis, it can be considered, even if Helmholtz doesn’t like it (*FP*, 137–38; *PO*², 595–96). (5) is a simpler version of the idealist hypothesis. It may even have empirically testable consequences.⁴⁷ Treating it as a hypothesis,

⁴⁷Helmholtz offers conflicting statements on the cognitive significance of metaphysical hypotheses. He tells us that idealism can’t be refuted. He later says that hypotheses that cannot “be tested and confirmed by observation and experiment . . . are to be regarded as worthless talk” (*FP*, 141; *VR*⁴, 2: 242–43; *PO*², 593). That he accepts idealism as a legitimate hypothesis suggests that, even if untestable, it differs cognitively from the other hypotheses (such as materialism) because it makes a different claim about the reality behind the

perhaps the discovery of neural mechanisms from the two eyes that connect in the brain and explain binocular single vision might count against (5) and for (4), as Helmholtz suggests in *PO* §33 (3: 432–33), where he aligns materialism with the postulation of “unknown” neural mechanisms (which presumably might, eventually, be discovered). He describes (3) as the simplest metaphysical hypothesis, that of spatial realism. In *FP*, he says that neither (5) nor (3) can be confirmed empirically. Does this mean that they have no factual sense? If not, are they “worthless talk”? It seems that he allows them as hypotheses even if they can’t be tested. Which presumably means that they differ cognitively, even if they don’t differ empirically.

I have suggested that (2) is a metaphysical hypothesis, even if Helmholtz does not label it as such, designating (3) as the simplest one. If “metaphysics” is what goes beyond the appearances to characterize the causes our perceptions, then (1) doesn’t count (it stays within the appearances) but (2) does. This seems plausible to me. And Helmholtz indicated (in a quotation above) that he prefers (2) to (3), presumably on the grounds that it is simpler. He likes his metaphysics modest.

In any event, *FP* offers an explicit softening from his earlier derision of metaphysics as “humbug” (§2, above). He remarks that “the various gradations of the realist and idealist views are metaphysical hypotheses, which, as long as they are acknowledged as such, have complete scientific legitimacy” (**FP*, 138; *VR*⁴, 2: 239; *PO*², 595). I have further suggested that appeal to “the actual” is a minimal metaphysical hypothesis because it goes behind the lawlike in the appearances. Accordingly, the phenomena themselves are the limits of what is known (that is, the limit of the facts, “without anything being insinuated hypothetically”). In venturing beyond them, he satisfies the need to

appearances. (The tension in his pronouncements can be reduced if we read him as saying that, *at present*, idealism can’t be refuted; still, I resist attributing to him a verificationist or confirmationist criterion of cognitive significance.)

find causes, where the notion of cause refers not to mere regularities in the phenomena but to causal powers that produce the phenomena.

6. Conclusions

I have sought to characterize Helmholtz's relation to philosophy especially in the areas of the epistemology and metaphysics of sense perception. We have seen several ways in which Helmholtz might be considered to have engaged in philosophy: in his essays on the "logic" of theories of the physiology and psychology of the senses (and other scientific theories); in his examination of the limits and justification of our sensory knowledge; in his examination of the formation of the distinction between subject and object; in his early metaphysical realism about spatial bodies and forces; and in his later, more modest, structural metaphysical realism.

With respect to the distinction between subject and object, some interpreters have found a Fichtean influence on Helmholtz's positing of the world as *Nicht-Ich* over against the self as *Ich*. In comparing Fichte's intellectual intuition of an active self with Helmholtz's associative account of the formation of spatial intuition and the externalization of phenomenal objects, the parallel is weak, mainly amounting to a role for voluntary motion in each. I find no compelling evidence that Helmholtz did more than (1) try to "gratify" his father by pointing out places where he could agree with Fichte, (2) in a speech as rector, offer kind words toward Fichte, the first rector of the university, and (3) acknowledge the value of Fichte's terminological distinction between *Ich* and *Nicht-Ich* for describing the process of externalizing (and objectifying) objects, while avoiding the core Fichtean thesis of an intellectual intuition of the self's activity and rejecting his Idealism.

Rather than aligning Helmholtz with Fichte, I have offered a glimpse into the extensive and articulate examination of the subject-object distinction and of the "externalization" of perception that was carried out in the physiological and psychological literature, up to Helmholtz's expression of his mature position in 1867. This literature discussed in detail the role of motor activity in the formation of spatial representations of the external world and in distinguishing self from world. These discussions included conceptual histories, conceptual criticism, and challenges based on empirical considerations.

In Müller's words, this literature reveals a physiology that is philosophical. But the kind of philosophy that we saw in these discussions is on the order of the logic or philosophy of the special sciences—the critical examination and discussion of fundamental concepts having to do with sense perception and its relation to a mind-independent (or not) world. Accordingly, there could be a philosophical background to Helmholtz's writings found in figures not usually designated as philosophers, that is, in the discussions of practicing scientists. Just as, in other cases before and after the nineteenth century, when science is forming a new framework, its participants are drawn to philosophize, so too here. Philosophical reflection may be demanded by the state of theory-making. There is no end to the need for philosophy.

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Abbreviations

These abbreviations are used to refer to Helmholtz's works and the Königsberger biography:

- FP* "The Facts of Perception," a translation of [Helmholtz \(1878\)](#) as in [Helmholtz \(1977\)](#), which itself translates the edited collection [Helmholtz \(1921\)](#).
- Kö* Königsberger, *Hermann von Helmholtz (1902–03)*, cited by volume and page number.
- PO* *Handbuch der physiologischen Optik*, first edition (1867), cited by volume and page number as reprinted in the third German edition (1909–11); this edition shows the 1867 pagination at the top of the page. [Helmholtz \(1925\)](#) provides an English translation, which I have used but often modified; it gives the 1909–11 pagination at the top of the page.
- PO*² *Handbuch der physiologischen Optik*, second edition (1896a).
- SW* [Helmholtz \(1971\)](#), Kahl's translation of Helmholtz's *Selected Writings*.
- VR*⁴ *Vorträge und Reden (Helmholtz 1896b)*, cited by volume and page number.
- WK* [Königsberger \(1906\)](#), Welby's abbreviated translation of [Königsberger \(1902–03\)](#).

Note: Where I modify a cited translation, I indicate so with an asterisk (*). Where no English translation is cited for a work, the translations are mine.

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