

## LEIBNIZ'S INFLUENCE ON HERMANN COHEN'S INTERPRETATION OF KANT

### A influência de Leibniz na interpretação de Hermann Cohen de Kant

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**Abstract:** In the second edition of Hermann Cohen's *Kant's Theory of Experience*, he abandons the interpretation of Kant's Anticipations of Perception that he gave in the first edition (1871), in favour of a radically different one. On his early interpretation, the Anticipations is largely of psychological interest for its influence on, and continuing significance for, physiological psychology and psychophysics. But on his mature interpretation, it defends the superiority of a dynamic conception of nature over a mechanical conception. Further, on his early interpretation, Cohen thought the Anticipations was not a central part of Kant's critical theory of knowledge. But on his mature interpretation, he thinks it is absolutely central to that project. What is more, Cohen seems to have revised his interpretation in a relatively short period of time, in 1880-1. This paper argues that Cohen's change in views about Kant's Anticipations is explained by his (and Paul Natorp's) reception of Leibniz in the very early 1880s, and specifically Cohen's reception of Leibniz's arguments against Descartes' view that extension is the essence of matter.

**Keywords:** Leibniz; Kant; Anticipations of Perception; Neo-Kantianism; Cohen; Kant's Theory of Experience.

**Resumo:** Na segunda edição da Teoria da Experiência de Kant, de Hermann Cohen, ele abandona a interpretação das Antecipações da Percepção de Kant dada na primeira edição (1871), em favor de uma radicalmente diferente. Em sua interpretação inicial, as Antecipações são de grande interesse psicológico por sua influência sobre, e significado contínuo para, a psicologia fisiológica e a psicofísica. Mas em sua interpretação madura, é defendida a superioridade de uma concepção dinâmica da natureza sobre uma concepção mecânica. Além disso, em sua interpretação inicial, Cohen pensava que as Antecipações não eram uma parte central da teoria crítica do conhecimento de Kant. Mas em sua interpretação madura, ele pensa que é absolutamente central para aquele projeto. Além disso, Cohen parece ter revisado sua interpretação em um período de tempo relativamente curto, em 1880-1. Este artigo argumenta que a mudança de opinião de Cohen sobre as Antecipações de Kant é explicada por sua recepção de Leibniz (e a de Paul Natorp) no início da década de 1880 e, especificamente, a recepção de Cohen dos argumentos de Leibniz contra a visão de Descartes de que a extensão é a essência da matéria.

**Palavras-chave:** Leibniz; Kant; Antecipações da percepção; neokantismo; Cohen; A teoria kantiana da experiência.

### 1. Cohen's radical revision of his interpretation of the Anticipations of Perception

In Hermann Cohen's *Principle of the Infinitesimal Method* (1883), he writes that "the *Principle of the Anticipations of Perception* contains and encapsulates the problem

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of the critique of knowledge” (Cohen, 1883, §32; Cohen’s emphasis)<sup>1</sup>. The Anticipations is a chapter of Kant’s System of Principles, in the *Critique of Pure Reason*. It follows the Axioms of Intuition, where Kant argues that “[a]ll intuitions are extensive magnitudes” (*KrV*, B202), that is, that extensive magnitudes are validly applied to objects in intuition. For Kant, a magnitude is *extensive* just in case the representation of its (homogenous) parts make possible the representation of the whole, and the whole is a synthesis of its (homogeneous) parts<sup>2</sup>. In contrast, the Anticipations argues that “[i]n all appearances the real, which is an object of the sensation, has intensive magnitude, i.e., a degree” (*KrV*, B207). That is, there is something in appearances to which a different kind of magnitude validly applies. That different kind of magnitude is intensive. For Kant, a magnitude is *intensive* just in case it “can only be apprehended as a unity, and in which multiplicity can only be represented through approximation to negation = 0” (*KrV*, A168/B210). In Cohen’s *Principle of the Infinitesimal Method*, he asserts that this chapter of Kant’s first *Critique* “contains and encapsulates” the whole problem of a Kantian account of knowledge. Two years later, he added a long, much-expanded interpretation of this chapter to the second edition of his *Kant’s Theory of Experience* (1885).

However, Cohen had not always thought the Anticipations was so important to Kant, or his own, account of knowledge. In the first edition of *Kant’s Theory of Experience* (1871), he regards the Anticipations as inessential to Kant’s account of knowledge. There, Cohen interprets the Anticipations as mostly significant for the influence he thinks it had on, and its continuing importance he thinks it has for, physiological psychology and psychophysics. By implication, for Cohen, the Anticipations was not essential to Kant’s account of knowledge.

A decade later, Cohen had a radically different interpretation. In the *Principle of the Infinitesimal Method* and the second edition of his Kant book, he abandons his earlier psychological interpretation of the Anticipations. Instead, he sees the Anticipations as a defense of a dynamic conception of the physical world, as against a mechanical conception on the mould of Descartes. Further he thinks this defense of a dynamic conception of nature is somehow essential to a critical account of how mathematical

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<sup>1</sup> Translations from Cohen are my own.

<sup>2</sup> *KrV*, A162-3/B203-4.

natural science represents *real objects*, that is, reality. The Anticipations is thus, on this interpretation, absolutely central to Kant's, and Cohen's, critical project.

What is more, this radical revision in Cohen's interpretation of the Anticipations seems to have happened relatively quickly, sometime in 1880-1. As Marco Giovanelli has established<sup>3</sup>, Cohen was still entertaining his early, psychological interpretation of the Anticipations as late as 1880, when he assigned a prize essay topic that asked students specifically about the psychophysical interpretation of it<sup>4</sup>. But then, in February of 1881, Cohen hinted in a letter to his friend and former student, August Stadler, that he was working on a new interpretation of the Anticipations that would overcome objections Stadler had to Cohen's earlier psychological interpretation (Cohen, 2015 [1881], pp. 128-9).

Cohen's radical revision of his interpretation of the Anticipations thus raises at least three distinct historical and interpretive questions. First, as a historical matter, what explains the timing of Cohen's radical rethinking of the Anticipations? What happened in 1880-1 to occasion this shift in his thinking? Second, what explains why Cohen abandoned his earlier psychological interpretation specifically in favour of one that defends a dynamic conception of nature against a mechanical conception?<sup>5</sup> Third, why did Cohen come to view the Anticipations, on his revised interpretation of it, as so central to the entire project of a critical account of knowledge? Why does it "contain and encapsulate the problem of the critique of knowledge"?

I will argue that the answers to all three of these questions can be found by looking to Cohen's collaboration with his student Paul Natorp on early modern physics and

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<sup>3</sup> My account in this paragraph of the timing of Cohen's revision of his interpretation of the Anticipations follows the excellent and detailed account in Giovanelli (2016b).

<sup>4</sup> See Holzhey (1986a, p. 1:381ff) for the text of Cohen's call for papers. See Sieg (1994, p. 130ff) for more on the Marburg philosophy faculty's prize essays.

<sup>5</sup> See Giovanelli (2011: Ch. 4; 2016a; and especially 2016b) for detailed accounts of one reason Cohen would have been dissatisfied with his psychophysical interpretation of the Anticipations. As Giovanelli shows, Stadler had raised an objection to Kant's Anticipations, on Cohen's psychophysical interpretation of it, and debate about it involving Stadler and other students of Cohen's had ensued over the course of the 1870s. Stadler argued that Kant's claims in the Anticipations (on Cohen's psychophysical interpretation of it) were falsified by a central result of psychophysics, namely, E.H. Weber's result that some changes in stimuli are proportionately small enough not to be noticed by the subject. However, while this objection can explain why Cohen would have been dissatisfied with his early psychophysical interpretation of the Anticipations, it cannot explain why he abandoned it specifically in favour of an interpretation that is about the dynamic and mechanical conceptions of nature. This point is underscored by the fact that, as Giovanelli (2016b, p. 8) shows, Stadler himself never gave up a broadly psychophysical interpretation of the Anticipations, thinking instead that even if some of the empirical details of Kant's Anticipations were wrong, his general psychophysical approach was right.

philosophy in 1880-1, and especially to their interest in texts of Leibniz's that were published for the first time only in 1879 and 1880. In particular, I will argue that, in Leibniz's arguments against Descartes' view that matter's essence is extension, Cohen would have found a problem with his own account of knowledge, a problem that was potentially devastating by his own lights. Leibniz's arguments revealed to Cohen that reality must be conceived by appeal to non-extensive magnitudes, in addition to extensive magnitudes. But then, the Anticipations would appear as the chapter of the first *Critique* that provides an account of just those non-extensive magnitudes<sup>6</sup>.

To make this case, I begin in §2 with an account of two important features of Cohen's account of knowledge in the first edition of *Kant's Theory of Experience*. This section does not offer a novel account of Cohen's views in that book, but only highlights parts of his views that will be important for the story that follows. §3 offers an account of Cohen's early psychological interpretation of the Anticipations from *Kant's Theory of Experience*.

§4 tracks a subtle shift in the focus on Cohen's thinking in the late-1870s and very early 1880s. During this period, Cohen seems to have started devoting more focus to the role of mathematics in his critical account of knowledge. §5 turns to his supervision of Natorp, and considers the latter's inaugural lecture on Leibniz, in which he foregrounds Leibniz's criticism of Descartes' account of matter. Then in §6, I consider the implications of those Leibnizian arguments for Cohen's own early account of knowledge. I argue that they reveal a way that Cohen's account of knowledge fails on its own terms, but also that they point Cohen to the Anticipations as the key to repairing his views. §7 sketches a strategy for interpreting Cohen's mature views of the Anticipations, in light of the Leibnizian arguments that prompted him to revise his interpretation. I conclude in §8 by showing how my account of Cohen's revised interpretation of the Anticipations can answer the three questions I started with: namely, why he revised his interpretation when he did in 1880-1; why he came to regard the Anticipations as being concerned with the superiority of a dynamic conception of nature over a mechanical conception; and, mostly

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<sup>6</sup> My account of Cohen's reception of Leibniz expands on those found in Zeman (1980), Holzhey (1983), and Seidengart (2012). Insofar as I think Cohen interprets the Anticipations in light of Leibnizian arguments for a dynamic conception of nature as opposed to a mechanical conception, I attribute to him a view of the Anticipations that is similar to the one recently proposed by Glezer (2018).

importantly, why he came to regard the Anticipations as central to the entire project of a critical account of knowledge.

## 2. Cohen's anti-subjectivism and idealism in the first edition of *Kant's Theory of Experience*

We cannot understand the change in Cohen's interpretation of the Anticipations of Perception without first bringing into view some of the broad features of Cohen's project in his early writings, especially the first edition of *Kant's Theory of Experience*. I will not try to give a comprehensive account of Cohen's views in his early writing<sup>7</sup>. However, certain ideas that he articulates in his Kant book help explain why he thought the Anticipations, as he interpreted it in this early period, was not central to Kant's (or his own) critical philosophy<sup>8</sup>.

There are two views in particular we need to see in Cohen's early writings. First, in *Kant's Theory of Experience*, his account of knowledge is motivated by a staunch (for lack of a better term) *anti-subjectivism*<sup>9</sup>. Cohen is largely allergic to accounts of scientific knowledge that threaten to make that knowledge in any way subjective, on a very broad understanding of what 'subjective' means. He thinks scientific knowledge is not private, individual, or idiosyncratic. It is not relative to, and does not depend on, any particular perspective. By the 1970s, he rejects accounts of scientific knowledge that make it subjective in any of these senses.

The second view we need to set clearly before us is the view Cohen would come to call *idealism*<sup>10</sup>. This is the view that the objects of experience are constituted by, and thus ultimately explained by, ideas -- that is, forms, principles, or laws of knowledge. In some of his early writings, Cohen conceives of these forms or principles of knowledge as produced by the knowing spirit [*Geist*]. By the late-1870s, he seems to have conceived of them more clearly as simply principles that are latent in mathematical and scientific

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<sup>7</sup> For more thorough accounts of Cohen's views in the first edition of *Kant's Theory of Experience*, as well as his other early writings, see Edel (2010), Poma (1997), and Beiser (2018).

<sup>8</sup> A more complete account of Cohen's early writings would have to include his early essays on Plato (Cohen, 1866), mythological representations of God and soul (Cohen, 1868-9), and the Trendelenburg-Fischer dispute (Cohen, 1871a). I believe, but cannot here argue, that all of these papers, in different ways and in differing degrees of clarity, express the commitments of Cohen's that I want to highlight in *Kant's Theory of Experience*, namely, his anti-subjectivism and his idealism.

<sup>9</sup> I am grateful to Christian Damböck for clarifying conversation about Cohen on this point.

<sup>10</sup> I follow Poma (1997) and Beiser (2018) in emphasizing this point about Cohen.

theories. But these details are not so important for our purposes. What is important for our purposes is simply Cohen's commitment to the view that objects of experience are explained by appeal to forms, principles, or laws of knowledge.

To be sure, for Cohen there is an important connection between his anti-subjectivism and his idealism. He thinks idealism is the way to avoid any account of knowledge that threatens to make scientific knowledge individual or relative to some particular perspective. Thus, as he sees it, in order to avoid that unacceptable view of scientific knowledge, the philosopher must adopt (some or another form of) idealism as he conceives it. The only way to preserve the objectivity of scientific knowledge is to explain the objects of experience by appeal forms, principles, or laws produced by the knowing spirit or contained within the knowledge itself<sup>11</sup>.

In Cohen's early writings, he does not always express his commitments to anti-subjectivism and idealism perfectly clearly. That is because it is never his immediate aim in his earlier writings to defend either of those two views. All of his writings from the 1860s and 1870s have some or another immediate aim: for example, to defend a particular interpretation of Plato (Cohen, 1866) or to intervene in the Trendelenburg-Fischer dispute (Cohen, 1871a). In these works, Cohen's anti-subjectivism and idealism appear less as doctrines he aims explicitly to defend, and more as positions he assumes as starting points from which he approaches the other philosophical questions that are his more immediate aim to answer. Likewise, in *Kant's Theory of Experience*, Cohen's anti-subjectivism and idealism are clear, despite the fact that they are not his immediate aim to defend.

As Cohen says at the outset of the book's preface, his most immediate aim is "to ground the Kantian doctrine of the *a priori* anew" (Cohen, 1871b, p. iii). However, that aim is motivated by a further concern to defend Kant against certain objections to him that were current in Cohen's time, and that Cohen thinks are rooted in a serious misunderstanding of Kant. These objections primarily concern Kant's views of space and spatial representation. J.F. Herbart and, later, Hermann von Helmholtz had objected to Kant's account of space as an *a priori* form of sensibility on the grounds that it made spatial representation innate, a view they both rejected<sup>12</sup>. Further, Cohen's former teacher, Adolf Trendelenburg, had objected that, contrary to Kant's claims in the *Transcendental*

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<sup>11</sup> Cohen's idealism is thus an example of the kind of account of objectivity that Daston and Galison call "structural objectivity" (Daston and Galison, 2010, Ch 5).

<sup>12</sup> Cf. Hatfield (1990), chs. 4 and 5.

Exposition, Kant had not shown that space is “exclusively” a form of sensible intuition. According to Trendelenburg, Kant’s arguments failed to take into account the possibility that space is a form of sensible intuition and also a real property of things in themselves<sup>13</sup>. At the same time that Cohen wrote *Kant’s Theory of Experience*, he also wrote his essay addressing Trendelenburg’s objections to Kant and the ensuing debate with Kuno Fischer, “On the Controversy Between Trendelenburg and Kuno Fischer” (1871a). Cohen returns to this topic in his Kant book, and deals with it alongside the claim that Kant was a nativist about spatial representations.

Cohen argues that both of these objections to Kant are based on misinterpretations of him, and in particular, of his doctrine of the *a priori*. Armed with the right interpretation of the *a priori*, Cohen argues, we can see how Kant’s account of spatial representation overcomes the distinction between “innate” and “acquired”<sup>14</sup>. Likewise, with the right interpretation of the *a priori*, we can see how Kant’s arguments in the *Transcendental Aesthetic* really do exclude the possibility that Trendelenburg thinks Kant ignored.

Given that Cohen’s aims are to develop an interpretation of the *a priori* in order to respond to these objections to Kant, it follows that he does not aim most immediately to defend his anti-subjectivism or idealism. Nevertheless, those commitments come through clearly in his discussion as assumptions that function as starting points for how he responds to the likes of Herbart, Helmholtz, and Trendelenburg. Indeed, as we will see, his account of Kant’s doctrine of the *a priori* is ultimately a clear expression of his idealistic view that experience and its objects are constituted by forms and principles that are latent in knowledge.

In the case of Cohen’s anti-subjectivism, there is one ubiquitous feature of his text that threatens to obscure the commitment. Without ever signposting that he is doing so, Cohen in fact uses two very different distinctions between subjective and objective. The result is that one could miss his anti-subjectivism. His mixing of these two different distinctions also results in claims that, if taken in isolation and read without care, appear possibly incoherent. For example, Cohen writes things like, “[t]he subjective can very well be objective at the same time” (Cohen, 1871b, p. 48) and “[o]nly that which *a priori* subjectivity ‘produces,’ constitutes is objective” (Cohen, 1871b, p. 54).

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<sup>13</sup> See Trendelenburg (1862, p. 1:158ff).

<sup>14</sup> See, for example, Cohen (1871b, p. 3 and ch. 7)

However, we can dispel any confusion and recognize Cohen's anti-subjectivism by carefully distinguishing between the two different senses of the objective-subjective distinction that Cohen appeals to. There is the distinction I have been discussing up to this point, that is, a distinction where 'subjective' connotes some epistemic failure due to the privacy, idiosyncrasy, or relativity of representations and where 'objective' connotes the contrasting epistemic successes. But in *Kant's Theory of Experience*, Cohen also uses the terms 'subjective' and 'objective' with the meanings they have in the Trendelenburg-Fischer controversy, that is, where 'subjective' means 'pertaining to the subject of knowledge' and 'objective' means 'pertaining to the object of knowledge.' Thus when he writes things like "[t]he subjective can very well be objective at the same time," we can unpack that as "representations whose origin is in the subject of knowledge can very well be epistemic successes in the sense that they are not private, idiosyncratic, or relative."

Once we have clarified which sense of 'subjective' we are considering, Cohen's anti-subjectivism is clear throughout *Kant's Theory of Experience*. For example, one of his stalking horses throughout his discussion of Kant's Transcendental Aesthetic and Transcendental Analytic is "sensualism," that is, the kind of empiricism (exemplified by Hume) that locates the origin and justification of all knowledge in sensation. On this kind of empiricism, complex representations are merely associations of "subjective sensations" (Cohen, 1871b, p. 53) and all knowledge is traced back only to the "subjective ground of sensation" (Cohen, 1871b, p. 131). He contrasts the subjective association of judgments of perception with judgments that carry an "objective unity" (Cohen, 1871b, p. 154), and his discussion of the Analogies of Experience is shot through with the contrast between, on one hand, "subjective perception" and "subjective succession" and, on the other hand, objective representations (Cohen, 1871b, pp. 221f; 230).

Kant's *a priori*, on Cohen's interpretation of it, is precisely what makes it possible for us to overcome the subjectivity of sensory representations in order to produce objective experience. Cohen emphasizes that, for Kant, *a priori* forms and principles are universally valid and strictly necessary (Cohen, 1871b, p. 10). In this respect, the *a priori* stands in contrast to experience, which provides merely "comparative" (that is, relative) universality (Cohen, 1871b, p. 11). For Cohen, these *a priori* forms and principles are "formal conditions of experience". That is, they constitute experience and its objects. But then, because Cohen explains experience by appeal to conditions that are strictly



necessary and universally valid, and not by appeal to conditions that are comparative or relative, he thinks his account of knowledge ensures that knowledge is not tainted by any subjectivity.

Of course, Cohen recognizes that this account of the *a priori* raises the further question of how knowledge of such *a priori* forms and principles is possible. Cohen thinks the answer to this question is Kant's claim "that we can cognize of things *a priori* only what we ourselves have put into them" (*KrV*, Bxviii), a claim that Cohen returns to repeatedly throughout *Kant's Theory of Experience*, and that he thinks is the principal insight of what Kant called his Copernican revolution in philosophy (Cohen, 1871b, p. 12)<sup>15</sup>.

It is precisely here that we can see the centrality of Cohen's idealism to his interpretation of Kant's *a priori* and consequently to his whole account of knowledge in *Kant's Theory of Experience*. In order to ensure that experience is not tainted by any subjectivity or relativity, he maintains a view on which experience and its objects are constituted by forms and principles that "we ourselves put into them".

How exactly Cohen articulates this idealism in *Kant's Theory of Experience* is ambiguous in at least one important respect. He often talks about the *a priori* forms and principles that constitute experience as "processes" or activities of "spirit"<sup>16</sup>. This suggests that, at least in the first edition of *Kant's Theory of Experience*, Cohen is committed to a transcendental subject that plays an essential explanatory role in his account of how objective experience is constituted<sup>17</sup>. On the other hand, one might argue that Cohen's appeals to the processes of spirit in his early work are best interpreted in light of his later insistence that Kant's use of faculty-psychological vocabulary is best understood as "abbreviations" for different elements of the theories of mathematical natural science<sup>18</sup>. In this case, when in the first edition of *Kant's Theory of Experience* Cohen refers to *a priori* forms and principles as processes of spirit, we should interpret him to mean they are forms and principles that are simply latent in the theories of mathematical natural science. On this interpretation, then, the activity of a transcendental

<sup>15</sup> See also Cohen (1871b, p. 33, 54, and 112).

<sup>16</sup> See for example Cohen (1871b, p. 12).

<sup>17</sup> Cf. de Schmidt (1976, p. 35ff), Edel (2010, p. 116ff), and Beiser (2018, p. 66ff) for discussion.

<sup>18</sup> For example, in the *Principle of the Infinitesimal Method*, Cohen says that "[i]ntuition and thinking are *abbreviations* for scientific methods" (Cohen, 1883, §3).

subject does no essential explanatory work in Cohen's account of how objective experience is constituted.

Fortunately, we need not settle this interpretive disagreement here. For my present purposes, all we need to note is that on either of these two interpretations of Cohen's views in *Kant's Theory of Experience*, his account is staunchly idealist. That is, on his account, experience and its objects are constituted by forms and principles of knowledge. For, as we have seen, Cohen thinks that idealism is required to explain the *a priori* of those forms and principles, which is in turn required to ensure that experience is not tainted by any subjectivity or relativity.

Indeed, the clarity of Cohen's expression of this idealism would only increase over the course of the 1870s. He repeatedly emphasizes it in the opening chapter of *Kant's Foundations of Ethics* (1877). If there is a shift in how Cohen expresses his idealism in this book, it consists in the fact that he now foregrounds the concept of law as the central organizing concept of his idealism. Whereas in *Kant's Theory of Experience* Cohen typically refers to the *a priori* structures that constitute experience and its objects as forms (of intuition and thinking) and principles, in *Kant's Foundations of Ethics*, those *a priori* structures are in the first instance *laws*. He thus insists that “[l]aws are the realities that make actuality objective” (Cohen, 1877, p. 20) and, more simply, “[t]he law is reality...” (Cohen, 1877, p. 21). For my purposes, this shift in emphasis is unimportant. What is important is simply Cohen's continued commitment to idealism<sup>19</sup>.

There is one important feature of Cohen's idealism in *Kant's Theory of Experience* that we need to take particular notice of -- namely, the role of space in constituting experience and its objects. As we will see in §6 below, the role that space plays in Cohen's idealistic account of knowledge is essential for understanding why he felt the need to revise his interpretation of Kant's *Anticipations* so radically in the 1880s.

Perhaps it is unsurprising that Cohen foregrounds the role of space in his account of how experience and its objects are constituted. After all, remember, his most immediate

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<sup>19</sup> I will note here in passing that the shift in emphasis from “forms” and “principles” in *Kant's Theory of Experience* to “laws” in *Kant's Foundations of Ethics* is likely important for a different reason: if in the former work Cohen conceives of *a priori* forms and principles as the “processes” of “spirit,” in the latter he seems more clearly to conceive of the *a priori* laws that constitute experience as principles that are simply latent in the theories of mathematical natural science, when those theories are conceived as if laid out in “printed books” (Cohen, 1877, p. 27). That is, in *Kant's Foundations of Ethics*, Cohen seems already to be moving away from substantive appeals to the activity of a transcendental subject.

aim in *Kant's Theory of Experience* is to defend an interpretation of Kant's doctrine of the *a priori* in order to respond to objections to Kant's views of space and spatial representation. Thus following Kant, Cohen conceives of space as an *a priori* form of sensible intuition, and as an *a priori* form it constitutes experience and its objects. Cohen claims, for example, that "[s]pace constitutes the external objects from which the impressions of experience proceed" (Cohen, 1871b, p. 7) and "[s]patial intuition constitutes experience" (Cohen, 1871b, p. 49). Consequently for Cohen, we cannot represent objects of experience without representing them spatially. We cannot represent objects of, say, physical theories without representing them as having geometrical form and standing in geometrical relations to one another.

### 3. The place of the Anticipations in the first edition of *Kant's Theory of Experience*

The centrality of Cohen's anti-subjectivism and idealism to the first edition of *Kant's Theory of Experience* helps explain why, in that book, he thinks the Anticipations is so relatively inessential to the book's larger project. He interprets the Anticipations as thoroughly psychological, but then, that very interpretation means it cannot play a central role in Cohen's anti-subjectivist, idealist account of knowledge.

It is useful to pause over Cohen's reconstruction of Kant's argument in the Anticipations, since that reconstruction strongly suggests the psychological character of Cohen's interpretation. Cohen understands the Anticipations to be about narrowing the gap between Kant's *a priori* forms of sensible intuition and the content of that sensible intuition, that is, sensation. In doing that, Cohen thinks, Kant brings his theory of experience into closer contact with the individual empirical sciences themselves (Cohen, 1871b, p. 214). Cohen introduces the Anticipations with the puzzle about how anything can be known about sensation prior to experience. The solution is, he reports, found in the Anticipations, in particular, in the distinction that Kant draws between the content of sensation itself and a property of sensation that can be anticipated *a priori*. That property is that sensation has intensive magnitude, that is, it has a degree.

In the Anticipations, Kant argues that sensation has intensive magnitude. Cohen quotes Kant's definition of intensive magnitude, namely, as a magnitude "which can only be apprehended as a unity..." (Cohen, 1871b, p. 214). Cohen is underlining one of the ways that Kant draws the contrast between extensive and intensive magnitudes. Recall

that extensive magnitudes are combinations of homogenous parts. In contrast, intensive magnitudes cannot be constituted from homogenous parts. But then, since intensive magnitudes cannot be constituted from parts, they must be apprehended as units in and of themselves. Consequently, as these magnitudes increase or decrease, they do not do so by adding or subtracting homogeneous parts; they do so by increasing or decreasing in degree of intensity<sup>20</sup>.

However, what does Cohen offer to justify Kant's view that sensation has intensive magnitude? He says that the object of sensation has a magnitude

that is not apprehended in successive synthesis. For the apprehension of mere sensation fills only an instant. Sensation does not go from the part to the whole, but starts from the unity: the sensation and its object, the real, has an intensive magnitude, a degree. (Cohen, 1871b, pp. 214-5)

On Cohen's reconstruction of Kant, sensation does not have extensive magnitude, since it cannot be constituted out of homogeneous parts, and thus is not apprehended by a synthesis that unifies those parts successively. But the reason sensation cannot be constituted from parts and synthesized successively is that, as Kant claims, it "fills only an instant." Cohen seems to interpret this as a claim about our awareness of sensation in inner sense. That is, Cohen takes the claim to be based on introspection, which he understands to be psychological. Cohen's interpretation of Kant thus suggests very strongly that the central claim of the Anticipations - that sensation has intensive magnitude - is itself a psychological claim or is justified by psychological means.

In fact, Cohen makes the psychological character of his interpretation explicit when he moves on in the following paragraphs to a discussion of the philosophical significance of the Anticipations. He begins by noting that the fact that sensations have intensive magnitude establishes "the fruitful idea of the *continuity* of magnitude" (Cohen, 1871b, p. 215).

However, he claims the Anticipations have a "higher importance" in another context, namely, sensory physiology, "that discipline on which Kant's influence is least

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<sup>20</sup> Of course, there is a great deal of controversy about how exactly to understand Kant's arguments in the Anticipations, and whether those arguments are successful. I here make no claims about what the correct interpretation of the Anticipations is. I aim only to characterize Cohen's interpretation. See Giovanelli (2011), Jankowiak (2013), Glezer (2018), and Landy (2020) for recent accounts.

disputed” (Cohen, 1871b, p. 215). In fact, Cohen argues that the Anticipations have two significant consequences for sensory physiology and psychophysics. Both consequences are about the continuity of sensation in consciousness. First, he seizes on Kant’s claim that sensory qualities have no smallest degree<sup>21</sup>, and suggests that this claim applies to the sensations investigated by physiology and psychophysics. Second, Cohen argues that there is continuity of psychological states between consciousness and unconsciousness. The Anticipations shows that between, for example, “every degree of light and ‘complete darkness’, ... smaller degrees can always be thought” (Cohen, 1871b, p. 215). But then, by analogy, between any state of consciousness and complete unconsciousness, there must be intermediate degrees of consciousness. In both of these arguments, Cohen suggests that the Anticipations establish *a priori* claims that, despite being *a priori*, nevertheless determine features of sensation that are directly relevant to and investigated by sensory physiology and psychophysics.

Cohen’s section on the Anticipations concludes with his account of what the “real” is. In the second edition of the *Critique of Pure Reason*, Kant’s principle of the Anticipations states that “the real” is “an object of the sensation” (*KrV*, B207). Cohen interprets this statement as an answer to the question of what sensations represent. His interpretation of the answer itself sits comfortably with physiological and psychophysical accounts of sensation. For Cohen, the object of sensation is the “*unit of the stimulus*” that caused the sensations. Thus, Cohen thinks, when Kant says that the real is the object of the sensation, he means that the real is the stimulus that caused the sensation (Cohen, 1871b, p. 216).

Cohen’s account of the Anticipations in the first edition of *Kant’s Theory of Experience* is thus thoroughly and explicitly psychologistic. It is concerned with sensation, and its importance lies in its influence on and consequences for the psychophysical and physiological study of sensation. But then for that very reason, the Anticipations is not central to Kant’s larger project in the first *Critique*, as Cohen interprets that project. For that project is the idealistic one of explaining how *a priori* forms and principles make possible a kind of experience that is not tainted by any kind of subjectivity, including the subjectivity that Cohen thinks characterizes sensation.

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<sup>21</sup> For example, “[e]very color, e.g., red, has a degree, which, however small it may be, is never the smallest, and it is the same with warmth, with the moment of gravity, etc” (*KrV*, A169/B211).

We have now seen Cohen's interpretation of the Anticipations in the first edition of *Kant's Theory of Experience*, and we have seen why, on that interpretation, it is not central to Cohen's larger project in that book. It is time to turn to the series of developments in Cohen's thinking that changed that interpretation radically.

#### 4. The central role of mathematics in Cohen's idealism

The first in that series of developments hardly seems radical. It was a slight but consequential shift in the emphasis of Cohen's historical interests. In fact, it might be more accurate to say that there were two distinct but related shifts in the emphasis of Cohen's historical interests that happened around the same time. First, his investigation of the history of idealism led to an increased focus on the history of mathematics and natural science. Second, that same interest in the history of idealism led to an increased focus on pre-Kantian early modern mathematics, physics, and philosophy.

To be sure, this was a shift only in emphasis, and not some radically new interest on Cohen's part. His historical writing before the late-1870s reveals interest in both the history of science and in the early modern period. But still, starting in the late-1870s and continuing into the 1880s, that interest increases and becomes increasingly central to his writing--to the point where over half of the *Principle of the Infinitesimal Method* (1883) is devoted to a historical survey of the development of mathematics and physics in (mostly) the early modern period and the new introduction that Cohen wrote for the second edition of *Kant's Theory of Experience* (1885) is largely a history of his particular form of idealism.

Cohen's turn to an explicit focus on mathematics and the central role it plays in his idealism comes in his "Plato's Doctrine of Ideas and Mathematics" (1878), which was his inaugural lecture at Marburg<sup>22</sup>. In it, he is concerned to establish the affinity between Plato's philosophy and Kant's idealism as he understands it. In this respect, Cohen maintains that Plato was the original source of "mature idealism" (Cohen, 1878, p. 1). The affinity concerns not just Plato's view of the role that ideas play in constituting the objects of knowledge, but also the specific role that mathematical (including geometrical) ideas play in that process. Cohen thus wants to identify the "epistemic value" of mathematics for Plato (6).

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<sup>22</sup> See Edel (2010, p. 161ff), Poma (1997, p. 33ff), and Beiser (2918, p. 105ff) for more detailed accounts of Cohen's inaugural lecture on Plato.

That epistemic value consists in the fact that, for Plato, mathematical ideas mediate between the other forms and the sensible world (Cohen, 1878, pp. 7, 16-18). On this view, mathematics is a body of knowledge that points us away from sensible subjectivity and relativity and towards “constant being”- that is, knowledge that is necessary, universal, and objective. Thus on Cohen’s interpretation of Plato, whatever objectivity there is in experience is established by mathematical ideas, including geometrical ideas. (Nevertheless, Cohen argues, because for Plato mathematical ideas have the status of hypotheses that always demand further rational grounds, any objectivity established by them in experience must remain partial and incomplete [Cohen, 1878, p. 25ff]).

However, Cohen’s discussion of Plato is not the only part of the lecture that is significant for our purposes. Early on in the lecture, Cohen considers Eleatic atomism as, perhaps surprisingly, an antecedent to Plato’s idealism<sup>23</sup>. Of course, Cohen does not endorse the atomist view that the cosmos is constituted by particles with definite sizes and shapes. But, he thinks, that view does have a consequence that is consistent with his idealism: namely, that the world must be conceived in terms of mathematical ideas, including geometrical ideas. That is, the atomists were right to “let all beings consist of number” (Cohen, 1878, p. 4).

So in Cohen’s Plato lecture, his focus on mathematics as central to his idealism is perfectly explicit. But his discussion of atomism also hints at the other subtle shift in the focus of his thinking during this period, that is, his increased attention to pre-Kantian early modern mathematics, physics, and philosophy. In his discussion of atomism, he notes in particular that the atomists anticipate a doctrine that was central to the mechanical worldview of the seventeenth century, namely, Descartes’ and Lockes’ distinction between primary and secondary qualities (Cohen, 1878, p. 5).

## 5. The “pre-history of criticism” and Natorp’s inaugural lecture on Leibniz

As I will argue in §§6 and 7 below, the time that Cohen spent working on early modern mathematics, physics, and philosophy -- roughly 1880-3 -- was absolutely

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<sup>23</sup> See Beiser (2018, pp. 105-6) for an illuminating discussion of the context of Cohen’s account of pre-Socratic atomism. Beiser points to F.A. Lange’s discussion of the atomists as forerunners of materialism, which helps explain why Cohen, in his inaugural lecture, goes out of his way to reclaim the atomists for the kind of critical idealism he was developing.

decisive for his interpretation of Kant, and especially for his interpretation of the Anticipations of Perception. For that reason, it will be useful to consider that period in some detail, and not just in Cohen's writing, but in the writing of someone he was working with at the time: Paul Natorp.

Cohen's increased interest in early modern mathematics, physics, and philosophy coincided with his beginning to work with Natorp, who came to Marburg in 1880 as Cohen's habilitation student and continued to work on early modern philosophy and physics as a *Privatdozent*<sup>24</sup>. There is good reason to believe that Natorp's interest in early modern science and philosophy was stimulated by his teacher: in the preface to his habilitation thesis on Descartes, which he wrote in 1881 and published in 1882, he explicitly thanks Cohen not just for "continued good advice," but for suggesting that he work on Descartes in the first place (Natorp, 1882a, p. vi).

There can be no doubt that for both Cohen and Natorp, their interest in early modern science and philosophy was motivated by a desire to better understand Kant's account of knowledge. Natorp, in the preface to his thesis on Descartes, calls the work a part of a "pre-history of criticism" (Natorp, 1882a, p. iii). For Cohen's part, in the foreword to the *Principle of the Infinitesimal Method*, he claims that "Kant's genius received its guidance to the transcendental method not from sensualistic Enlightenment figures, but from the founders of modern mathematical natural science," and concludes that "Galileo, Kepler and Newton, Descartes and Leibniz, with their associates and interlocutors, can teach us to understand Kant, and can help us continue the work of philosophy in his spirit" (Cohen, 1883, p. iv).

Natorp's thesis is about Descartes' theory of knowledge. He argues that despite important differences between Descartes' and Kant's views of knowledge, Descartes nevertheless agreed with Kant on a number of significant points, not least of all the need for philosophy to develop a theory of knowledge prior to and independently of metaphysics, in order first to determine if metaphysical knowledge is possible and if so what its limits are<sup>25</sup>. However, Natorp is also at pains in his book to articulate Descartes'

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<sup>24</sup> I rely on Holzhey (1985) and Beiser (2018) for Natorp's biographical details from this period.

<sup>25</sup> Natorp's book opens with an awareness of the difficulty of squaring this Kantian-sounding view with the text of Descartes' *Discourse on Method*, *Meditations*, and *Principles of Philosophy*, since those texts seem to combine epistemological and metaphysical concerns in a way that precludes the possibility that epistemology is prior to and independent of metaphysics. Natorp argues that Descartes' *Regulae* predates



conception of the physical world, and the importance of his philosophy for the emergence of mechanism in the seventeenth century. The last part of the book includes a chapter on the development of the mechanical view of nature in Kepler, Galileo, Descartes, and Hobbes.

Natorp's interest in those figures continued. Also in 1882, he published three essays on early modern physics and philosophy, emphasizing the significance for philosophy of scientific figures such as Copernicus and Galileo. In one essay, he argues that Copernicus' "discovery" of a heliocentric universe was important because it disrupted the Aristotelian view of the physical world and thereby opened up intellectual space for early modern science and philosophy (Natorp, 1882b, p. 372ff). In another essay, Natorp provides a very quick sketch of the ancient origins of the idea of a science of "phenomena," and the influence of that idea on early modern physicists and philosophers (Natorp, 1882d, p. 588ff).

Of Natorp's three essays from 1882, it is the one on Galileo that provides the clearest picture of Natorp's efforts to develop an idealism inspired by Cohen. Natorp argues that Galileo is significant for philosophy, not just as a physicist but as a philosopher in his own right. Indeed, Galileo's significance for philosophy lies primarily in his anticipation of critical idealism. Natorp argues that Galileo locates the source of the necessity of the lawful connection of physical events not in the objects themselves, but in a "form of consciousness," which is itself partly expressed in mathematical law (Natorp, 1882c, p. 206).

However, by far the most consequential work of Natorp's from this period was something that, perhaps oddly, he never published: his inaugural lecture, which he delivered in Marburg in October of 1881. He called the lecture "Leibniz and Materialism," and in it he defends a view of Leibniz on which he has an idealism that is a clear antecedent to Kant's.

It is easy to understand why both Natorp and Cohen would have been interested in Leibniz at this time. Most of Leibniz's works, including almost all of his mathematical writings but also the works that contain his important 1686 metaphysics, had been unpublished until the second half of the nineteenth century, when C.I. Gerhardt began

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those other works, and functions as an epistemological investigation that is independent of Descartes' metaphysics (Natorp, 1882a, pp. 1-3).

publishing his two comprehensive editions, *Leibniz's Mathematical Writings* (1849-63) and *Leibniz's Philosophical Writings* (1875-90). The account that Cohen gives in the *Principle of the Infinitesimal Method* of Leibniz's place in the history of mathematics would have been impossible without Gerhardt's editions of the mathematical writings. But Natorp's inaugural lecture would likewise have been impossible without Gerhardt's editions of Leibniz's philosophical writings. In particular, Natorp's lecture relies on texts of Leibniz's that Gerhardt had only made available in the second and fourth volumes, published in 1879 and 1880 respectively, less than two years before Natorp wrote his lecture. Natorp and Cohen were thus working with texts of Leibniz's that were brand new to them and to other historians of philosophy.

Among the texts that Gerhardt made available for the first time in 1879 and 1880 were Leibniz's correspondence with de Volder, his "New System," and his "Reply to Foucher." All three of these texts contain arguments that are central to Leibniz's criticism of Descartes's conception of matter as extended substance. They thus all contain arguments that are essential for motivating Leibniz's alternative, dynamic conception of nature. The importance of these arguments was not lost on Gerhardt. He draws particular attention to them in his editorial introductions to the de Volder correspondence (Gerhardt, 1879, p. 146) and the "New System" (Gerhardt, 1880, p. 412ff).

In Natorp's inaugural lecture, he also recognizes the importance of Leibniz's arguments against Descartes. He makes them central to the lecture's argument that Leibniz "uproots" materialism by establishing that the "reality of phenomena" or the "whole world of appearance" can be determined only by "the unity in the concept of law" (Natorp, 1985 [1881], p. 13). Thus, in line with his project of discovering the "prehistory of criticism," Natorp sees in Leibniz a view that prefigures Kant's claim that knowledge has its source in both sensibility and a distinct understanding. In fact, Natorp argues, Kant failed to recognize that affinity between his own views and Leibniz's only because the writings of Leibniz that best express the relevant views were not available to Kant, since after all Gerhardt had only just published them in the two years prior to Natorp's own lecture (Natorp, 1985 [1881], p. 14).

Natorp devotes a long and central stretch of his lecture to Leibniz's criticism of the Cartesian view that the essence of matter (and thus the essence of the physical world) is nothing but extension. The objection is that on this conception of matter, matter cannot

be *real*. Natorp starts by connecting this view to Parmenides' and Plato's view that matter lacks the *unity* that the concept of being requires, and that the required unity cannot be supplied by the senses but must have its source in thinking<sup>26</sup>. But in the case of Leibniz, the objection to Descartes is that any unity that is grasped exclusively in terms of space and time -- that is, exclusively in terms of modifications of extension -- "is *valid* only *conditionally* and in an *abstract manner*" (Natorp, 1985 [1881], p. 9; emphasis in original)<sup>27</sup>. That is, it cannot be a genuine unity<sup>28</sup>.

Natorp identifies two different of Leibniz's arguments for this objection, although he does not distinguish them very clearly. First, "[m]ere matter contains no principle of *activity*; likewise, absolutely no *identical subject* of any *motion* is given without a *formal principle of force*" (Natorp, 1985 [1881], p. 9; emphasis in original). That is, for Descartes, space and time are in themselves passive and not sources of any activity. But then, if matter is conceived as essentially extension (and thus essentially spatio-temporal), matter is likewise passive and not a source of any activity. But if a piece of matter lacks any source of activity, Leibniz argues, it lacks any ground for the identity conditions that could genuinely distinguish that piece of matter from any other. Thus matter, conceived as having extension as its essence, cannot constitute any real objects.

The second of Leibniz's arguments that Natorp identifies is this. Space and time, and more generally extension, are infinitely divisible. Thus if a material thing's essence is space, time, or extension, that thing will be infinitely divisible, or as Natorp puts it "dissolvable again without limit..." (Natorp, 1985 [1881], p. 9). Consequently, that thing will be a mere aggregate and not a genuine individual, and thus will not be real in the fullest sense. Natorp concludes

thus [the thing] remains *incomplete* and *dependent on our conception*; consequently *not* matter, *not* body, and in general *no being given in space and time* can present the true objectivity [*Sachlichkeit*] that we seek. (Natorp, 1985 [1881], p. 9; emphasis in original)

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<sup>26</sup> Holzhey (1985, p. 293) also notes Natorp's emphasis on the importance of the connection between reality and unity for Leibniz.

<sup>27</sup> Translations from Natorp are my own.

<sup>28</sup> Natorp says: "space, time, likewise matter, insofar as it is defined by mere extension, are incomplete concepts, *abstractions*, and have no true unity and consequently no true substantiality, *law* and not *physical being*, are not *true things*: for reality cannot be understood without true *unity*; . . ." (Natorp, 1985 [1881], p. 9; emphasis in original).

If matter's essence were extension, it would contain no principle for individuating real bodies, and thus our decision to call a thing a body would depend entirely on our conception of it.

Leibniz's arguments point to what he thought were the limitations of Descartes' mechanical worldview. But Natorp understands perfectly well that the significance of those arguments is not limited to just his criticism of Descartes. They also motivate Leibniz's own introduction of force as an active principle in substance. Natorp names the de Volder correspondence as especially important on this point (Natorp, 1881, p. 9). He thus understands their importance for Leibniz's defense of a dynamic conception of nature.

At the same time, the importance of Leibniz's criticism of Descartes goes well beyond Leibniz's own system. In fact, as I will argue in the next section, the underlying reasoning of Leibniz's criticism of Descartes has decisive consequences for Cohen's idealist account of knowledge.

## **6. An objection to Cohen's idealist account of knowledge**

We can finally see what happened just prior to 1881 to make Cohen decisively abandon his early, psychological interpretation of the Anticipations, and instead to interpret it as a defense of a dynamic conception of nature as against a Cartesian mechanical conception.

As Natorp presents Leibniz's arguments, they contain two ideas that together entail a serious objection to Cohen's own idealist account of knowledge. First, Leibniz's arguments assume a connection between the concept of reality and the concept of a genuine unity or genuine individual. On this assumption, conceiving of the real requires conceiving of unities or individuals. This is just the point Natorp draws attention to when he recalls the Parmenidean and Platonic antecedents to Leibniz's arguments: a thing must have the right kind of unity to be a being properly so called. Second, Leibniz argues that extension on its own is insufficient to let us conceive of genuine unities or individuals, both because extension contains no active principle and because it is infinitely divisible. As Natorp presents him, Leibniz concludes from these two points that extension alone is insufficient to let us conceive of the real.

Consider how Cohen would have received these two Leibnizian ideas, reading Leibniz's correspondence with de Volder, the "New System," and the "Reply to Foucher" for the first time. He would have been forced to realize that the reasoning underlying Leibniz's objections to Descartes also constituted a serious objection to his own account of mathematical natural scientific knowledge, expressed in the first edition of *Kant's Theory of Experience*. In particular, Leibniz's objection to Descartes would have shown Cohen that there was an enormous gap in his account of how mathematical natural science represents individual physical objects, that is, *real* objects.

In the first edition of *Kant's Theory of Experience*, Cohen had emphasized the role of space and time as forms of sensible intuition in constituting objects of experience. Similarly, in his lecture on Plato and mathematics he emphasized the role of geometrical ideas in establishing what knowledge of objects in experience it is possible for us to have. But space and time are extension. That is, they are extensive magnitudes, since they are syntheses of homogeneous parts.

Here is the point where Leibniz's argument against Descartes bites against Cohen too. If real objects must be genuine unities or individuals, then they cannot be constituted by space and time alone. For extension on its own is not enough to allow us to conceive of genuine unities. Extension, and thus space and time, are infinitely divisible. They are, as Natorp puts it, "dissolvable again without limit". Consequently, again as Natorp emphasizes, unities conceived only in terms of extension will be "*valid only conditionally...*" Those unities will be "*dependent on our conception*" (Natorp, 1985 [1881], p. 9).

For Cohen, the consequences of this argument are potentially disastrous. If unities or individuals that are constituted only by space and time are "dependent on our conception," then they are *relative* to our conception, that is, relative to our particular point of view. By Cohen's own lights, that means those unities or individuals are tainted by precisely the kind of subjectivity he thinks our knowledge overcomes. Thus on the assumption that real objects must be conceived as genuine unities or individuals, Cohen's own account of how mathematical natural science represents real objects makes them subjective. Leibniz's arguments would thus have shown Cohen that, by his own lights, his account of knowledge from the first edition of *Kant's Theory of Experience* fails to meet his own anti-subjectivist standards.

What resources does Cohen have at his disposal to address this problem with his earlier views? No appeal to sensibility can help. The consequence for Cohen's views of Leibniz's objection to Descartes is that the *a priori* forms of sensibility, on their own, can constitute only relative unities or individuals, and thus only relative objects. But of course, appeals to the matter of sensibility, that is, sensation, cannot help either. By Cohen's lights, appealing to sensation to explain how unities or individuals, and thus objects, are constituted would make those objects subjective. In either case, appeals to sensibility cannot help Cohen's views meet his own anti-subjectivist standards.

Consequently, if Cohen was to repair his earlier views he would have to appeal to forms or principles of thinking. Which ones? The categories of relation cannot help. Precisely because they are categories of *relation*, they are unsuited to explain mathematical natural science's representation of genuine unities or individuals. Rather, they must presuppose individual objects as the *relata* that relations obtain between. Cohen makes exactly this point in the *Principle of the Infinitesimal Method* when he insists that causal relations require the positing of the individual objects that are related by cause and effect (Cohen, 1883, §31). He makes the same argument about the concept of substance, which to be sure is no less a category of relation for Cohen (following Kant)<sup>29</sup>.

Fortunately, while Leibniz's arguments against Descartes raise this problem for Cohen's account of knowledge, they also hint at the problem's solution. Leibniz argues that if we are to conceive of individual objects in the physical world as real, we must conceive of those objects with resources that go beyond mere extension and its modifications. For Leibniz, those resources are the concepts of force and the substantial unities that give individuals their identity conditions and that ground the reality of things in the physical world conceived as "well-founded phenomena". But force, as Cohen understood perfectly well, is an intensive magnitude. And the substantial unities that Leibniz thinks ground the reality of things in the physical world are infinitesimally-sized. For Cohen, both of these strains in Leibniz's thinking point to the idea that intensive or infinitesimal magnitudes will play an important role in solving his problem accounting for the constitution of real objects.

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<sup>29</sup> Cohen is less clear what exactly the relation is in the case of the category of substance. A plausible hypothesis is that it is the relation of the underlying substratum to its modifications (Cohen, 1883, §31)

Of course, Cohen does not endorse all of Leibniz's views, and in particular thinks Leibniz conflates the concepts of substance and reality, which he thinks Kant was right to distinguish (Cohen, 1883, §§51).

However, for Cohen, Leibniz's invocation of intensive and infinitesimal magnitudes would have pointed to the chapter of the first *Critique* that could provide a Kantian with the resources needed to explain the constitution of real objects in experience: the Anticipations of Perception. After all, that is the chapter where Kant attempts to establish a connection precisely between the real and intensive magnitude, and where he attempts to show that intensive magnitudes are validly applied to objects in experience. So while Leibniz's arguments against Descartes show that real objects must be conceived with resources that go beyond extensive magnitudes, the Anticipations provides a Kantian account of just the non-extensive magnitudes that are needed.

## **7. A sketch of Cohen's argumentative strategy in his mature interpretation of the Anticipations**

If this story about what motivated Cohen's mature interpretation of the Anticipations is right, we would expect to see echoes of Leibniz's arguments in Cohen's discussion of the Anticipations in the second edition of *Kant's Theory of Experience*, as well as in the *Principle of the Infinitesimal Method*. In particular, we would expect to see Cohen affirming the two points from Leibniz's arguments that Natorp emphasizes in his lecture: first, that there is a connection between the concept of reality and the concept of a genuine unity or individual, such that real objects must be genuine unities or individuals; and second, that genuine unities or individuals cannot be conceived in terms of extension alone, but must be conceived in terms of intensive or infinitesimal magnitudes. Further, we would also expect to see the conclusion entailed by the conjunction of these two points: namely, that reality or real objects cannot be conceived in terms of extension alone, and must be conceived by appeal to intensive or infinitesimal magnitudes.

In fact, looking at Cohen's arguments in the *Principle of the Infinitesimal Method* and the chapter on the Anticipations in the second edition of *Kant's Theory of Experience*, we find he repeatedly emphasizes exactly these points.

The most obvious and ubiquitous of these points in Cohen's texts are the twin points that genuine unities cannot be conceived in terms of extension alone and must

instead must be conceived in terms of intensive or infinitesimal magnitudes. These are points Cohen returns to repeatedly in the *Principle of the Infinitesimal Method*. He claims that unities (or units) [*Einheiten*] defined by appeal to extension alone are merely “comparative” (Cohen 1883: §§44, 58, 68), indeed, “floating in a comparison” (Cohen, 1883, §68). They are thus “arbitrary” (Cohen, 1883, §§58, 68, 78, 92), “fictions” or “fictive” (Cohen, 1883, §§62, 68, 77), “relative” (Cohen, 1883, §§58, 92), and ultimately “subjective” (Cohen, 1883, §§77).

Consequently, Cohen insists that genuine unities or individuals must be conceived by appeal to a kind of magnitude that goes beyond extension, namely, intensive or infinitesimal magnitude. He thinks Leibniz got something right when he insisted that genuine substances cannot be mere aggregates (Cohen, 1883, §60). But then they cannot be combinations of homogeneous parts, that is, extensive magnitudes. Cohen claims that unity requires intensive reality (Cohen, 1883, §34). And he claims that the “meaning of unity” is given by the concept of quality, which following Kant he explicitly associates with intensive or infinitesimal magnitudes (Cohen, 1883, §440).

The Leibnizian point that real objects must be conceived as genuine unities or individuals appears less frequently in its most explicit form. But it does appear. For example, when Cohen argues that for the categories of relation to describe reality, they must presuppose the individual objects that are their relata, he argues that “the explicit and independent positing of the A and the B [i.e., individuals] is required...” (Cohen, 1883, §31). Further, Cohen’s concern with sensible *givenness* in the *Principle of the Infinitesimal Method* often seems motivated by a belief both that sensible intuitions are always of particular *individual* things and that, on a naive philosophical view, sensible intuitions are responsible for connecting knowledge to *reality*. Cohen thus argues that the differential concept, in its “realizing meaning,” “*uproots naive realism*” by providing a different connection between reality and mathematical natural science’s representation of genuine individuals (Cohen, 1883, §§88-9)<sup>30</sup>.

More often, Cohen’s point that real objects must be genuine unities appears as an unstated assumption of his repeated complaint that when objects are conceived by appeal

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<sup>30</sup> I can only note here without going into any details that, in the *Principle of the Infinitesimal Method*, Cohen attempts to reinterpret the concept of sensible givenness to make it consistent with his idealism. See Baumann (2019) for a detailed account of his analogous treatment of *sensation* in the second edition of *Kant's Theory of Experience*.



only to extensive magnitudes, which of course are not genuine unities, then those objects are not real. For example, in the opening paragraph of his chapter on the Anticipations in the second edition of *Kant's Theory of Experience*, he says that an object constituted by extensive magnitudes “is thus also only a comparative object” (Cohen, 1885, p. 422). The object fails to be real because it is not conceived as a genuine unity.

Thus Cohen affirms both the claims that real objects must be genuine unities and that genuine unities must be conceived by appeal to intensive or infinitesimal magnitudes. Throughout the *Principle of the Infinitesimal Method*, he also affirms the conclusion that follows from the conjunction of these two claims: real objects must be conceived by appeal to intensive or infinitesimal magnitudes. Indeed, that claim is arguably the one Cohen repeats, in various different guises, more than any other in the book<sup>31</sup>. He claims, for example, that a “*lack of a knowledge-critical foundation for the differential concept... explains at the same time the gap in the series of categories: the foundational concept of reality*” (Cohen, 1883, §31). Further, his interpretation of Leibniz highlights the ways in which Leibniz draws this connection between reality and the intensive or infinitesimal. He finds in Leibniz the view that “this realization, which is effected by the differential, is brought about *through the mediation of the intensive*” (Cohen, 1883, §58). As a final example, the fact that intensive or infinitesimal magnitudes play an essential role in mathematical natural science’s representation of reality is what Cohen means when he talks about the “realizing meaning” of the intensive, infinitesimal, or related mathematical concepts. He thus claims that “the realizing meaning of the infinitesimal is at work in the fact that the *foundation* of the real that is missing from the *analogy of substance* is located in the infinitesimal” (Cohen, 1883, §93)<sup>32</sup>.

However, nowhere in Cohen’s writing is this Leibnizian pattern of argument more clear than in the opening paragraphs of his chapter on the Anticipations in the second edition of *Kant's Theory of Experience*. He begins the chapter by observing that the principle of the Axioms of Intuition is the principle of extensive magnitude, and thus the principle of “comparative” magnitude. The object that the principle of the Axioms “constitutes is thus also only a comparative object.” Because that object is merely

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<sup>31</sup> In fact, it is plausible to think that establishing this claim -- that reality must be conceived by appeal to intensive or infinitesimal magnitudes -- in Cohen’s principal aim in the *Principle of the Infinitesimal Method*. However, I do not here have the space to defend that claim.

<sup>32</sup> For similar appeals to the idea of the “realizing meaning” of the intensive, infinitesimal, or related mathematical concept, see Cohen (1883, §§49, 54, 56, 61, 65, 77, 89, 94).

comparative, it cannot be a real object: “how is the object supposed to consist merely in such a comparative relation? Rather, the relation itself seems to presuppose a something which exists in and for itself, independently of the fact that it has to serve for a comparison” (Cohen, 1885, p. 422). Thus Cohen needs a kind of magnitude that will supplement comparative extensive magnitudes, “so that the concept of a unity becomes something other than the concept of a comparative unity” (Cohen, 1885, p. 423). That additional kind of magnitude is intensive or infinitesimal magnitude, and Cohen now asserts that “the infinitely small not only originates in consciousness, but makes consciousness something objective as such” (Cohen, 1885, p. 424). The principle of intensive magnitude is thus necessary for mathematical natural science’s representation of real objects.

We thus find echoes of Leibniz’s arguments against Descartes’s concept of matter in Cohen’s mature interpretation of the Anticipations. To the extent that these echoes are representative of Cohen’s arguments in the *Principle of the Infinitesimal Method* and his chapter on the Anticipations in the second edition of *Kant’s Theory of Experience*, they confirm the story I have told about what prompted him to revise his interpretation of the Anticipations, and about what motivates his concern with the Anticipations in his writings from the 1880s.

## **8. Why Cohen revised his interpretation of the Anticipations**

The story I have told is this. Cohen’s and Natorp’s interest in early modern mathematics, physics, and philosophy led them to Gerhardt’s then-recently published editions of Leibniz’s philosophical writings, including key texts containing Leibniz’s criticism of Descartes’ account of matter. Natorp emphasized precisely those arguments in his 1881 inaugural lecture. But for Cohen, those arguments revealed that his previous account of knowledge failed to meet his own anti-subjectivist standards. Extensive magnitude had been the only kind of magnitude he appealed to in his account mathematical natural science’s constitution of objects. But extensive magnitudes are comparative and thus (by his lights) relative and subjective. Consequently, the objects they constitute are likewise relative and subjective.

At the same time, Leibniz’s arguments also hinted that the way to repair this problem in Cohen’s view would involve intensive or infinitesimal magnitudes, and thus

that Kant's Anticipations contained the required resources. Consequently, Cohen's mature interpretation of the Anticipations is ultimately motivated by his desire to explain mathematical natural science's constitution of real objects in a way that meets his anti-subjectivist standards.

This story answers the three questions about Cohen's interpretation of the Anticipations that we started with: why did he revise his interpretation when he did?; why did he adopt an interpretation of the Anticipations on which it is concerned primarily with defending a dynamic conception of nature against a mechanical conception?; and why did he come to regard the Anticipations as so central to a Kantian account of knowledge?

Consider the timing of Cohen's revised interpretation. Remember that he seems to have abandoned his earlier, psychological interpretation of the Anticipations in favour of his mature interpretation in a relatively short period of time, roughly in 1881. But that is precisely the period in which we can surmise that Cohen was reading key texts of Leibniz's that contain his criticisms of Descartes' account of matter, namely, Leibniz's correspondence with de Volder, his "New System," and his "Reply to Foucher." Gerhardt only made those texts available in 1879 and 1880, and 1880-1 was when Cohen started to work with Natorp on early modern mathematics, physics, and philosophy. By February of 1881, Cohen was starting to work on a new interpretation of the Anticipations, and later that year Natorp, in his inaugural lecture, emphasized the same arguments of Leibniz's that explain Cohen's revised interpretation of the Anticipations. Thus Gerhardt's publication of key texts of Leibniz just when Cohen was focusing on early modern mathematics, physics, and philosophy seems to have been a decisive turn of events for Cohen's interpretation of the Anticipations.

Further, the story I have told about what motivates Cohen's mature interpretation of the Anticipations explains why it differs so radically from the one in the first edition of *Kant's Theory of Experience*.

First, the story explains why Cohen would have abandoned his previous psychological interpretation of the Anticipations specifically in favour of an interpretation on which the chapter is about the superiority of a dynamic conception of nature over a mechanical conception. Descartes' view that extension is the essence of matter is the foundation of his defense of a mechanical view of nature. But for Cohen, Leibniz's arguments would have shown that such a mechanical conception cannot account for

mathematical natural science's representation of real objects. On the contrary, an account of how mathematical natural science represents reality must appeal to extensive magnitudes, but must also appeal to a kind of magnitude that is non-extensive, that is, intensive or infinitesimal magnitudes. Thus on Cohen's mature interpretation of the Anticipations, it defends a dynamic conception of nature in the tradition of Leibniz (or for that matter Newton), where there are features of nature such as forces that can only be measured by intensive magnitudes.

However, just as importantly, the story I have just told about what motivates Cohen's mature interpretation of the Anticipations also explains another way that it differs from his earlier interpretation. In the first edition of *Kant's Theory of Experience*, as I observed in §3, Cohen does not interpret the Anticipations as in any way central to Kant's critical account of knowledge. On the contrary, he thinks the Anticipations is important mostly for the influence it had on, and its continuing significance for, physiological psychology and psychophysics.

However, the story I have told above makes plain why Cohen came to view the Anticipations as central to his critical idealism. Without the account that Cohen finds in the Anticipations of the role of non-extensive magnitudes in mathematical natural science's constitution of real objects, his own idealist account of knowledge would explain the constitution of objects only by appeal to extensive magnitudes. But objects constituted only by appeal to extensive magnitudes would be relative unities. As we saw in §6, appeals to, for example, the categories of relation cannot help here. Consequently, without the Anticipations, Cohen's idealism leaves knowledge tainted with exactly the kind of subjectivity he thinks natural scientific knowledge overcomes. Cohen's commitment to anti-subjectivism - a commitment that goes back to his writings in the 1870s (and likely even earlier) - can be satisfied only by the connection Kant sought to establish in the Anticipations between reality and intensive magnitude. Without the Anticipations, Cohen's idealism cannot explain how mathematical natural science constitutes experience and its objects in a way that is free from any subjectivity or relativity. That is, without the Anticipations, Cohen's idealism would fail to satisfy his own commitment to anti-subjectivism. The Anticipations thus "contains and encapsulates the *problem of the critique of knowledge*" (Cohen, 1883, §32).

I conclude with an important qualification about the account I have given here. In §7, I provided a sketch of an argument pattern that recurs throughout the *Principle of the Infinitesimal Method* and Cohen's chapter on the Anticipations in the second edition of *Kant's Theory of Experience*. In those works, Cohen repeatedly makes two points that echo Leibniz's criticism of Descartes: first, that real objects must be genuine unities or individuals; and second, that genuine unities or individuals cannot be conceived in terms of extension alone, but must be conceived in terms of intensive or infinitesimal magnitudes. Cohen likewise repeatedly emphasizes the conclusion that follows from these two points: real objects cannot be conceived in terms of extension alone, and must be conceived by appeal to intensive or infinitesimal magnitudes.

However, this sketch of an argument pattern does not on its own constitute a sufficiently detailed interpretation of Cohen's mature view of the Anticipations. At best, this sketch suggests a strategy for interpreting that view as it appears in the *Principle of the Infinitesimal Method* and the second edition of *Kant's Theory of Experience*. The strategy points to where in those works Cohen's most important arguments might be, but leaves the hard work of reconstructing the details of those arguments largely unbegun. That larger and more difficult task will have to wait.

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