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## FRENCH CONVENTIONALISM AND THE VIENNA CIRCLE

Anastasios Brenner<sup>1</sup>

### Introduction

Conventionalism is a source of influence explicitly mentioned in the *Vienna Circle Manifesto*. Yet its meaning is often misunderstood or its scope misconstrued. One may distinguish two lines of interpretation: an analytic and a historical. The first line more or less ignores the historical development and tends to focus on late forms of conventionalism: a Wittgensteinian “iconoclastic conventionalism” or a Quinian “global conventionalism” (Ben-Menahem 2006; Horwich 1998). Such categories leave us with several perplexing questions. Whence comes conventionalism? Although Poincaré is generally mentioned, little attention is given to the origins of this doctrine. How did it evolve during a period marked by profound scientific revolutions, from the crisis of classical physics to the general theory of relativity? Or again, what should be made of the developments in philosophy after Wittgenstein and Quine? What is at stake in the doctrine we are examining is a whole array of problems — the given and the constructed, the artificial and the natural, the contingent and the necessary — and numerous debates touching on one or another of these dichotomies have arisen in the meantime. It is not without reason that Poincaré and other conventionalist thinkers have been subject to greater scrutiny during the past twenty years.

The historical line of interpretation takes us back to the discussions of the turn of the twentieth century between Poincaré, Duhem, Le Roy and others (Frey 1976; Brenner 2015). It scrutinizes the various channels of transmission of these discussions to the Vienna Circle. The two lines of interpretation mentioned are perhaps symptomatic of a difference of sensitivity between Anglo-American and Continental scholarship. However that may be, recourse to history reveals implausible or gratuitous claims in an approach strictly based on rational reconstruction. I shall aim to complete the picture as regards the emergence of conventionalism, its development and its significance for us.

## 1. The Context of Emergence

It was Poincaré who initiated the debate on conventions. As early as 1891 in an article on “Les geometries non euclidiennes”, he writes: “*The axioms of geometry are not synthetic a priori judgments nor experimental facts. They are conventions; our choice, among all possible conventions, is guided by experimental facts; but remains free.*”<sup>2</sup> (Poincaré 1891: 773) Poincaré is dismissing the conceptions of geometry formulated by Kant and Mill. The former held that the propositions of geometry — as opposed to those of logic — were synthetic a priori; in other words, they extend our knowledge while being valid independently of experience. Mill, in contrast, claimed that geometry is founded on facts, albeit of an abstract nature. Poincaré rejected these two traditional conceptions, by calling on the discovery of non-Euclidean geometries and the numerous consequences mathematicians had drawn from these since the 1830s.

One can indeed construct different geometrical systems. Being free from contradiction, all these systems are equally legitimate; they are also fruitful from a mathematical point of view. To resort to Euclidean geometry to describe the physical world, as was the rule at the time, was to endorse unconsciously a series of assumptions, which rested not on facts but reasons of convenience. Poincaré would later extend and complement this thesis on the hypotheses of geometry to provide a broad philosophical conception in his noteworthy *Science and Hypothesis* (Poincaré 1902).

Eugène Dupréel, who embraced conventionalism in the 1920s, highlights the novelty of Poincaré’s proposal, by pointing to the fact that no philosophical dictionary in use in the major European languages around the turn of the century even registers the term convention — with the sole exception of a brief reference to Hume in Baldwin’s *Dictionary of Philosophy and Psychology* (Dupréel 1925: 283). Following the reception of Poincaré’s ideas, lexicographers would not only be forced to take into account the recent debates on science, but also to recall what is an important philosophical concept in its own right. Hume was referring to an argument that went back to Antiquity. The conventional nature of language and law had often been defended. On the basis of this thesis, the skeptic, Sextus Empiricus, went so far as to question dogmatic philosophy as well as science in favor of a general suspension of judgment. His views became popular again during the sixteenth century, and the founders of modern science sought to meet the challenge by conceiving various metaphysical foundations for scientific knowledge. Such foundations came once again into

question at the turn of the twentieth century. One can gather from the preceding remarks that the context in which Poincaré first put forth his ideas was one of a pervasive and unquestioned naturalism.

But Poincaré was not alone. Duhem reached independently an analogous conclusion with regard to physics in an article “Quelques réflexions au sujet des theories physiques”, published in 1892 — in fact just a few weeks after that of Poincaré. He states: “Physical definitions make up a genuine vocabulary; just like a French dictionary is a set of *conventions* making a name correspond to each object, so in physical theory the definitions are a set of *conventions* making a magnitude correspond to each physical notion.” (Duhem 1892: 143-4, emphasis mine) Duhem gives the example of the notion of temperature. This notion is conceived so as to represent heat, but one should understand that between the two there is no natural relation. And Duhem proceeds to draw the implications: there are an infinite number of possible definitions. The physicist thus has freedom of choice.

But what is more significant is that two years later in a companion article, “Quelques réflexions au sujet de la physique expérimentale”, Duhem went on to apply the same critical analysis to experimental physics. Here one finds the first formulation of the claim according to which one can never condemn an isolated hypothesis but only a whole body of theory — known today as the Duhem-Quine thesis (Duhem 1894: 187). The article explores the numerous consequences of this thesis, offering a novel analysis of experiment. On this basis Duhem claims that observation implies recourse to interpretation; it is accomplished in the light of theories. Some twelve years later he would take up this analysis of experiment in conjunction with the ideas put forth in his earlier article on physical theory, in order to reach the broad conception given in *The Aim and Structure of Physical Theory* (Duhem 1906).

Let us dwell on the reasons underlying Poincaré and Duhem’s foray into philosophy. Although the former made every effort to bring his study to a general readership and to introduce the necessary philosophical references, the connection with his own scientific work is conspicuous. Indeed, one of Poincaré’s major scientific discoveries concerns automorphic functions and exploits the analogy with Lobatchevski’s geometry. Such applications go to prove that Non-Euclidean geometries are in no way a vain exercise, as some had contended.

As for Duhem, he was involved in formulating a general thermodynamics. He was thereby led to reflect on the concepts and hypotheses of this branch of physics and how they could contribute to the task of unifying physics. The reflections of Poincaré and Duhem derive from their practice as scientists. This gives substance to their views. It is perhaps the consequence of an exceptional situation: a crisis leading up to a revolution, a period of extraordinary science, to employ Thomas Kuhn’s vocabulary. What had occurred was a

breakdown of the rules and values, giving rise to discussions of a philosophical nature. At the same time the link with the scientific knowledge of the time may explain some of the difficulties of their specific views. Poincaré would uphold Euclidean geometry as the language of physics; Duhem would remain satisfied with macroscopic thermodynamics.

## 2. The Advent of a Movement of Thought

The simultaneous emphasis on conventions by an eminent mathematician and a distinguished physicist was to impress their contemporaries. Gaston Milhaud was one of the first to bring together Poincaré and Duhem's views. In "La science rationnelle" in 1896 he argues that all mathematical systems of hypotheses involve conventions, and therefore Poincaré's thesis applies as much to geometry as to physics. Duhem's analysis of experimental testing reveals the role of hypothetical reasoning. Milhaud emphasizes the theoretical intermediaries that intervene between the fact and the law. In speaking of Kepler's third law, he writes: "It is not just the theories confessed as it were, the hypotheses clearly stated, the elaborate constructions which separate the observer from the thing observed, it is also sometimes the *conventions* or almost *unconscious definitions*, of which one would not stop to think." (Milhaud 1896: 287, emphasis mine) Milhaud was intent on deploying fully these ideas.

What Milhaud saw in the early articles of Poincaré and Duhem was material suitable for establishing a general course of study in the philosophy of science. He went on to introduce expressions that do not occur in Poincaré or Duhem, speaking of the contingency, the creative power and the intellectual activity inherent in scientific practice. Milhaud was thereby signaling a connection with the philosophy of Boutroux, who had drawn attention to such factors, in questioning various forms of determinism (Boutroux 1874). Now, this connection is all the more interesting as Poincaré was always reserved in expressing his general philosophical views. But Boutroux was his brother-in-law, and their writings reveal a mutual influence.

Milhaud was soon joined by Édouard Le Roy. In "La science positive et les philosophies de la liberté", he likewise emphasized the relation between the assertion of the conventional nature of scientific hypotheses and the claim of the global character of testing. Le Roy did not hesitate to generalize the considerations of his predecessors. In speaking of the principle of the conservation of energy, he writes:

“Our principle presents itself [...] as the very definition of a closed system. Wherever it is found to fail, we shall say that there was an exchange between the system considered and the outside. Here again the law seems so well established only because it has become a *conventional decree* helping to fix our language.” (Le Roy 1900: 318, emphasis mine)

Le Roy had endorsed a Bergsonian outlook, and he believed that his analyses of science favored a clear break with Kant. He perceived here the signs of a movement of thought, which he called a “new positivism” (Le Roy 1901).

In 1907 when Abel Rey published his dissertation *La théorie de la Physique chez les physiciens contemporains*, he could attempt some sort of assessment of the discussions initiated by Poincaré, which had been pursued for well over a decade. According to Rey, these discussions renewed our understanding of scientific objectivity, and could be seen as a response to the far-reaching achievements of science over the past half a century, including the advent of the social sciences. But Rey adopted, more wholeheartedly than his predecessors, the atomic theory of matter as championed by Jean Perrin. He was careful to point out that this did not mean a return to classical mechanicism. A considerable amount of material on the conventional aspects of science had been accumulated by then, and the term of conventionalism was soon to gain currency.

The difficulty is that one is confronted with numerous and divergent forms of this doctrine. Its exact meaning has given rise to much disagreement among commentators. Some have gone so far as to discount Poincaré or Duhem as genuine or wholehearted conventionalists, in a conspicuous move to claim them in favor of present-day realism, while guarding against Le Roy’s so-called radical conventionalism. Such a construal is deeply misleading. The situation of the turn of the twentieth century is in a sense diametrically opposed to that of today: the French thinkers under consideration were fighting the traditional view of science, imbued by naturalism, mechanicism, causalism, etc. We are now confronted rather with the dangers of relativism, incommensurability and social construction. Moreover, there is no evidence that Poincaré and Duhem ever abandoned in the heat of the debate the basic tenets set forth in their early writings; they continued to point out the conventions involved in science, or better the claims implied thereby: the free choice of axioms, the multiplicity of logically possible systems of hypotheses, the decisions inherent in experimental testing, etc. Poincaré, extending the claim he had made with regard to geometry, asserted that some of the fundamental principles of physics are likewise conventions. Duhem generalized his early remarks with regard to physical magnitudes: the physicist is free to choose his definitions; several such definitions are possible, and the mathematical symbols

have no natural relation to the properties signified. It appears rather that the discussions prompted the protagonists to clarify their arguments and incited them to seek for viable solutions. To be sure early conventionalism did not give rise to a homogeneous doctrine; it represented a variety of positions, which interacted closely with one another. In fact, all the thinkers mentioned — including the maverick Le Roy — defended in some way or another the value of science. Their views were more opposed to naturalism than to realism, and are perhaps better construed as the conception according to which our knowledge of the external world is an intricate mixture of facts and artifacts.

### 3. The Reception of Conventionalism

The debates we have been studying were quick to have an impact in German-speaking countries. In 1907 Philipp Frank called attention to Poincaré's basic insight in one of his first articles, "Experience and the Law of Causality", claiming that this fundamental law should be considered as a purely conventional definition. Frank's endeavor to apply Poincaré's ideas to the principle of causality elicited a response from Gerhard Hessenberg, a German mathematician based at the time in Bonn and later at the University of Tübingen. In an article under the title "Willkürliche Schöpfungen des Verstandes?" he seized the occasion of an examination of the paradoxes of set theory, including Poincaré's discussion of Richard's paradox, to take issue with Frank. Number being one of several organizing principles of reason, he proceeded to consider space, time and causality. Hessenberg then delivered his claim: "Indeed academics of the rank of Poincaré, Dedekind, Weber have wisely been wary of taking to extremes their 'conventionalism [*Konventionalismus*]'." (Hessenberg 1908: 161) What he objects to is the implicit criticism of Kant's conceptions that he perceived in this recent publication among others. Hessenberg's analysis is neither open-minded nor perceptive, but his article signals the appearance of the expression of conventionalism much earlier than hitherto acknowledged by historians. "Conventionalism" is then a category of the actors, to use an anthropological turn of speech and, in consequence, carries a historical significance.

Far from being shaken by such a label, Frank rose to the challenge of defending it (Frank 1908: 230). A few years later in a review of Poincaré's *Last Thoughts*, he asserts clearly his position:

"Much has been voiced against 'conventionalism' in the past few years. But one needs only to call to mind Poincaré's expression, which is so clear, free from any exaggeration

and ambiguity, or verbosity, to dispel any doubts, and we willingly again acknowledge ‘conventionalism’ as an effort of clarification directed against the pseudo-problems of a merely grammatically oriented pseudo-philosophy.” (Frank 1914: 54)

In a retrospective account Frank would acknowledge that he was involved at the time in an informal discussion group, which included Otto Neurath and Hans Hahn (Frank, 1949: 1). This discussion group has come to be called the first Vienna Circle, and historians have emphasized its importance (Haller 1991; Uebel 1991). It brings to light the slow maturation and multiple influences that contributed to the development of logical empiricism or logical positivism, as it was likewise called by its advocates. According to Frank, Poincaré and Duhem played a decisive role in initiating a new attitude; they marked a clear break with traditional theories of knowledge. But there were difficulties in Poincaré and Duhem: in particular, their ambivalence with regard to atomism, relativity and, ultimately, quantum theory. Rey, who rallied the new atomism from the outset, helped to adapt their philosophical views to the recent discoveries, and conventionalism was to have a new lease of life. Rey provided a synthesis of the aphoristic remarks of Poincaré. He also showed that the Duhem’s account of the structure of physical theories was a step toward an axiomatic point of view. As Frank further adds in his historical introduction: “We agreed with Rey’s characterization of Poincaré’s contribution as a ‘new positivism’” (Frank 1949: 9). In summary, what Frank saw here was a movement of thought that was not unrelated to Mach’s endeavor, and that represented a deeper understanding of scientific activity.

Neurath, while corroborating Frank’s account, began to sketch his own philosophical project, in particular with regard to the holist argument:

“Duhem has shown with special emphasis that every statement about any happening is saturated with hypotheses of all sorts and that these in the end are derived from our whole world-view. We are like sailors who on the open sea must reconstruct their ship but are never able to start afresh from the bottom.” (Neurath 1921: 199).

Neurath gives to Duhem’s thesis, which was based on a careful analysis of experiment in physics, a broad scope and places it within a sociological perspective. Like Frank, he rebuts those who see here merely “a new fashion”, (Neurath 1916: 28); a break with traditional views is necessary. And he concludes, foreshadowing the encyclopedic project he would develop later:



“The theory of systems of hypotheses has been greatly advanced by men like Mach, Duhem, Poincaré. The right moment may now have come to group the systems of hypotheses of all sciences systematically.” (Neurath 1916: 31).

What he is doing here is bringing together several related claims made by these thinkers, and putting them to work in favor of his systematization of knowledge, which involves not only physics, but the whole of science.

One discovers similar interests in Frank and Neurath’s German counterparts. Thus Schlick referred significantly to Poincaré in connection with general relativity (Schlick 1915). At first blush this reference may come as a surprise. For the French mathematician had indeed stated that if several geometries were possible, one would in the final analysis choose Euclidian geometry to describe the world. Schlick nevertheless found in Poincaré a philosophical framework conducive to the interpretation of Einstein’s new theory. What he took up was the claim that Poincaré made in his later writings of the relativity of geometry.

If Schlick does not appear to have professed to be a conventionalist, he voiced his sympathy with the theory of conventions promoted by Poincaré. This would not prevent Reichenbach for reproaching him to incline too much in this direction: “[Schlick’s] conception of the theory of relativity, which is related to Poincaré’s conventionalism, is shared by Einstein” (Reichenbach 1922: 34). The inclusion of Einstein in this category can be explained by a certain ambivalence in his early texts.

Schlick further develops the consequences of this relativity of geometry in his *General Theory of Knowledge* (1918: 351). But more important for him in this setting is Poincaré’s analysis of definition:

“By a suitable choice it is always possible under certain circumstances to obtain an unambiguous designation of the real by means of the concept. Conceptual definitions and coordinations that come into being in this fashion we call *conventions* (using this term in the narrower sense, since in the broad sense, of course, all definitions are agreements). It was Henri Poincaré who introduced the term ‘convention’ in this narrower sense into natural philosophy.” (Schlick 1918: 71).

Likewise on the German philosophical scene Carnap went through a conventionalist period (Carnap 1963: 15). Thus he writes in one of his first articles after his dissertation:

“The main thesis of conventionalism, established by Poincaré and pursued by Dingler, states that in order to build up physics, one must set down conventions [*Festsetzungen*] which belong to our free choice. It follows that the constituent parts of physical propositions that derive from these conventions can neither be confirmed nor refuted by experience. The choice of these conventions should not be made arbitrarily but only in accordance with methodical principles, among which the principle of simplicity, which determines in the final analysis the decision.” (Carnap 1923: 90)

I leave aside here the case of Dingler. Although the latter was a go-between, his own position is both confused and ambiguous, as Gereon Wolters convincingly shows (Wolters 1985). Carnap, in a manner similar to Schlick, is turning around Poincaré’s argument with respect to the criterion of simplicity and considering physics and geometry taken together. He is probably drawing on Duhem’s holism, on which he explicitly calls with regard to the logic of measurement, that is, coordinating definitions (Carnap 1926). Conventionalism thus occupied him in several publications up to the *Logical Construction of the World* (Carnap 1928).

What is striking is that several major figures of the Vienna Circle, both Austrian and German, were so attracted to conventionalism at the beginning of their careers. Conventionalism, as interpreted by the Vienna Circle, provided so to speak a stepping-stone in the elaboration of a common program, along the lines of anti-foundationalism, positivism and the importance of decisions.

Thereafter logical empiricists strictly speaking abandoned conventionalism. Carnap moved toward logical construction and logical syntax. Schlick adopted a Wittgensteinian verificationism. Neurath embarked on his Encyclopedia of Unified Science. These evolutions did not however prevent the debate from springing up again in different forms. Thus Carnap strikingly evokes Poincaré and Duhem in connection with the “liberalization of empiricism” (Carnap 1963:56). And Neurath brings out decisions and holism in his encyclopedic project (Neurath 1936).

#### **4. Conventions and History**

One could say that the debate between Poincaré and Duhem foreshadowed that between Wittgenstein and logical empiricism, or again that between Carnap and Quine. My intention here is not to diminish the originality of these later thinkers, nor to minimize the contribution of logic and philosophical grammar. Indeed, the reformulations of Poincaré and Duhem’s

theses helped to adapt them to the recent developments in science and to sharpen their focus. But these results, which belong to the mid-twentieth century, have been largely integrated into the literature, and it appears timely to raise the question of what has been overlooked in this ongoing inquiry. The lack of attention to history and to practice has been pointed out once and again, on the one hand by Kuhn, and on the other by Michel Foucault.

Poincaré, in response to Le Roy, stressed the pragmatic criteria that allow scientists to reach reliable decisions. He believed that it is possible to distinguish to some extent the artificial from the natural, the theoretical from the empirical. Poincaré went on to suggest that these criteria could be justified in a number of ways. He claimed that science is aimed at structures rather than things. He also referred to the intersubjective agreement of scientists. Duhem, on the other hand, claimed to find a solution to the difficulties brought up by Le Roy in his holist thesis: “Hypotheses which by themselves have no physical meaning undergo experimental testing in exactly the same manner as other hypotheses.” (Duhem 1906: 328, trans. 216)

Both Poincaré and Duhem called attention to the temporal dimension of scientific theories. In rejecting an a priori form of the intuition of space, Poincaré made legitimate the question of its origin. He pursued this issue, by offering a carefully analysis of the genesis of the concept of space. He resorted to mathematical methods as well as the findings of psychology and physiology, thus calling for a rigorous study of the functioning of the mind. In contrast, the founders of mathematical logic were unable to benefit from psychological research out of fear of falling into what they saw as psychologism. The later development of cognitive science and the instruments with which it has provided us has completely changed the situation. This may explain a renewed interest in Poincaré’s work.

Duhem in his late *Traité d’énergétique* offers an example of the numerous conventions involved in a thorough presentation of the principle of the conservation of energy:

“To create a mathematical symbol suitable for representing the value of work [*oeuvre*], we form an expression that satisfies certain conditions that we decide to impose on it. We establish these conventions not at random; we choose them in such a way that they offer the image of the simplest and most prominent traits presented by the notion of work, or at least that they match these traits without difficulty.” (Duhem 1911: I, 82).

Conventions then are those conditions that are required but not unequivocally determined. Duhem brings out no less than ten such conditions, among them the definition of

kinetic energy as a magnitude that is conserved. This fact should put to rest any attempt to minimize the centrality of convention in Duhem.

In order to make himself understood, Duhem does not hesitate to mention a few historical figures: Cardanus, Descartes and Leibniz. They represent three major stages leading to the constitution of the modern concept. Duhem is alluding here to his historical research, in particular his *Études sur Léonard de Vinci*. Cardanus was responsible for spreading Leonardo's ideas, who had taken up and refined the medieval theory of impetus (Duhem 1906-1913: I, 223-8). Benefiting from this legacy, the founders of modern science endeavored to establish an efficacious mathematical theory. What had to be sorted out were the different concepts involved (velocity, quantity of motion, and kinetic energy proper) and to settle on the most appropriate one for establishing the conservation principle. Such a task could be carried out only through a long and complex process. One may raise objections to the details of this historical interpretation, which asserts a continuity between the natural philosophy of the Middle Ages and modern physics. But there is no doubting in Duhem's case the importance of history for philosophy of science (Brenner 2014).

## Conclusion

The significance of conventionalism cannot be reduced to the controversies between Wittgenstein, Carnap and Quine, or one of its offshoots. What I have been suggesting in the preceding pages is that one should be attentive as much to the similarities with regard to our present situation as to the differences. The movement initiated by Poincaré and Duhem arose in a specific context: the breakdown of the Newtonian paradigm and the advent a series of sciences devoted to the human subject and society. The development of science over the past century has given rise to new challenges, those raised for example by cognitive science, nanotechnology, and computer science. Yet one could argue that present-day discourse on simulations prolong in a sense the debates on models and idealizations of the turn of the twentieth century. The concept of virtual reality further exacerbates the issue of the natural-artificial distinction.

The conventionalist line of reasoning surfaces once and again. In endeavoring to moderate the fierce quarrel over social construction, Ian Hacking issues the following warning: "The roots of social construction are in the very logical positivism that so many present-day constructionists prefer to detest." (Hacking 1999: 42-3) Furthermore, as we saw, Carnap among others drew on the work of the French conventionalists. The latter had already given importance to construction. But the logical positivists were intent on constructing

entities, concepts and worlds from the basic empirical elements. They were not inclined to study historical events, psychological genesis or social processes. The “sticking points”, which Hacking brings out in recent discussions — contingency, nominalism and the stability of explanations —, are not new (Hacking 1999: 68-99). It is then not surprising that Hacking draws a parallel between Duhem’s analysis of experiment and that purposed by Andrew Pickering in a constructivist vein.

The present survey leads us to raise some further questions: how do conventions come into being? Why do they slip into oblivion? As we have noted, “convention” is a generic term referring to various elements of scientific activity that go beyond the axiomatic structure: the heuristics, the ontologies, the rational values, etc. We may reformulate our problem: Where do these other elements come from? How do they evolve over the course of history? Promising new paths of research are being directed to exploring such questions. In this sense conventionalism has not disappeared from the philosophical scene.

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### Notes

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<sup>2</sup> Translations of texts unavailable in English are mine, unless otherwise indicated.