Poincaré's reception in Italy

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Abstract In the early years of the twentieth century, Poincaré's epistemological thinking was discussed in the literary-philosophical journal entitled *Leonardo*, in articles and reviews written by Giuseppe Prezzolini and Giovanni Vailati, allowing Poincaré's ideas to spread beyond the circle of scientists. Prezzolini gave a radically conventionalist interpretation of language that was an adaptation of the position of Édouard Le Roy, of whom Poincaré was critical. The two most important epistemologists in Italy at the turn of the century, Federigo Enriques and Vailati, wrote several papers and reviews about Poincaré's philosophical works, expressing significant opposition to them, though in different keys. Enriques rejected the 'nominalism' that Poincaré's conventionalism led to, while Vailati harshly criticised the refusal of mathematical logic and the pride of place given to intuition in the cognitive process, identifying the 'pragmatist characteristics' of mathematical logic.

Keywords Henri Poincaré · Giuseppe Prezzolini · Federico Enriques · Giovanni Vailati · Philosophy · Positivism · Conventionalism · Intuition

1 The presence of Henri Poincaré in *Leonardo*

Curiously, the first appearance of Henri Poincaré's philosophical thought is to be found in the Florentine journal *Leonardo*, founded by its editors Giovanni Papini and Giuseppe Prezzolini and published from 1903 to 1907. In *Leonardo*, Prezzolini published his extensive analyses of

the 'contingentists' in a series of articles: 'La filosofia della contingenza' [9]; 'La mitologia della scienza' [12] and 'Lo spiritualismo scientifico' [13] and, even earlier than those, 'La miseria dei logici' [10]. In 1904 he published his philosophical 'manifesto', in the booklet *Il linguaggio come causa d'errore—H. Bergson* [14]; the following remark appears on the cover: 'some paragraphs from the forthcoming book *Uomini e teorie della contingenza*', a work that was never actually released. Prezzolini introduced to Italy the English pragmatist Ferdinand S. Schiller, having him—the only non-Italian pragmatist—contribute to *Leonardo*. In short, we might say that Prezzolini's variant of pragmatism was characterized by the ideas of the 'contingentists' to the extent that they were compatible with the pragmatist Schiller's position. When I, with my wife and Arnaldo Forni, the publisher from Bologna, went to Lugano to present Prezzolini—he had just turned 100—with the anastatic reprint of *Leonardo* [17] that I had edited, I asked him about the roots of his pragmatism. He answered in the words that later appeared in an interview published in *Quaderni razionalisti* [16]: 'If you reread the article in *Leonardo* on my pragmatism, you will see that I praise individual creative freedom, and one's inner life: all of which are themes suggested by Bergson'.

Prezzolini published a summary of his reading of Poincaré's *La science et l'hypothèse* in the first issue of Benedetto Croce's journal, *La Critica* [11]; there he situated the French thinker among 'the contingentist philosophers who discerned in the sciences a pure instrument of the action of spirit over things; in the laws, economical and easy-to-use symbols (Hertz, Mach); in the theories and hypotheses, ways to represent reality, more or less promising for scientific progress'. He then asserted the originality of conventionalism, according to which geometrical axioms are just 'conventions of the spirit'. As we can see,

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there is an indubitable tendency towards the explicitly spiritualistic positions expressed by the Bergsonian thinker Édouard Le Roy, against which Poincaré would be in open conflict in an essay which later became the third and final part of his *La valeur de la science*.

2 Federigo Enriques: a critical evaluation of Poincaré's thought

The philosophical works by Henri Poincaré, when first read in Italy, were the object of harsh critical analyses by both of the most important Italian epistemologists straddling the nineteenth and twentieth centuries: Federigo Enriques and Giovanni Vailati.

In his main epistemological work, *I problemi della scienza* [3], Enriques engaged in a constant dialogue with Poincaré and placed Poincaré's 1902 book *La science et l'hypothèse* at the centre of his discourse. The two scholars agreed on the importance of some of the subjects to be dealt with, although they sometimes reached quite opposite conclusions. According to Gaspare Polizzi [8], 'The former [Enriques] sets out for an experimental rationalism that maintains a preferential relationship with the physical and psychological reality, while the latter [Poincaré] contributes to the birth of conventionalism, finding in hypotheses the driving force of the scientific progress [8, p. 209]. The focal point for both Poincaré and Enriques lay in a radical critique to positivism; while in France its founder, Auguste Comte, outlined in his *Cours de philosophie positive* [1] an encyclopedia of the six fundamental sciences, after a methodological introduction, in Italy Roberto Ardigò developed his own positivistic doctrine without knowing Comte's thought—as he himself admitted—and which was thus devoid of a systematic knowledge of sciences and their history. So, while in France the critique to positivism was a crucial component, ensuring its continuity and educating a whole generation of scholars (Poincaré, Le Roy, Abel Rey, Pierre Duhem, Pierre Boutroux, Leon Brunschvicg and others), in Italy the critiques from Enriques and Vailati remained isolated and, on the whole, without followers.

There is one peculiar fact: both Poincaré and Enriques reached their respective positions starting from an analysis of geometry. Poincaré first arrived to the notion of convention in his 1891 investigation of non-Euclidean geometries, published as chap. III of *La science et l'hypothèse* [6], while Enriques discussed his geometrical method in his 1901 essay 'Sulla spiegazione psicologica dei postulati della geometria' [2], in which he claimed that geometrical propositions had an ineliminable reference to reality. These are the initial theoretical choices which would be investigated further, corrected, completed by the two scholars, but

never abandoned, thus becoming the immutable bases of two scientific research programmes, and two profoundly different epistemological models.

Enriques had strong ties to French culture; no fewer than fifty-six of his articles were written in French, and several French scientists and philosophers contributed to the journal *Scientia*, which he had founded in 1906. He radically criticized Poincaré, rejecting the fundamental assumption of conventionalism, which he identified with nominalism, that is, with the negation of the objective value of scientific knowledge (he would criticize the pragmatism of William James in an analogous way). Section 5 of his chapter 4 of *I problemi della scienza* is expressly devoted to 'Il nuovo nominalismo di H. Poincaré' (H. Poincaré's new nominalism). Already in Sect. 2 he had defined as follows the difference between the nominalistic view and the physical or realistic one:

Così alla tesi di Kant che nega l'esistenza di un oggetto reale rispondente alla parola 'spazio', si oppone con Herbart il riconoscimento della realtà dei 'rapporti spaziali'; e al nominalismo, recentemente sostenuto da Poincaré, che mette in luce come codesti rapporti non abbiano un significato reale indipendente in modo assoluto dai corpi, si contrappone una più precisa valutazione della Geometria, intesa come parte della Fisica [3].

(Thus Kant's thesis negating the existence of a real object corresponding to the word 'space' is opposed in Herbart by the recognition of the reality of 'spatial relations'; and nominalism, recently advocated by Poincaré, which claims that these relations have no real meaning, no absolute independence from bodies, is contrasted by a more precise evaluation of geometry, considered as a part of physics).

The latter evaluation was of course Enriques's position.

Enriques indicated precisely the point where he broke with the position of Poincaré, who, he remarked, went beyond simply asserting that the elementary geometrical notions were symbols expressing 'certain relations of position with the bodies', described through the propositions of geometry. Enriques strongly concurred with this claim, but Poincaré went further and concluded that 'the geometrical propositions themselves do not refer to any real fact, but must be considered as a pure *system of conventions* used to express physical facts'. 'We do not find this conclusion acceptable', Enriques wrote. In other words, he regarded the transition from considering geometrical propositions as symbols to asserting their conventionality as arbitrary, devoid of a logical justification, wholly extraneous to a verifiable and verified scientific practice, since 'those symbols find an approximate

correspondence in certain objects, which are thus represented by them'. Enriques developed ulterior arguments to refute the 'genial artistic constructions' used by the French epistemologist, on the assumption that conventionalism is embraced on the basis of a 'fundamental delusion', that is, considering 'knowledge as *complete*, in its *present* form, disregarding its genesis', a psychological genesis, as he had claimed since the seminal essay 'Sulla spiegazione psicologica dei postulati della geometria' [2], mentioned earlier. By looking into this development, the relationship between geometry and physics would be shown clearly, that is, the fact that geometrical theorems are 'the symbolic expression of incompletely stated physical relations, determined in concrete applications'.

The difference of opinion between the two epistemologists reappears in their conception of physical principles. While Enriques claims the existence of relations connecting physical principles with experience, Poincaré argues that physics is based 'on principles, interpretative canons of experience, almost pure *conventions*'. For his part, the Italian epistemologist considers the principles to be 'assumptions progressively determined', which always imply 'something that precedes any experience'. We might say that Enriques maintained a position of 'weak' realism or objectivism which, however, was able to stand up against a subjectivistic, conventionalist view of scientific knowledge. This is a conclusion expressed by Lenin too, in his *Materialism and Empirio-criticism* [4], written in 1908 and published the following year, in which space is devoted to examining the French philosopher's proposals:

The three latter physicists [Poincaré, Duhem, Pearson] even know nothing of either of these doctrines. They have 'only' one thing in common—philosophical idealism, towards which they all, without exception, *tend* more or less consciously, more or less decisively.

3 Giovanni Vailati: the reasons for opposition

Giovanni Vailati wrote two reviews of works by Henri Poincaré: the first of his *La valeur de la science* [18]; the second of the essays on 'Les mathématiques et la logique' [7] published in the *Revue de métaphysique et de la morale* [19]. The beginning of the latter review is bizarre: *Dove vai?—Le son cipolle* (literally, 'Where are you going?—They are onions', to indicate a non sequitur). Even if this is not a 'formula in mathematical logic', Vailati wrote, 'it is useful in summarizing the content of these two articles, in which the author gives a critical analysis of the works by Peano and other logicians about the principles of geometry and arithmetic. In fact, the objections Vailati raised to the claims of Poincaré tended to stress the incongruence

between the questions he put forward and the answers he gave. For example, Poincaré, after asserting the fundamental role of intuition in determining mathematical truths, claimed that in the mathematical reasoning 'it is necessary to apply the 'principle of complete induction' and *beaucoup d'autres principes analogues* (many other analogous principles). Vailati recalled that even in the opinion of those who refuse to appeal intuition (as himself) 'it is necessary to start from a number of unproven principles'; the problem, if any, is to determine 'how to use them, and taking precautions against resorting unconsciously or implicitly to unstated principles'. Now, none of this has anything to do—according to Vailati—with the role that the principle of induction plays in mathematical constructions. Indeed: *Dove vai?—Le son cipolle*. This is even more apparent in Poincaré's criticism of the definition of number as given by Peano in his *Arithmetices principia* [5], a criticism performed by means of a feat of 'logical acrobatics' whose source lay, in Vailati's opinion, in an initial error, that is, in having assumed that there is a difference between mathematical proofs and logical arguments. Vailati closed with a claim that calls to mind the introductory remarks he did not use (see below): 'I believe that Poincaré, as a philosopher, takes somewhat undue advantage of the prestige he enjoys as a scientist'.

In a handwritten note that he had intended to use to begin his review to *La valeur de la science* (1905), but which went unused, Vailati expressed his almost prejudicial hostility towards Poincaré, regarding what he later defined as 'the alarming philosophical activity of Poincaré':

Poincaré has hoarded such a large wealth of scientific merits that he can allow himself to squander it in philosophical debauchery, as he is doing in the booklets being published in Gaston Lebon's *Bibliothèque de philosophie scientifique*. Peculiar in the latest, even more so than in the previous one (*Science et hypothèse*), is the contrast between the brilliant and elegant style of exposition and a distinct inconsistency and lack of precision in his views, between the abundance, the vividness, the topicality of the images and the illustrations taken from physical and mathematical sciences and the strange naivety, not to say more, of the conclusions and the philosophical theses they are produced to defend.

We must point out that this first draft was mitigated in a second revision:

It must be said to Poincaré's credit that he submitted to the risk of seeming, and even being, superficial, incoherent, imprecise in order to attain the goal of promoting among the non-specialist audience an interest in and a care for the loftiest and most general

issues in the field of contemporary physical and mathematical sciences.

The basic thesis attacked by Vailati in his review was: *La logique, qui peut seule nous donner la certitude, est l'instrument de la démonstration. L'intuition est l'instrument de l'invention* (Logic, the only one that can give us certainty, is the instrument of proof. Intuition is the instrument of invention). Vailati, for his part, set out to prove the groundlessness of the idea that all or most mathematical discoveries were brought about or at least aided by resorting to intuition and relying on evidence not supported by any argument. To this end, Vailati recalled instances from the history of mathematics when trust in intuition happened to be a stumbling block towards the search and discovery of new truths.

An analogous criticism was expressed against the contrast that, in Poincaré's opinion, exists between intuitive and logical procedures: the former are supposed to have 'the hallmarks of boldness, courage, conquering capacity', while the latter are credited with 'the privilege of leading to more certain, nay *absolutely indisputable* results'. Now, even leaving aside the fact that in some cases 'doubting may require as much boldness and drive as believing', deduction not guided by intuition exposes itself to risks quite similar to those caused by placing a naive trust 'in intuitive evidence'. And then, what is the source of the feeling of evidence that induces us to accept intuitive propositions, that is, to not require a proof? This is a question that Leibniz was among the first to consider, suggesting a clever solution that it would be worthwhile to re-examine.

Finally, in Vailati's opinion it was artificial to distinguish, as Poincaré did, between a proof based on an *intuition sensible* (sense-related intuition) and one based on an intuition of the *nombre pur* (pure number) or of the *formes logiques pures* (pure logical forms), only attributing to the latter the power to lead us to new results. Such a distinction has no correspondence in actual scientific (here, mathematical) practice. Lastly, Vailati dealt with the chapter in which Poincaré criticized Le Roy's thesis summarized in the statements *La science n'est qu'une règle d'action. Le fait scientifique est créé par le savant* (Science is nothing but a rule of action. Scientific facts are created by the scientist). If Vailati found Poincaré's answer to the first motto unsatisfactory, his answer to the second one was reasonable, since it aimed to criticize and delimit the notion that scientists 'create' scientific facts.

4 Two or three concluding remarks

The opinion expressed in particular by Giuseppe Prezzolini about Poincaré's work was a direct consequence of his

radically conventionalistic view of language, as expressed extensively in 1907 *L'arte di persuadere* [15], reviewed by both Vailati and Croce. One of the fundamental views in this book was that there are definite parallels between the construction of lies and that of scientific theories. Prezzolini wrote:

In order to shape a lie so that has the greatest probability of being accepted, one must follow the same rules as the scientist who shapes a scientific theory: lies and scientific theories respond to the same intellectual needs.

He held this view his whole life long. In the interview with Prezzolini mentioned earlier [16], I also asked him: 'And if you were to write again on the same subject you treated in *Il linguaggio come causa d'errore* (Language as a cause of error), how would you title your essay?' He answered immediately: *Il linguaggio come causa di menzogna* (Language as a cause of lies). In any case, the Florentine journal *Leonardo* had the undisputed merit of bringing Italians into contact with the thinking of the French epistemologist and, more in general, French philosophical (and literary as well) culture, with a number of texts illustrating Bergson's thought with a special attention towards the problem of language, a theme that Vailati himself dealt with in the same journal, in some of his most perceptive and original works.

We need a last, crucial remark: nobody carried on the work Federico Enriques and Giovanni Vailati, the two greatest Italian epistemologists of the turn of the century, nor are any signs of appreciable philosophical interests shown by the great logician Giuseppe Peano. Moreover, some of the main philosophical currents of the early twentieth century (such as phenomenism, rationalism, neo-Kantism, spiritualism) never displayed a significant interest in or care for scientific rationality; on the other hand, we may notice that pragmatism showed divergent attitudes on this subject, with the situation worsened by the fact that the prevailing position—Croce's idealism, followed by Gentile's—denied theoretical value to science. In short, during the early twentieth century we had scientists distant from philosophy and philosophers incapable of understanding the revolutionary breakthroughs of science. Then again, Italian positivism and its main exponent, Roberto Ardigò, never failed to stress the cognitive and even civil value of science, but without due knowledge of the achievements of mathematical (Enriques and the Italian School algebraic geometry) and logical (Peano and his School) research in Italy, and hence its difficulties when the so-called 'critics of science', Poincaré among them, showed the crisis of the positivistic approach and proposed a different one.

Some scholars, such as Ludovico Geymonat, saw in the lack of cooperation between the two scientific schools one

of the reasons for the late development of Italian epistemology and of its inadequate receptiveness towards what was happening in other countries. Actually, Enriques and Vailati were among the few who were interested in starting a dialogue with foreign scholars, both through their journals (*Scientia* and *Leonardo*) and via frequent correspondence and participation in the international meetings in science and philosophy that characterized European cultural life in those years.

There is still a difference between Vailati's pragmatism and critical pragmatism. Enriques pinpoints this difference in the fact that Vailati goes so far as to deny that intuition is the basis of scientific judgments, an attitude dating back to Peano and his school. And it was about intuition and its role in constructing a scientific theory that there was, as we have seen, a confrontation with no hope of a compromise between Vailati and Poincaré. Enriques corresponded for a long time with Vailati, on important issues. They were divided by the fact that Enriques took a psychologist approach to epistemology, while Vailati followed the Peanian programme of axiomatizing arithmetic (and scientific theories in general), and by the weight given by Enriques to intuition in acquiring knowledge, with the consequent devaluation of mathematical logic. Vailati, while intending to free epistemology from psychologism, recognized that psychology (and 'human sciences') had an autonomous theoretical status. Finally, while Enriques proposed a revision of the 'classic-Comtian' positivism, Vailati shared some of the beliefs of the so-called 'critics of science' and arrived at a radical critique of positivism, especially its Italian variant, even though he, together with Enriques, defended scientific rationality. He still recognized the importance of the history of science as an integral part of epistemology and conceived scientific knowledge as a progressive approximation to reality.

Thus, the two epistemologists had strong views against Poincaré's brand of epistemology, from very different positions. To conclude, the most fundamental difference between Enriques's and Poincaré's positions lay in the fundamental idea they had of scientific knowledge. Enriques saw it as a progressively more complete approximation to reality, while Poincaré did not attribute an historically determined value to scientific propositions. The position of Vailati was quite different; he was harsh, almost derisive, precisely because of Poincaré's radical refusal of mathematical logic, which Vailati not only considered to be the instrument of choice for scientific knowledge, but also to have a crucial philosophical value, as he made unequivocally clear in a letter to Giovanni Papini written on 14 September 1908. Vailati wrote:

...(it matters whether the current exponents of philosophy in Italy realize it or not) [Peano's logical

research] undoubtedly represents the most important contribution to the theory of knowledge in the last five decades. Please do not think I am exaggerating if I say that this contribution is even greater than that by Peirce, which is itself most distinguished.

Vailati published in *Leonardo* in 1906 what I consider to be his 'variation' on pragmatism with respect to those proposed by Calderoni, Papini, Prezzolini. *Pragmatismo e logica matematica* [20] is one of his clearest and most profound writings, with the goal of determining 'what we could call the "pragmatistic characters" of the new logical theories'.

In other words, between mathematical logic and philosophy there is a close relationship which is frustrated by a conventionalistic view of science. This explains Vailati's panning of Poincaré's work, which he deemed necessary since the French epistemologist was considered to be one of the greatest scientists. It was to be feared, as Vailati wrote in the unpublished text, that the scientific prestige of Poincaré would conceal the limitations of his philosophical and epistemological thoughts.

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