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E.W. Beth and the Logical Empiricists

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Abstract. This paper is concerned with Beth's reactions to logical empiricist doctrines, mainly during the period that logical empiricism did not yet belong to the past, beginning with Beth's first publication, and ending at the time that Beth formulated his own conception of scientific philosophy. In Beth's development, three phases are distinguished; in the first period, which runs from 1933 to 1940, Beth's appeal to "evidences" is seen as a fundamental difference with the views of the logical empiricists, though Beth stood sympathetic toward their rejection of metaphysics. During a short second period, from 1940 to 1942, Beth tried to establish a form of "modern metaphysics", which he believed to account for the logical empiricist objections against traditional metaphysics, but after 1942, in his third period, Beth propagated a "scientific philosophy" in which all results are open to revision. However, he maintained, against the logical empiricists, a principal distinction between the natural sciences and the humanities (*Geisteswissenschaften*), on the basis of a general hypothesis, Beth's "complementarity principle".

Résumé. Cet article prend en considération les réponses de Beth face aux doctrines de l'empirisme logique à partir de sa première publication jusqu'au moment où Beth formule sa propre conception de la « philosophie scientifique ». Nous distinguons trois phases : la première, de 1933 à 1940, celle dans laquelle l'appel aux « évidences » représente une différence fondamentale avec les vues des empiristes logiques, même si Beth partageait, lui aussi, le rejet de la métaphysique. Pendant la deuxième période, de 1940 à 1942, Beth tente d'établir une forme de métaphysique « moderne » qui prendrait en compte, selon lui, les objections des empiristes logiques contre une métaphysique traditionnelle. Dans la troisième période, Beth promouvait une philosophie scientifique dans laquelle les résultats sont sujets à révision. Cependant, Beth maintenait une

distinction entre la science naturelle et les humanités (*Geisteswissenschaften*), sur la base d'une hypothèse générale, le « principe de complémentarité » de Beth.

Introduction

In November 1946 Beth got an invitation to participate in a conference in which representatives of different philosophical and religious schools should answer the question 'how philosophy is possible'. Beth's [1946a] answer was revealing:

I highly appreciate the invitation; the more I'm sorry to inform you, that I cannot accept this invitation. It is addressed to me as a representative of neo-positivism. By accepting it, I would contribute to the continuance of a misunderstanding, which is incomprehensible to me. I am, namely, no representative of neo-positivism, though apparently very many regard me as such.

However when the conference was held, in August 1947, Beth did participate, and he pleaded for logical analysis as the main means in philosophical discussion. He even acknowledged that the logical empiricists were the first to use the apparatus of symbolic logic extensively for logical analysis. But Beth took no sides when he remarked that this apparatus is, in essence, neutral, so that it can equally serve several philosophical schools [Beth 1948, 173-174].

This incident and its end evoke the problem of Beth's true relationship to logical empiricism. In how far did he or did he not agree with views of the logical empiricists? Do we have to distinguish between different views of representatives, such as Carnap, Frank, Neurath and Reichenbach? Did Beth's opinions on «neo-positivism» change in the course of time? In order to elucidate such questions, I have set myself the task of pursuing Beth's reactions to logical empiricist's doctrines mainly during the period that logical empiricism did not yet belong to the past – beginning with Beth's first publication, and ending at the time that Beth formulated his own conception of scientific philosophy.

1. Earlier views

There can be no doubt that Beth's philosophical education at the University of Utrecht was rooted in the ideas of the Marburg school of neo-Kantianism, founded by Hermann Cohen and Paul Natorp. Other Marburgers, such as Brunstäd, Cassirer, Görland, Liebert and Stammer, they were all read by Beth in his youth. The ideas of this school were widely known in The Netherlands at that time through Ovink, professor of philosophy at Utrecht from 1913 to 1932, who had also brought his successor Franken, who taught from 1932 to 1941, to neo-Kantianism. Franken was, as we know, Beth's thesis supervisor.

Because of its (partial) orientation on mathematics and the natural sciences, the Marburg School may have been attractive to philosophy-minded students with training in the exact sciences, such as Beth. But at the end of the twenties the Marburgers got serious competition from the side of the logical empiricists of the Viennese Circle and the Berlin Group. Both neo-Kantians and logical empiricists were anti-metaphysical and anti-psychologistic. The difference as to the foundations of mathematics concerned the character of mathematical «judgments». Notably Cassirer argued in his well-known «Kant und die moderne Mathematik» that the arithmetical theorems, for example in the concept of «sum», contain a synthetical presupposition [Cassirer 1907, 47], whereas Carnap emphasized that arithmetic requires no new fundamental concepts above those of formal logic [Carnap 1928, 107 and Carnap 1929, 2], in other words, the arithmetical theorems are, just as the logical theorems, tautologies; in arithmetic, «summation» is nothing more than an indication of tautological restructurings [Hahn 1933a, 17].

Given that Carnap's *Abriss de Logistik* was eagerly read by the mathematically trained members of the Dutch division of the Marburg School, the Society for Critical Philosophy, it is understandable that they felt forced to occupy themselves with the logico-empirical philosophy of mathematics, that is, the logicist view, in the concise formulation of Carnap [1929, 2]:

Wenn wir eine gewisse Auffassung über die Logik voraussetzen (...), so zeigt sich, dass aus den Grundbegriffen, auf denen sich die Logik aufbaut, auch alle mathematischen Begriffe abgeleitet werden können. Die ganze Mathematik ist dann ein Zweig der Logik.

Needless to say that this view was rejected by the Dutch critics. However their leading spokesman on the philosophy of mathematics, Vredenduin, also rejected Brouwer's [1907, 1] intuitionist view that mathematics is based on «intuitively evident things». This prompted Beth to a reaction on the occasion of Vredenduin's appointment as an external lecturer at the University of Utrecht. The result was Beth's first scientific publication, in which he expressed his respect for Vredenduin's method on the one hand, but demonstrated his appreciation for intuitionism on the other hand [Beth 1933, 218, in Dutch]:

(...) in my opinion, the critical method promises much for the construction of philosophy and for the research in the foundations of the sciences. (...) In the mean time, it soon appears that the author prejudices his decision as to the controversy on method in mathematics, namely as to the point at which he defines mathematics as a «science without facts». One could think that nothing can be brought against this view –

unless one places oneself on the empirical point of view. Yet the author goes highly hurried on that assumption. For precisely intuitionism can be best conceived and appreciated as an attempt to base mathematics exclusively on facts, that is as a positivist conception of mathematics. In this connection it is curious that the strongly positivistic *Wiener Kreis* remains so closely connected with formalism (...) The foundation of mathematics on evidence is, in my opinion, unassailable, as long as evidence is meant as *pure factuality*, and is well distinguished from subjective conviction. In this sense all other sciences rest on evidence, don't they?

Here we have the first known reference to the Vienna Circle by Beth. Interesting is his accusation that logicism would be akin to formalism. It seems that he still saw the controversy about the foundations of mathematics as a battle between the formalists, led by Hilbert, and the intuitionists, led by Weyl, following Brouwer. But conspicuous is Beth's «emphasis on «evidence», a notion that is lacking in Vredenduin's [1933] lecture. It seems that he was influenced on this point by Hermann Weyl, who was so fond of the following formulation, given by him in his lectures *über die neue Grundlagenkrise der Mathematik*, that he repeated them in *Die heutige Erkenntnislage in der Mathematik* [Weyl 1921, 54; Weyl 1926, 19]. It concerns the choice between Brouwer's intuitionism and the «absolutist» view, embodied in the belief in the *tertium non datur* («if I go through the sequence of natural numbers, in order to break off, when I find a number with a previously given property, then this breaking off either occurs once or not; it is so, or it is not so, without a third possibility»):

Man muß solche Dinge nicht von außen erwägen, sondern sich innerlich ganz zusammenraffen und ringen um das «Gesicht», die Evidenz.

How important «evidence» was for Beth's entire philosophy in the thirties will appear in the sequel. Here it suffices to remark that in 1933 Beth's knowledge of the contemporary discussions on the foundations of mathematics was still superficial. But gradually he turned to a closer examination, not only of Brouwer's writings and those of Hilbert and Bernays, but also of publications by the logical empiricists, notably Carnap and Hahn. Though this did not lead to an association with their views, it did give occasion to a more critical view of the possibilities of neo-Kantianism. Beth came to recognize that the newer criticist schools offered few support to the solution of the specific questions that had to be answered before the general problem of the foundations of mathematics could be solved. As for that, the adherents of the Vienna Circle would display a much greater command of the relevant modern logic, a fact

that, according to Beth, was not wholly unconnected with two issues on which they differed from the members of the Marburger Schule: (1) their «physicalism», that is, the view that the method of the natural sciences is the outstanding *scientific* method, and (2) their pursuit of a unified science, that is to say, the abrogation of the separation of «natural» and «spiritual» science (*Geisteswissenschaft*) [Beth 1935b, 4]. But most interesting is that Beth, though sympathetic to the «anti-metaphysical attitude» of the Vienna Circle, still saw a «serious onesidedness» in this attitude with regard to the role of «evidence» [Beth 1935b, 5]:

Thus for example the fundamental problem field inherent to intuition is simply ignored. Its consequence is an unsatisfactory conception of logic and mathematics. The Vienna Circle holds, namely, that these sciences consist of mere tautologies, which owe their validity exclusively to their form, and not to a process of verification. Logic and mathematics would have no independent relation to «reality», they deal with the language of science. This is, in my opinion, an incorrect view of mathematics (...) derived (...) from Wittgenstein's interpretation of *Principia Mathematica*; its philosophical weaknesses are not sufficiently recognized.

It follows that Beth, in his dissertation on «reason and intuition in mathematics» (*Rede en aanschouwing in de wiskunde*), was more interested in «formalism» and «intuitionism», since these views would take into account «the primordial fact of mathematical evidence» indeed, albeit in divergent ways [Beth 1935b, 5]. But Beth found another one-sidedness in the views of the Vienna Circle. This can be seen from the fourth «thesis» accompanying his dissertation:

Despite the propaganda of the *Wiener Kreis*, there is as yet no occasion for scientific philosophy to restrict itself to the study of the *Syntax der Wissenschaftssprache*.

As it appears from annotations in Beth's hand-copy of the thesis, this was a reaction to a formulation by Carnap [1934a] in *Die Aufgabe der Wissenschaftslogik*. Beth wrote down the following quotation:

«Während die Metaphysik von den «Hintergr[un]den» und dem «wahren Wesen» der Dinge zu handeln vorgibt, bezieht sich die Wissenschaftslogik überhaupt nicht auf die Dinge. Denn alles, was über die Dinge und Vorgänge zu sagen ist, sagt die Wissenschaft, nämlich die Fachwissenschaft des betreffenden Dingbereiches ... Das Objekt der Wissenschaftslogik ist vielmehr die Wissenschaft selbst als ein

geordnetes Gefüge von Sätzen Die Sätze der Wissenschaftslogik (sind) Sätze der logischen Syntax der Sprache...Logische Syntax ist nichts Anderes als Mathematik der Sprache.» [R. Carnap, *Die Aufgabe der Wissenschaftslogik*, S.6/7]

Apparently Beth's conception of «scientific philosophy» was different from Carnap's at that time, and the disagreement continued in Beth's [1963] discussion with Carnap in *The philosophy of Rudolf Carnap* in the series of *The Library of Living Philosophers*, [Schilpp (ed.) 1963]. Yet Beth's criticism in the thirties was not restricted to the Vienna Circle, for in his sixth «thesis» he also criticized the neo-Kantian philosopher Brunstäd for not doing justice to formal logic in his *Logik*.

Beth's withdrawal from neo-Kantianism deserves a separate study. Here I confine myself to one detail: the fact that Beth [1935b] restricted the significance of Kant's aprioristic view of space by maintaining it only for «empirical science, in so far as it is not mathematical». This was noticed by the Dutch mathematician Mannoury [1938], who propagated «signific» foundations of mathematics in his well-known publication in *Erkenntnis* [Mannoury 1934]. As a matter of fact, it was Mannoury [1935], who saw the logical empiricist movement as a congenial current in comparison with the Signific Circle in its endeavour to eliminate pseudoproblems and to propagate mutual understanding between scientists of different profession. The relativist Mannoury [1938, 87] regretted that Beth still had «somewhat too much confidence» in the evidence of mathematical truths, but he concluded to his satisfaction that Beth could not be considered an absolutist *pur sang*, since he attributed not only an *approximate* Euclidean metrics to perceptual and physical space, but also to intuitive space. Beth had written that «there are two forms of intuition, time and space» [Beth 1935b, 84]:

Time is the form of self-consciousness and offers the subjective foundation for the construction of mathematics. Time and space are both forms of perceptual consciousness and both offer the subjective foundation for the construction of empirical science. Time is an one-dimensional, space a three-dimensional continuum; both have an approximate Euclidean metrics.

Though this sounds very Kantian, Beth's argument for his claim that the intuitive space (*aanschouwingsruimte*) is approximately Euclidean, was quite different from Kant's, since he gave a «physiological-physical» account, derived from Bain, obviously from *The senses and the intellect* [Bain 1855/1894, 684-691]. Though Mannoury did not comment on this, except for the remark that «Beth's conclusion is quite far removed from Kant's views

about the foundation of mathematical certainties», he eagerly expressed the suspicion that Beth's mathematical «evidences and certainties» might also be meant as «approximations» ... [Mannoury 1938, 87].

Remarkably, Beth developed his views on mathematical certainty in answer of the argument of the deceitfulness of intuitive evidence, given by Hans Hahn [1933b, 56] in «Die Krise der Anschauung» and Menger's [1933, 114-118] criticism of Brouwer's intuitionism. The latter's view was summarized by Beth [1935a, 55] in the words that «the foundation of mathematics on evidence necessarily introduces in this science an element of arbitrariness, of taste, in short of 'subjectivity'». First of all, he pointed, with Brouwer, to the «impossibility of eliminating evidence»:

The investigation of symbolized theories (formal logic and proof theory) is theoretically unthinkable and practically unfeasible (as the formalist school of Hilbert fully acknowledges), and the evidences are, in essence, completely similar to the traditional mathematical evidences.

Secondly, Beth argued that «the fact that evidence may sometimes mislead us, is as less a sufficient motive for banishing evidence from mathematics, as the occurrence of sensory illusions makes perception worthless for natural science». And finally, he accused Menger of a hidden search for absolute certainty:

The demand to avoid every appeal to evidence can only be done, if one requires an absolute certainty of mathematics (curiously a standpoint of which Menger reproaches the intuitionists!), and therefore needs an absolute guarantee against mistakes and errors.

Beth' solution was, then, that mathematics can and should be based on two «foundations», a subjective and an objective, in the sense that «we come acquainted with the construction of the mathematical objects in self-consciousness», whereas the laws of this construction guarantee the objectivity of mathematics. As a result, mathematical judgments are *a priori* and *synthetic*. It is, therefore, not accidental that the title of Beth's dissertation was «Rede en aanschouwing in de wiskunde» (*Reason and intuition in mathematics*). The following summary elucidates it [Beth 1935b, 89]:

Mathematics gets its subjective (intuitive) foundation in the construction of the mathematical objects, its objective (rational) foundation in the laws of this construction. Therefore Intuition and Reason are, in mathematics, not cognitive sources of a different character, cooperating in a mysterious way on its construction; they are concept formations,

which owe their existence to the two different ways, the objective and the subjective, in which mathematics can and should be founded.

With his acceptance of the *synthetic a priori*, the gulf between Beth's early philosophical views and the ideas of the Vienna Circle seems unbridgeable. However, he had less difficulties with the philosophy of the natural sciences of the logical empiricists than with their philosophy of mathematics. Beth [1934] explicitly subscribed to Hahn's [1933a] doctrine of «constitutibility» in the natural sciences, which requires that sentences containing terms that are not linked to immediate perceptions, can be transformed into sentences that can immediately be confirmed or refuted by observation. He saw constitutibility as a form of evidence, in the sense of «the possibility of an objective verification» that forms the base of natural science. However, Beth rejected the thesis of «physicalism», that this form of evidence also governs all other scientific disciplines (with the exception of logic and mathematics, which would only relate to the language of science); he relativized the concept of constitutibility for each branch of science to a corresponding specific form of evidence [Beth 1935a, 144]:

In order to be complete, it should be indicated within which scientific domain a concept, a relation is or is not constitutive.

Moreover, as Beth remarked without further comment, «there is also a certain form of evidence, or possibility of verification which is inherent to mathematics; this is called 'the primordial intuition' (*oerintuïtie*) of mathematics». Apart from the way of speaking in terms of «verifiability», this is wholly in the spirit of Beth's dissertation, and the Brouwerian overtone is conspicuous. However, there is more in Beth's relativization of verifiability, since it paves the way for a criticism of a view of psychology that was also held by some members of the Vienna Circle. This appears from a short reaction to Neurath's [1933] plea for behaviorism in *Einheitswissenschaft und Psychologie*, the first brochure in the series *Einheitswissenschaft*, given by Beth [1935a, 133] in his paper on «Totality, causality and finality as principles of scientific treatment» (in Dutch). Neurath's psychology would be nothing more than a subdivision of biology, but there should be still room for psychology in quite another sense:

The psychology of personality brings up a completely new concept, for which behaviorism has no place: the concept of self-consciousness (...). The person creates his own cosmos, which can be regarded as an expression of his personality.

Neurath, of course, rejected a bipartition of natural sciences and the humanities (*Geisteswissenschaften*), so Beth must have had good grounds for setting apart «personality psychology» and then even on the basis of the concept of «self-consciousness». Relying on his references to the literature, my hypothesis is that Beth thought of William Stern's «personalistic psychology», as exposed by Stern himself in Saupé's [1928] *Einführung in die neuere Psychologie*. Beth's notion of self-consciousness would then coincide with Stern's notion of *Ichbewusstsein*. Whatever this may be, it is clear that at that time Beth was much more acquainted with authors who tried to establish «modern psychology» without an exclusive adoption of methods from physics and biology, than with the logical empiricists.

Beth's [1935a] paper contained the content of a lecture, given on November 24, 1935 at Utrecht, before the Dutch Society for Critical Philosophy. At that time, Neurath, whose views on psychology were considered too narrow for Beth, lived already more than a year in The Hague, and thanks to his contacts with Mannoury, the ideas of the Vienna Circle became better known in The Netherlands. Mannoury [1935] discussed these views in his article on «The Vienna Circle and Signific Concept Analysis» in the leading Dutch philosophical journal. But also the editors of a new periodical, *Synthese*, who had good relations with Mannoury, devoted ample attention to – what they called – «the synthetic movement» abroad. The death of Schlick was extensively memorated.

In the mean time, Beth had become a teacher in mathematics, and *Euclides*, journal for the didactics of the exact sciences, became his favourite paper, so to say. Brouwer, Heyting, and Mannoury contributed to the journal, with papers on intuitionistic and relativistic views on mathematics. Beth himself dealt with both positions in the thirteenth volume, and thereby he seized the opportunity to give a more detailed criticism of Carnap, who dismissed philosophical discussions about the foundations of a scientific language as irrelevant [Carnap 1934, V]:

Eine Frage der «Berechtigung» gibt es da nicht, sondern nur die Frage der syntaktischen Konsequenzen.

Taking into account that for Carnap logic and mathematics would solely depend on the formal properties of a scientific language, it is no surprise that Beth could not accept this position. He considered it too easy to settle all disputes in the philosophy of mathematics by allowing anyone to make the arrangements of the forms of language – methods of expression and of inference – as he wants [Beth 1936, 149]:

From the side of people of different beliefs - I think here both of the schools of Brouwer and Mannoury as well of that of Hilbert - one will not fail to point out against Carnap that both the understanding and application of the syntactic rules, and the application of language to the description of nature, necessarily presuppose a certain degree of intuitive mathematical thought; and as soon as the priority of intuitive mathematical thought above the application of syntactical rules of some or another pasigraphic system has been ascertained, doubt arises about the possibility of a complete arbitrariness in the choice of a symbolic language that should serve as a means to rational communication.

In other words, Carnap's *Principle of tolerance* that would leave open «an ocean of free possibilities», is an illusion. Such syntactical relativism is unable to answer «the vital question of significs»: *In how far is it possible to express mathematical thought processes by means of pasigraphic systems? Upon which does such a symbolization of mathematical thinking rest?* The latter question was answered by Beth with the claim that *the processes of recognition, reproduction and decomposition*, in short, *the acts of recognition* are the only psychical processes which are essential for the possibility of symbolization. But then he did not take sides with one of two possible answers to the former question, to wit *formalism*, which «holds such acts the only ones that are relevant to science», and *intuitionism*, which «holds certain further acts of construction to be essential», as Langford [1937a, 53] summarized the distinction. In this respect, Beth's next prize essay, on «the concept of number and the intuition of time», is much more informative. It shows, moreover, how far away Beth was from logical empiricism, since he explicitly based his preference for intuitionism on the *Kantian* functions of *apprehension, reproduction, and recognition*, confessing that he considered the corresponding sections of the *Kritik der reinen Vernunft* «the most beautiful parts ever written by Kant» [Beth 1938a, 192]. Only he modified Kant's system by a relativization of the so-called «possibility conditions» (*Bedingungen der Möglichkeit*) in the sense that a certain scientific domain can only be called *a priori* with respect to another domain. He admitted that thereby also the subject-object distinction is relativized, and he even remarked that this is «an extremely difficult and dangerous question, which cannot be dealt with in a satisfactory way without taking into account the principles of Hegel's *dialectic*»... [Beth 1938a, 209]. It is clear how different this philosophical attitude is from the iconoclast approach of the logical empiricists. According to Beth, they have not contributed to the solution of philosophical and psychological problems connected with the foundations of mathematics. They are «opportunists» who freely use foundational results without making

themselves fundamental discoveries. More serious is that they declare mathematics «dependent of extra-mathematical factors and thereby rob it from its objectivity, its independent character, and its own truth aspect». This «relativism» that the logical empiricists shared with Mannoury, was definitely rejected by Beth. However, there are also more «technical» objections against Carnap's syntactical approach, as Beth [1937a] argued in his contribution to the Ninth International Congress of Philosophy, held at Paris, from August 1 to 6, 1937.

«*L'évidence intuitive dans les mathématiques modernes*» is, in fact, the first publication by Beth which is directly concerned with ideas of members of the Vienna Circle. It is primarily directed to their attempt to eliminate any appeal to «intuition» in the foundations of mathematics, but at the same time it contains a statement to the effect that the publications of the Vienna Circle do have an original importance, as Beth promises to discuss on another occasion. We shall see that he kept his promise, but for the moment it is most relevant to summarize his arguments against the rejection of intuition, since Beth's Congress paper can be seen as a coping-stone of his philosophical work since he started writing his doctoral dissertation. Beth argues that the appeal to intuition is necessary, on the condition that the use of intuitively given insights is permanently checked in a rational way, and intuition is not confounded with visual perception, but is conceived as an «activity of thought towards the singular and the concrete». Its role is demonstrated with quotations from Hilbert and Bernays [1934] on *finitistic* methods of proof – their thought experiments with intuitively represented objects (*an anschaulich vorgestellten Objekten*) – and from Herbrand, arguing that their conception is completely analogous to Kant's [1781, A 714; 1787, B 762]. An example of a simple axiomatic system with only one axiom, a , and only one proof procedure – deriving $A \diamond a$ from the premise A – is given in order to show that «intuitive reasonings» (*des raisonnemnets intuitifs*) can demonstrate that the system is non-contradictory in the sense that no proposition and its contradictory can be derived. The example would show that «the application of intuitive evidence is effectively possible and that it permits to acquire a degree of certainty which is not surpassed by that which one obtains if one exclusively leans on purely formal procedures» [Beth 1937a, 164]. This leads to the answer of the question whether it is possible to give a foundation of mathematics without any appeal to intuition, as Carnap tried to show in his *Logische Syntax der Sprache*, called by Beth «the crowning of a whole series of less successful or more fragmentary works by other authors». In order to avoid the difficult task of translating Beth's French text into English, I quote the summary given by Everett J. Nelson [1937]:

Dr. Beth then argues that the syntax method of Carnap does not suffice to found mathematics because this method, he says, meets the insuperable difficulties (1) that since «analytic in object language O» cannot be defined in O but only in a syntax language S, there is required an infinite regression of languages O, S, S', ... , which regression can be avoided only by taking as the syntax language either a non-formal system or a contradictory formalism ; and (2) that since the results of the analysis of O are relative to the syntax language S, a proof of the invariance of these results for every syntax language would be necessary, which proof the author doubts the syntax method can supply. He concludes that the only way to found mathematics is to use both the intuitive and the formal methods in such a manner that they mutually control and verify each other.

The Paris congress gave Beth also the opportunity to follow other lectures. First of all, there was Bernays [1937], whose «*Thesen und Bemerkungen zu den philosophischen Fragen und zur Situation der logisch-mathematischen Grundlagenforschung*» became, in due time, so important for Beth's further development as a philosopher of mathematics, though his first reaction was to answer Bernays' objections against the view – in Beth's formulation – «that an investigation into the foundations of mathematical thought must necessarily start from the intuitively justified mathematics» – in Beth's opinion intuitionistic mathematics only [Beth 1938a, 201]. Notably Bernays' criticism that Brouwer's thesis of the untenability of the «*tertium non datur*» can only be made precise as a *syntactical* matter, had to be answered. Beth did this in an Appendix to the printed version of his second prize essay, the one in which the relativization of the *a priori* – *a posteriori* distinction took place. (He maintained the view that intuitionistic mathematics should be regarded as the touching stone of more formalized systems and metamathematical investigations, but he also saw some points of contact with Bernays' [1937] assumption of «materially motivated elements» (*gegenständlich motivierte Elemente*) [Beth 1938a, 211].

Secondly, Beth attended at Paris the lectures of the leading logical empiricists, and this resulted in a closer inspection of their views in his account on «Mathematics, logic and philosophy of nature at the Congress Descartes» in the leading Dutch philosophical journal. Here we find a more balanced opinion on the «philosophy» of the logical empiricists than in any of Beth's earlier writings. Moreover it seems that Beth began to develop a more sympathetic attitude toward the adherents of logical empiricism. For example, Carnap's incorporation of «logistics» into «the empirical system» is said to bear witness of an «insight of genius» (*geniaal inzicht*). Also Beth's discussion of the

Viennese program for a «severely logically construed and severely empirically founded» *Einheitswissenschaft* sounds positive [Beth 1937b, 131-132]:

A consequence of the striving after the construction of a science which satisfies the highest demands, both with regard to the checkability and concerning their logical structure, is the rejection of (what is called by the Viennese) metaphysics, i.e. the system of those statements which withdraw principally from each empirical check, whereas they also do not belong to the logico-mathematical «tautologies», or derive their validity from the structure of the scientific language in another way. In my opinion, it is settled that one has succeeded in showing that a number of problems about which have generations of philosophers have stumbled, are rooted either in a contamination of real and linguistic questions (e.g. the question «are concepts things?») or in certain peculiarities of natural languages, which make these less appropriate for their use as a scientific language («is this the third street to the left?»); the latter, so-called *Pseudoprobleme*, disappear in a purification of language: they cannot be formulated anymore in a purified language; the former problems find mostly a new interpretation and a surprising solution. In this connection I want to point to Tarski's investigations on the «classical» concept of truth (...).

Beth explained the agreement with, or at least the appreciation of the ideas of the Vienna Circle by the fact that the «unity of science» of logical empiricism meets a «still living need of a systematic overview of human thought» to a large extent. The philosophical systems of earlier generations are scientifically not satisfactory, the more since contemporary adherents adopted a negative attitude toward recent scientific developments (non-Euclidean geometry, the theory of relativity, formal logic). But just in this field the logical empiricists did important work, for example as to the clarification of the concept of space (Carnap), and the foundations of the theory of relativity (Schlick, Reichenbach). In this way Beth spoke appreciatingly about «the Viennese thinkers», and he concluded [Beth 1937b, 132]:

On the ground of the positive-scientific results which they achieved by their work, they deserve the attention, also from those, who do not share their basic philosophical convictions.

The basic philosophical convictions of the logical empiricists were, according to Beth, first, the statement that mathematics can be derived from logic, in other words consists of «tautologies», which are «analytical a priori», second, the endorsing of the Principle of Tolerance, with the presupposition that «logic», that is the structure of scientific language, is independent of a priori principles,

and third, the demand of banishing metaphysics from the system of *Einheitswissenschaft*. Apparently, Beth did not share the first and the second conviction, but it seems that he was inclined to sympathize with the third one. We will see that Beth's seemingly changing attitude toward metaphysics presents problems to the historians, but for the time being it suffices to remark that he would have no problems with the rejection of metaphysics *in the above formulated sense*, whereas the question of the relation of «metaphysics» *in another sense* and logic is left open. Beth's account of the various contributions to the Congress gives no definite answer to this question. On the whole, his summaries of the lectures, also of these by Carnap, Neurath, and Reichenbach, are neutral, though perhaps Beth's «correction» of Carnap's statement that a «reduction» of the biological terminology to the physical, the psychological to the biological, and the sociological to the psychological terminology would be «possible» to the statement that this is «thinkable» should be mentioned [Beth 1937b, 133]. Finally, Beth's retrospective of the *Congrès-Descartes* is interesting, if only because of its plea for a better understanding of Brouwer's *neo-intuitionistic* ideas. Beth hoped that the tenth philosophical congress, foreseen for Groningen in 1941, would contribute to it ...

2. «Nietzsche and the neo-positivists»

How it came about is unclear, but it is a fact that the number of studies devoted to the writings of Nietzsche in The Netherlands increased in the thirties. The sociologist Banning [1937] even spoke of «the Nietzsche cultus as a cultural phenomenon». Perhaps this makes it less strange that a thinker who was trained in the exact sciences and whose main philosophical source was Kant, Evert Willem Beth, also devoted such an attention to the study of Nietzsche that the editors of the leading Dutch cultural periodical *De Gids* accepted a contribution about «Nietzsche and the neo-positivists». On the first sight, this seems a remarkable combination: what, if any, are the links between the logical empiricists who were interested in the unity of science, and a nineteenth century classical philologist whose «philosophy of culture» seemed only attractive to a non-scientific public? But a closer look into the writings of some of the logical empiricists, and even of the most «exact» scientists among them, Philipp Frank and Richard von Mises, shows that they too were well acquainted with Nietzsche's writings, witness their relatively many quotations of Nietzschean «statements». So after all it might have been not wholly beside the truth when Beth said to find a «deeper agreement» between Nietzsche and the logical empiricists, also with regard to the «ethical origin» of the pathos which they both displayed [Beth 1938b, 13-14]:

They combat metaphysics for the sake of intellectual veracity. They too will finally try to realize the practical consequences of their views.

The central point of Beth's comparison of Nietzsche and the logical empiricists, as set out in the remarkable essay on «the concept of science in Nietzsche and with the neo-positivists», published shortly after the 1937 congress of philosophy, is indeed the fact that «both Nietzsche and the neo-positivists reject metaphysics». Taken into consideration that analysts of philosophers are often regarded as their adherents, it is plausible that it is this article that may have contributed to the opinion that Beth was an adherent of the Vienna Circle – it appeared, as I already said, in a general cultural periodical, and moreover it contains a surprising closing paragraph which I shall quote presently.

For our purpose it is important that Beth introduced his conclusion on the anti-metaphysical character of the philosophy of both Nietzsche and the logical empiricists after an exposition of the principles of logical empiricism, together with an indication of their «coherence». These principles concern, successively, logic, mathematics, science, and metaphysics, and in each case authors are mentioned who might have contributed to their establishment: Carnap, Frege and Russell – apparently as precursors of Hahn – Reichenbach and Neurath [Beth 1938b, 4-5]:

1. Logic is dependent of the structure of scientific language, which on its turn is determined by considerations of suitability; it is senseless to speak of the correctness or incorrectness of a logical system: scientific philosophy can only investigate the consequences which the choice of a certain scientific means of expression has: Carnap's principle of tolerance (*Toleranzprinzip*).
2. Mathematics is analytical; this is broadly the same as the view that mathematical judgments can be developed purely deductively with appropriately chosen language systems, without an appeal to «experience» or «intuition».
3. Not only mathematics, but the entire science can be build up without the need for an appeal to aprioristic principles, except in so far as these bear a purely analytical character, that is, rest on the formal properties of the scientific language.
4. Metaphysics in the traditional sense lacks every scientific value; its problems are pseudoproblems, suggested by a colloquial language which is less suitable as a scientific means of expression.

It is clear that in this view mathematics and science do not contain any synthetic a priori. The question remains whether logic would provide an access to an «aprioristic, metaphysical choice». The answer is no: the incapability of logic in this respect follows from the conventional character of the logical laws. This position was not yet reached by Nietzsche, whose statement that «rational thought is interpretation according to a scheme, which we cannot throw away» (*Das vernünftige Denken ist ein Interpretieren nach einem Schema, welches wir nicht abwerfen können*) is quoted. However, Beth finds Nietzsche's view of the object of logic in «deep agreement» with the logical empiricists, since Nietzsche too would bring logic in relation to language. A further conspicuous similarity is seen in Nietzsche's formulations about mathematics, notably those in which it is said that mathematics contains (only) descriptions (definitions) and consequences of definitions, with the implication that «its objects do not exist» (*ihre Gegenstände existieren nicht*). «The truth of its consequences depends on the correctness of logical thinking» (*Die Wahrheit ihrer Folgerungen beruht auf der Richtigkeit des logischen Denkens*). But as soon as the alleged synthetic a priori character of mathematics has been rejected, a strong support for the belief in the existence of synthetic a priori judgments in general has fallen away. With quite many quotations from Nietzsche's writings, Beth can conclude that Nietzsche must conclude («with the neo-positivists») to the rejection of metaphysics. He sees even similarities in their account of the origin of metaphysical thoughts: «the unconscious domination of grammatical functions». For the historian of philosophy is Beth's analysis of Nietzsche extra interesting; the quotations and the comments could easily be used for a discussion of «the concept of philosophy in Nietzsche and the later Wittgenstein». I cannot resist the temptation of repeating the following quotation from *Jenseits von Gut und Böse* [Beth 1938b, 10]:

Die wunderliche Familien-Aehnlichkeit alles indischen, griechischen deutschen Philosophierens erklärt sich einfach genug. Gerade, wo Sprach-Verwandtschaft vorliegt, ist es gar nicht zu vermeiden, dass, Dank der gemeinsamen Philosophie der Grammatik – ich meine Dank der unbewussten Herrschaft und Führung durch gleiche grammatische Funktionen – von vornherein alles für eine gleichartige Entwicklung und Reihenfolge der philosophischen Systeme vorbereitet liegt (...).

Nevertheless Nietzsche's doctrine of the «eternal return» (*ewige Wiederkehr*), which would replace, in a sense, metaphysics, is absent in the scientific world view of the logical empiricists. On the other hand, their prognosis of the unity of science, which Beth mentions with sympathy, cannot be found in Nietzsche. However, speaking about Neurath's Encyclopedia project as the preparation for

a new «Enlightenment» (*Aufklärung*), Beth expresses a more personal opinion at the end of his article [Beth 1938b, 14]:

Both Nietzsche's philosophy and neopositivism can, rightly conceived, contribute to the situation that modern scientific man not only becomes aware of his historical responsibility, but as acquires the mental attitude needed for bearing this responsibility. This is, using a current mathematical expression, a necessary and probably also sufficient condition for overcoming the present confused political and social situation.

3. Modern metaphysics?

After he had written about the logical empiricist doctrine in his Nietzsche essay, Beth did not change his characterization: the four points, respectively on logic, mathematics, science, and metaphysics were repeated in his second book, *Introduction to the philosophy of mathematics* (in Dutch), written on invitation for a Belgian-Dutch series. But this time he was more explicit in his criticism. After he summarized the last paragraph of his essay in the statement that the problems of the philosophy of mathematics are not detached from the deepest questions of life, Beth concluded that his own view - that a completely rigid construction of classical logic would only be possible with an appeal to an interpretation of this logic in the sense of a platonizing realism - would be very difficult to make compatible with the principles of the Vienna Circle. For how else could non-constructive means in Proof Theory be justified? Again Beth's supposition was that the logical empiricists would adopt an «opportunistic» view with regard to the rigor of the construction of their system of syntaxis and semantics, an opportunism that he «personally found not very attractive» [Beth 1940, 248]. It is conspicuous that this opinion about the «opportunism» remained the same throughout the years, as we can see from Beth's [1965] (posthumously published) *Mathematical thought*, in which the formulations of 1940 are literally translated. This also holds for Beth final statements about non-constructive theories, in which he says to agree with Brouwer, who called such theories *devoid of sense*, «that is, as not capable of intuitive interpretation», but adds:

One would in my opinion, however, go too far if one were to deny to such theories *every* sense (for the sense does not always have to exist in the possibility of an intuitive interpretation) and to deny *all* scientific value to consideration given to such theories. This would possibly not even be Brouwer's own opinion.

Even the last sentences of the 1940 book, stating that «all activity of the human mind has the tendency to go beyond its natural bounds», but that such «exceedings of boundaries are never completely devoid of sense», reappear at the end of the 1965 book, together with Beth's remarkable conclusion:

To define that sense – again, that is in my opinion a task for philosophy, in our case for the philosophy of mathematics.

However, in the original publication this conclusion implied a program: the task of articulating a «metaphysical» interpretation of classical logic without getting into pseudoproblems. This would be the only way out for rescuing «metaphysical knowledge», unless one would, with the logical empiricists, conclude to «the conventional character of the laws of logic' [Beth 1940, 246; English translation in Beth 1965, 178]. The program was taken up by Beth in a sequel to the Nietzsche article, the manuscript with the title «*Moderne metaphysica*» (*Modern metaphysics*) written in the years 1941-1942 (incorrectly dated in the *Inventory of the papers of Evert Willem Beth*). The first paragraph makes clear that Beth took the criticism of metaphysics by the logical empiricists serious, but also that he wanted to rescue a form of metaphysics which resists their objections [Beth 1942b, 1]:

In an earlier contribution on *the concept of science in Nietzsche and with the neo-positivists*, I explained, among others, that the neo-positivists, and in particular the members of the Vienna Circle, reject metaphysics as a science on the ground of the results of modern logic and methodology. In what follows, I have the intention to show that these results, on the contrary, can and must lead rather to a better understanding of metaphysics – in particular the Aristotelian – and to the construction of a system of metaphysics that can stand the test of the sharpest logical criticism.

At the same time, he dissociated himself from the view of metaphysics which he had expressed in a lecture given in October 1939, printed in 1941, and this could mean that Beth had come closer to the standpoint on metaphysics of the logical empiricists. However, the manuscript of «*Moderne metaphysica*» did never appear in print, and this could mean that Beth again changed his views, possibly even more into the direction of the logical empiricists. But let us first see what «modern metaphysics» in Beth's «new» view meant. It is different from Aristotelian views, because (1) it takes the form of a deductive theory, and (2) their theorems are not based on induction – they are a priori judgments. But what is more important for our purpose, the metaphysical propositions of rational psychology, rational cosmology, and rational theology, in general all those metaphysical propositions «which lead to insoluble questions such as the

problem of universals», have no place in Beth's system of metaphysics. This was explicitly stated by Beth, who added the following conclusion, which shows that he took the criticism of the logical empiricists serious indeed [Beth 1942b, 8]:

Hereby the objections against the traditional metaphysics, adduced by the neo-positivists, are, in my opinion, fully accounted for.

In fact, Beth's conception of metaphysics is comparable with Scholz's metaphysics, as set out in *Metaphysik als strenge Wissenschaft*. For Scholz [1941], metaphysics is the system of statements that are «true in every possible world», but Beth considered it the system of statements that are «unconditionally true for the *real* world». This meant that his metaphysics contains «all important and acceptable metaphysical theses, which are formulated by Aristotle and his predecessors and successors: the principles of Parmenides («being is», «non-being is not»), the identity principle, the principles of contradiction and the excluded third in Aristotle's ontological formulation, and the principle of indiscernibles of Leibniz» [Beth 1942b, 6]. Though this sounds rather old-fashioned, this was not Beth's intention. What he had in mind can be seen from his *Summulae logicales*. All these metaphysical principles can and must be formalized in a second-order language; they are «tautologies» in the sense that each substitution for the occurring variables renders them into a true judgment. They are applicable to each «being», without discrimination, and this explains why they are unconditionally true in the above sense [Beth 1942a, 47]:

The tautologies of formal logic develop (...) those properties of everything what there is, which are enclosed in the presuppositions that make our reasonings possible, notably in the concept of truth.

One wonders whether this would be acceptable for logical empiricists such as Carnap [1939], who do not attribute any «factual content» as such to logically true sentences of a semantical system, and refuse to speak of ontological presuppositions of logical deduction. There are different logical systems, and the only criterion for a choice between them is their usefulness as a basis for the language of science. Beth may, then, have abandoned «traditional» metaphysics, his «modern» metaphysics seems still remote from the views of Carnap. However, the essay on this subject was not printed, for unknown reasons. Instead, *De Gids* published an article on «Past and future of scientific philosophy» [Beth 1943], which marks, in my opinion, a new phase in Beth's philosophical development – perhaps best characterized as «the turn to scientific philosophy».

4. Scientific philosophy!

Beth's reflections about «scientific philosophy» started in 1941, when he finished a manuscript [Beth 194], but his first published paper on this subject dates from two years later. In the time between, Beth had «discovered» that the Aristotelian theory of science recognizes the so-called *evidence postulate*, requiring that a *deductive science* contains *fundamental terms and theorems* which do not require any explanation for the simple reason that their meaning and truth is *evident*. The postulate was already mentioned in the manuscript on «Modern metaphysics», together with the remark that the postulate is rejected in modern science, but then Beth found still room for metaphysics of a kind, and he even tried to show that also the modern theory of science necessarily leads to such a metaphysics. But things are different in the published paper, and one would almost hypothesize that Beth's attempt to characterize *scientific philosophy* urged him to ban traditional metaphysics and theory of knowledge from this discipline, and also to drop his «modern metaphysics» by giving another «turn» to the tautologies which would make up its content.

The published paper begins (again) with one of the conclusions of the earlier Nietzsche essay, namely the fact that both Nietzsche and the neo-positivists «deny any objective meaning to metaphysics and the theory of knowledge». The problem is clear: is there an *objective-scientific* basis for metaphysics and theory of knowledge? The answer, restricted to metaphysics, is straightforward. Since metaphysics is conceived as the doctrine of the fundamental principles on which mathematics and the positive sciences rest, its legitimacy is dependent of the Aristotelian theory of science which holds that there are fundamental principles for mathematical and scientific theories. However, the Aristotelian theory is untenable as soon as the evidence postulate is rejected, and therefore metaphysics has no objects whatsoever, and its scientific significance has disappeared [Beth 1943, 9-11]. Of course, the rejection of the evidence postulate requires a separate argument, and it is interesting to see that Beth still admits that some fundamental concepts and principles of, for example, geometry are «evident», but the fact that it is possible to build scientifically significant theories on axioms that are in conflict with «evident insights», is decisive [Beth 1943, 8].

From now on, Beth does not want to establish any more a «modern metaphysics» which would escape the criticism against the Aristotelian doctrine. Eventually his rejection of metaphysics becomes explicit, with the argument that scientific knowledge can never yield definite knowledge as metaphysics pretends to provide: «scientific research is always liable to further extensions and its results are always open to revision» [Beth 1946b, 12]. But

then what about those magnificent «tautologies of modern logic»? Beth's surprising answer was that it is true that some of them are similar to traditional ontological principles – theorems of Parmenides, Aristotle, Leibniz, Kant, Hegel! – but this leads only to the conclusion that the valuable insights of the traditional metaphysics and theory of knowledge will not be lost: «they will, purified, rather get a place in a new construction, which will do full justice to them» [Beth 1943, 10]. What Beth meant with this «new construction», is contained in his remark that the metaphysical and epistemological systems are replaced by «new sciences, which investigate the principles of the positive sciences, with the help of positive-scientific methods, based upon modern logic and a new theory of science» [Beth 1943, 11], in other words: *foundational research* (*Grundlagenforschung*, *Grondslagenonderzoek*) will be part of a «philosophy» that deserves to be called «scientific». It seems that the distance between Beth's «scientific philosophy» and the «scientific world view» (*wissenschaftliche Weltauffassung*) of the Vienna Circle is not large. And indeed, Julius Kraft concluded in his short review of Beth's essay to such a rapprochement [Kraft 1946, 29]:

Beth asserts that modern science does not satisfy several fundamental methodological rules formulated by Aristotle and that therefore, his methodology (and furthermore all metaphysics) are obsolete. Instead Beth advocates a philosophical standpoint akin to logical positivism.

However, in Beth's view, «scientific philosophy» would not only comprise more activities than the investigation of the principles or foundations of the sciences, he had also a different opinion about the admissible methods of the positive sciences. The latter view already glimmers through his paper, when Beth discusses Brouwer's conception of mathematics, in order to show that his appeal to «immediate evidence» does not lend support to the Aristotelian theory of science. According to Beth, Brouwer's introspective view rehabilitates, in a sense, the «evidence» which the logical point of view refuses to acknowledge, but only in so far the mathematician does not go over to formulate or communicate his mathematical insights [Beth 1943, 11]. But if he does, the immediate evidence of the original insights is replaced by the logical relations between the corresponding formulations.

Beth's ideas about «scientific philosophy» were further developed in his attempts to write an elementary introduction to philosophy in the winter of 1944-1945. Unfortunately, the resulting book, *Natuur en geest*, was not published, despite Beth's attempts, both in 1945 and about fifteen years later, when he had revised the chapter on logic in the light of recent developments – including his own invention of deductive and semantic tableaux. As a result,

the outside world has never been able to get a full picture of Beth's scientific philosophy, as it was conceived in the last half year of the Second World War, and as it remained substantially the same until his death. Though he wrote in a later essay in *De Gids* [1946c] that «scientific philosophy» does not only consist in «foundational research in modern style», that is, research into the principles or foundations of the special sciences» mentioned in his earlier study [Beth 1943], but comprises also a scientific «philosophy of life» (*levensfilosofie*), which tries to give an explanation of human life experiences, his indications of the content of this part of scientific philosophy remained very elliptic. We have to turn to the manuscripts of *Natuur en geest* for detailed information about Beth's program of scientific philosophy in a broad sense. Similar remarks can be made on the differences which Beth saw between this program and the original enterprise of the Vienna Circle, notably with regard to the question of the defensibility of the so-called *Geisteswissenschaften*. Only Beth's treatment of a controversy about the *Naturwissenschaften* (the natural sciences) was discussed by Beth in another book that he wrote for the greater part at the end of the war, and which was published as *Natuurphilosophie* in 1948. Leaving aside a discussion of Beth's philosophy of life, I turn now to the disputes about problems with these two departments of science.

Kraft's conclusion that Beth's philosophy was akin to that of the logical empiricists seemed plausible in the light of Beth's «anti-metaphysical» essays of the forties. Had Kraft known that Beth also found a similarity between the logical-empiricists view that logical and mathematical propositions mirror the structure (logical syntax) of scientific languages, and the «realistic» view of Bernays, according to which logic and mathematics contain not only «formally», but also «materially» motivated elements, than he would have had still more reason for seeing resemblances. After all the «neo-positivist» view gets «strong support from the fact that different logical systems are applied in the natural sciences», just as the «realist» view. But Beth had also ideas about the philosophy of physics and biology, let alone the philosophy of psychology and the so-called *Geisteswissenschaften*, and here the differences between his views and those of some of the logical empiricists are very instructive. The question is that an anti-metaphysical attitude can lead, and has led, to a rejection of points of view which are harmless, or even significant according to Beth. I will give two examples, one from the philosophy of biology, the other from the philosophy of the humanities.

In the nineteenth-century philosophy of biology, the discussions on «vitalism» ended in a victory of the anti-vitalists, who succeeded in showing that vitalism was an unscientific, «metaphysical» view. However, years later, it was noticed by Zilseï - to his horror - that Niels Bohr and Paul Jordan tried to rehabilitate

vitalism quantum-mechanically, thereby again opening the gate to metaphysical ways of thought. Support for Zilsel came from Frank, Neurath, and Schlick, though Reichenbach's had a different opinion. He asked for a unprejudiced examination by the specialists. It was Beth, who accepted Reichenbach's challenge in his book on the philosophy of nature (*Natuurphilosophie*), not only arguing that the criticism rested on a misunderstanding, but also stating that there is nothing wrong with two complementary treatments of the phenomena of life. And precisely such a *complementarity* could also be embraced in order to solve the problem about the possibility of the so-called *Geisteswissenschaften*, which were emphatically rejected by the logical empiricists. We have seen that Beth already in the thirties broke a lance for a *personality psychology* besides Neurath's behavioral psychology. With his *complementarity principle*, he could now give a fundamental argument in favour of a special methodology of the humanities (*Geisteswissenschaften*) – though this does not mean that Beth accepted everything which was written under this title, on the contrary: he characterized the views of, for example, Treitschke and Harnack as «the most unscientific irrationalisms and subjectivisms, which should be rejected most emphatically» [Beth 1945, 160].

A clear formulation of Beth's intentions into the direction of such a special methodology can be found in a letter to the physicist Wolvekamp, who defended the orthodox logical empiricist view [Beth 1961]:

I confront two points of view, namely, that of the natural sciences and that of the humanities. The latter is characterized by the fact that for the explanation and evaluation of an object (that is, a human individual) one is not guided by data acquired by observing the object «from outside», but by data which the object itself provides about his «inner side». The ordinary practitioner takes the latter data serious, to the psychologist it is roughly the other way round. Each of these fields is closed in itself (...) The relation between both can, in my opinion, be thought in analogy with the complementarity of wave and particle points of view.

In other words, Beth accepted *introspection* as a means of acquiring scientifically useful information. When this view already differs from Neurath's «reductionism», also the – for logical empiricists questionable – method of «understanding» (*Verstehen*) is acknowledged by him, and he calls it «the foundation of a method of the humanities (*geestes-wetenschappelijke methode*), which has a real existence and is absolutely indispensable in large scientific areas». Only by such «understanding» would it be possible to interpret introspective reports. Of course, this is nothing new; what is important, is that Beth tried to give a meta-theoretical foundation for this view

by his assumption of complementarity. Does this mean that Beth's *conception* of scientific philosophy is fundamentally different from, say, Reichenbach's? The answer is no: Beth's complementarity principle for psychology is admittedly an *hypothesis*. As always, his «scientific-philosophical» results are open to revision.

Why would Beth not be regarded as a representative of logical empiricism? I think that his resistance against such a qualification rested on his repugnance of the one-sidedness which went together with the anti-metaphysical attitude of the prominent logical empiricists. Beth's anti-metaphysical turn, on the other hand, freed him from one-sidedness, it just paved the way for a *pluralism*, in which quite different views are admissible, as long as they are not «absolutized». It is too easy to dismiss certain statements purporting «to fill a gap which science must leave open» as «incomprehensible» or «meaningless», if only one is willing to permanently test them in the development of science.

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