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## The Reception of Ernst Mach in the School of Brentano

Franz Brentano is one of the most influential figures in the philosophy of the late nineteenth century. Brentano and his successors have established a philosophical program which had a decisive impact on the history of philosophy in Austria. This program stands out clearly in several lectures delivered by Brentano during his stay in Vienna, particularly in his inaugural address at the University of Vienna (Brentano 1929) in which Brentano outlines the program that he systematically develops in his *Psychology from an empirical Standpoint* (2009). This program was the result of Brentano's research in Würzburg (1866–1873) which has been partly inspired by Auguste Comte's positive philosophy and John Stuart Mill's empiricism (Münch 1989; Fissette 2018). During his stay in Vienna, Brentano's interest in positivism remained intact as evidenced by his 1893–1894 lectures "Contemporary philosophical questions" in which he examines several versions of positivism, including Mach's version.

This paper is about the reception of Mach by Brentano and his students in Austria<sup>1</sup>. I shall outline the main elements of this reception, starting with Brentano's evaluation, in his lectures on positivism, of Mach's theory of sensations. Secondly, I shall comment the early reception of Mach by Brentano's pupils in Prague. The third part bears on the close relationship that Husserl established between his phenomenology and Mach's descriptivism. I will then briefly examine Mach's contribution to the controversy on gestalt qualities. The fifth part bears on Stumpf's debate with Mach on psychophysical relations and I shall conclude this study with some remarks on Husserl's criticism of Mach's alleged logical psychologism in his *Logical Investigations*.

<sup>1</sup> In a series of papers, I addressed Brentano's relationship with several versions of positivism, namely J. St. Mill (Fissette, forthcoming), Auguste Comte (Fissette 2018) and Ernst Mach (Fissette 2012). In this paper, I shall summarize Brentano's stance *vis à vis* Mach and emphasize the reception of Mach by Brentano's students.

## I. BRENTANO'S LECTURES ON POSITIVISM (1893–1894)

In his lectures “Contemporary philosophical questions” which he held in Vienna one year before he left Austria, Brentano extensively discusses Mach’s positivism (LS 20. 29366–29475). He compares four versions of positivism, that of Auguste Comte, which he compares to Kirchoff’s descriptivism, and Mach’s phenomenalism, which he compares to John Stuart Mill’s empiricism. Brentano claims that the two last versions of positivism mark a progress over the other two versions namely because they are more up-to-date with respect to the development of natural sciences at the time, and because, unlike Comte, for example, they recognize the philosophical value of the field of mental phenomena, i.e. psychology.

Brentano’s correspondence with Husserl and Mach in 1895 testifies that, despite his reservations regarding the metaphysical positions advocated by these different versions of positivism, there remains, however, a “consensus on the method of research”, namely with Brentano’s methodological phenomenalism (Brentano 1988. 203). Indeed, Brentano is an empiricist and he is also very much concerned with positivity. Brentano agrees with positivism that the given consists in phenomena which are also the objects of sciences (physical and psychological alike). The inquiry is limited to phenomena and relations between phenomena that one seeks to subsume under general laws. Brentano is also in agreement with this aspect of descriptivism which favours the “how” question over the why question in the sense that the description of phenomena is prior to, and a necessary condition to their explanation. However, Brentano does not endorse Mach’s thesis according to which the task of science is merely to describe and not to explain phenomena. In his lectures on positivism, Brentano also claims that “it is unfair to claim that advanced sciences renounces the search for causes” (LS 20. 29403).

But Brentano’s overall criticism of Mach rests on Mach’s phenomenalism with regard to a spatial external world which, according to Brentano, is grounded on the identity of the mental and the physical. In Brentano’s own words: Mach’s proof of the “absurdity of the assumption of a spatial outside world on the basis of the identity of the mental and the physical in sensations is a complete failure” (LS 20. 29443). Brentano’s criticism of positivism targets not only Mach’s theory of elements, but also Comte and especially Mill’s doctrine of the permanent possibilities of sensation, to which Brentano grants much importance in these lectures. Brentano maintains that most versions of phenomenalism that he considers in these lectures claim that they “do not allow anything real then their own mental phenomena” (LS 20. 29411), and the limitation to the description of phenomena presupposes that the objects of experience are reducible to our own mental phenomena, and to percepts in the case of sensory perception. For if phenomena are somehow related to experience, and then they are necessarily

related to mental states (sensory perception). In other words: *esse est percipii*. Moreover, Mach's doctrine of elements amounts to identifying two irreducible classes of phenomena and it therefore does not account satisfactorily for the duality in the percept or in one's state of mind such as an emotion between the feeling and what is felt, or between perceiving and what is perceived. According to Brentano, this duality correspond two classes of phenomena which are bearers of heterogeneous and irreducible proprieties.

Brentano advocates instead a form of critical realism according to which the only access one has to the external world is by means of phenomena through which they are given to experience, but these objects exist independently of being perceived. However, Brentano claims that with some modifications, it might be possible to preserve the core of Mach's doctrine of elements, provided that one replaces the identity relation between the two classes of phenomena by that of intentional correlativity (*Correlativität*), which Brentano has worked out in his lectures on descriptive psychology delivered in Vienna in the late 1880s and which I shall later examine<sup>2</sup>.

## II. THE EARLY RECEPTION OF MACH IN PRAGUE

Mach witnessed the very first moments in the establishment of a school of Brentano in Prague where he held a chair of physics from 1867 to 1895. It is also in Prague that the first contacts between Mach and Brentano's students took place. Several of Brentano's students held chairs in Prague at that time, the first being Carl Stumpf who began his teaching in Prague in the fall of 1879 and held that position until 1884. Thanks to Brentano's and Stumpf's efforts, Marty obtained a position in Prague and began his teaching in 1880. A few years later, Masaryk obtained a position in the newly created Czech University in 1882 and he will be joined later by Ehrenfels in 1896.

Beside Mach, the main leading scientist in Prague was Ewald Hering, with whom Stumpf maintained a close relationship (Stumpf 1930. 399).<sup>3</sup> With Hering and Mach, Stumpf and Marty were both members of a circle of scientific researchers in Prague whose official organ was the well-known journal *Lotus*.

<sup>2</sup> Let us recall Brentano's marked interest in Mach's positivism and his doctrine of elements, as evidenced by his numerous notes dictated in Florence during the winter of 1905–1906, when he was practically blind (Brentano, 1988). Brentano's interest in Mach (1914) is clear in the article "Von der psychologischen Analyse der Tonqualitäten in ihre eigentlich ersten Elemente" (Brentano 1979) which he had prepared for the Fifth International Congress of Psychology in Rome in 1905, and in which he discusses Stumpf's and Mach's doctrines.

<sup>3</sup> Notice that Stumpf was already acquainted with Hering's work in physiology, which he extensively discussed in his *Rambuch* in connection with the nativism-empiricism controversy on space perception (Stumpf 1873).

Hering and Mach were very much involved in the activities of this circle<sup>4</sup>. Due in part to the reputation of the researchers associated with the research group Lotos, Prague was considered at that time a leading research center in Europe and has attracted many researchers from abroad and many students. It was also during that period that began the formation of Brentano's students of the second generation such as Emil Arleth, who attended Stumpf's lectures as early as 1879 and received from Hering a solid training in the field of physiological psychology (see Marty 1916). Franz Hillebrand, a close friend of Stumpf, who, under the recommendation of Brentano, went to Prague in 1886 to study philosophy with Marty, has worked both with Mach and Hering and contributed significantly to Hering's research in physiology. He later published many works in this field, and in his intellectual biography on Hering, he acknowledged his debt to him (Hillebrand 1918; see Stumpf & Rupp 1927).

The scientific reputation of Prague partly explains why the American philosopher William James went to Prague, during his trip to Europe in 1882, in order to meet Hering, Mach, and Stumpf. The empiricism advocated by James at that time and which he later developed systematically in his book *The Principles of Psychology* (see Marty 1892) is in many respects akin with the positions advocated by Hering, Mach, and Stumpf on sense experience. Although Stumpf is very critical of James' sensualism as shown by Stumpf's works on emotions (Stumpf 1928b), and moreover of James' later conversion to pragmatism, he maintained a lasting correspondence with James that shows a close relationship between the two philosophers (Stumpf 1928a)<sup>5</sup>.

### III. HUSSERL'S PHENOMENOLOGY AND MACH

Brentano refers to his lectures on positivism in a letter to Mach dated May 1895 in which he responds to a letter from Mach (14-05-1895) in which he informs him of his appointment in Vienna to the chair of history and theory of inductive sciences, left vacant since the resignation of Brentano in 1880, and he thanks Brentano for supporting him despite the circumstances that precipitated his departure from Vienna in 1895. We know that most students from Brentano in Vienna enthusiastically supported Mach's appointment. Indeed, in September 1894, Mach was invited to the Congress of the Association of German physicists and naturalists held in Vienna and gave a talk entitled "The principle of com-

<sup>4</sup> The lists of lectures which are relevant for this period are published in the journal *Lotos* V. 1884. VI–VIII and VI. 1885. VIII–IX. Hering held many lectures during Stumpf's stay in Prague, mainly on the subject of colors, and on the law of specific nerve energies. Mach mainly lectured on the fundamental concepts of electrostatics.

<sup>5</sup> In a recent book, E. C. Banks (2014) compared Mach's and James' empiricism to that of B. Russell.

parison in Physics” (Mach 1997). Mach’s talk has generated so much interest from Brentano’s students, that Alois Höfler, a student of Brentano and Meinong, invited Mach to discuss his talk at a meeting of the Philosophical Society of the University of Vienna. This discussion aroused in turn so much interest that two further discussion sessions were organized by Josef C. Kreibitz, another student of Brentano. These discussions have convinced several members of the Philosophical Society, including Brentano’s students who were very much involved in this organisation (see Fissette, 2014), of the interest of Mach’s candidature to occupy Brentano’s chair in Vienna. Mach began his teaching at the University of Vienna in 1895 and we know the major influence he has had on the course of the history of philosophy in Austria.<sup>6</sup>

Worth mentioning in this regard is Husserl’s positive review of Mach’s talk three years before the publication of his *Logical Investigations* (Husserl 1897). We know that Mach (1897: 200) uses the term “phenomenology” (a “general physical phenomenology extending to all domains”) in his talk to name his own methodological stance based on the description and analysis of sensations as the main task he assigns to science. This phenomenology is in many respects similar to Husserl’s phenomenology in the *Logical Investigations*, which he defines as a descriptive psychology, but also to that of Stumpf understood as a neutral science whose task consists in the description and analysis of sense phenomena (Stumpf 1906a). Brentano himself explicitly establishes the connection between his descriptive psychology and Mach’s doctrine of elements in his lectures on descriptive psychology which he taught in Vienna between 1887 and 1891. Brentano also uses the term phenomenology to refer to this part of his psychology which deals with the description and analysis of conscious experiences and the subtitle of the second version of these lectures: “Psychognosie: the doctrine of the elements of human consciousness” unequivocally refers to Mach’s doctrine of elements<sup>7</sup> and thus confirms that there is some kinship between these different versions of phenomenology.

Let us now return to Husserl. In his Amsterdam lectures (1928), Husserl even characterizes his phenomenology as a radicalization of a phenomenological method previously used “by some scientific researchers and some psychologists” (Husserl 1997: 213) and he mentions the names of Mach, Hering, and Brentano. The first two names are the natural scientists who, according to Husserl, have extensively used this phenomenological method, while the psychologists he refers to in this passage are, of course, Franz Brentano and his pupils. This is confirmed in an appendix to § 1 of the 1925 lectures on phenomeno-

<sup>6</sup> See Haller & Stadler 1988. On several other aspects of the relationship between Mach and Höfler, see Blackmore 2001; on A. Meinong’s relationship with Mach, see Lindenfeld 1980.

<sup>7</sup> In the manuscript of Brentano’s lectures *Deskriptive Psychologie oder Beschreibende Phänomenologie. Vorlesungen 1888–1889* (59115–59116), he refers explicitly to *The Analysis of Sensations*.

logical psychology in which Husserl claims that one of the main sources of his phenomenology lies in Mach's work in the domain of sensations (Husserl 1962. 350) namely because his approach to psychology differs from that of traditional natural sciences thanks to its descriptive character. Referring this time to the famous empiricism-nativism debate between Helmholtz and Hering, Husserl writes about the meaning of the method in Mach and Hering:

The sense of this method in men like Mach and Hering lay in a reaction against the threatening groundlessness of theorizing in the exact natural sciences. It was a reaction against a mode of theorizing in mathematical speculations and concept-forming which is distant from intuition, a theorizing which accomplished neither clarity with insight, in any legitimate sense, nor the production of theories. (Husserl 1997. 211.)

This amounts to saying that in Mach and Hering, this phenomenological method imposes several constraints on one's descriptions, namely that which consists in admitting as *descriptum* only what is immediately and intuitively given in experience, which Husserl conceives of in *Logical Investigations* as sensory data and immanent contents of perception and experience as a whole.

Another quote, taken from his 1910 lectures "The Fundamental problems of phenomenology", corroborates what Husserl says in the Amsterdam lectures. He once again maintains that the origin of the phenomenological method lies in J. S. Mill and "in the sensation-monism of Mach, who likewise substitutes connecting groups of sensation for the thing" (Husserl 2006. 76).<sup>8</sup> *Prima facie*, these two remarks make it possible to establish a close link between Husserl's phenomenology and Mach's descriptivism which, as Husserl points out in this passage, beyond its strict methodological meaning of describing phenomena in the simplest and more economical possible way, is coupled with a metaphysical postulate which, as we have stressed several times, amounts to the reduction of physical objects and psychical functions to aggregates or complexes of sensations. Yet just like Brentano and most of his pupils, Husserl has always criticized this form of phenomenalism. The question is therefore how to reconcile the repeated criticisms of Mach's phenomenalism throughout his work with the leading role that Husserl clearly assigned to him in the genesis of his own phenomenology. Part of the response lies in Husserl's criticism of Mach in the *Logical Investigations* where he raises the objection of logical psychologism which I shall later discuss (see Lübke 1960; Sommer 1985).

<sup>8</sup> In the winter semester of 1903–1904, Husserl gave a lecture on the new publications in the domain of natural sciences, and Mach's book, *The Analysis of Sensations*, was on the program (see Schuhmann 1977. 76). Mach's book was also an important topic in Husserl's lectures entitled „Philosophische Übungen mit einigem Anschluß an E. Machs *Analyse der Empfindungen*“ in the summer semester of 1911 (see Husserl's letter to Vaihinger dated May 24, 1911, in Husserl 1994/V. 211–212).

## IV. MACH AND THE CONTROVERSY ON GESTALT QUALITIES

The name Mach is also associated with what has been called the controversy on Gestalt qualities to which gave rise the publication in 1890 of Ehrenfels' study "On Gestalt qualities" to which participated most of Brentano's students.<sup>9</sup> Ehrenfels' starting point is the first edition of Mach's book *Contributions to the Analysis of Sensations* in 1886, in which Mach points out that we have the ability to immediately "feel" spatial forms and even "sound forms", or melodies. The question that arises in connection with descriptive psychology pertains to the nature of these peculiar contents of presentation which are called spatial forms and melodies, for example. Ehrenfels wonders then if these phenomena are mere syntheses or sums of sensations or something entirely new and irreducible to such syntheses. Ehrenfels finally opts for Mach's position on that issue and claims that this species of phenomena constitutes something entirely new and autonomous with respect to mere bundles and aggregates or to mental chemistry and he relies on three short passages in Mach's book including the following:

If two series of tones be begun at two different points on the scale, but be made to maintain throughout the same ratios of vibration, we recognize in both the same melody, by a mere act of sensation, just as readily and immediately as we recognize in two geometrically similar figures, similarly situated, the same form (Mach 1914. 285).

Ehrenfels argues that Mach's analysis of sensations paved the way for his own solution to the problem of Gestalt qualities.

After reading Ehrenfels' paper, Mach wrote to him that he himself had developed, twenty years earlier, the ideas that are found in this study, and we can assume, with Mulligan and Smith (1988), that Mach (1865) here refers to his study "Bemerkungen zur Lehre vom räumlichen Sehen". In this original study, Mach wonders how it is possible to recognize two spatial configurations (*Gestalten*) as being one and the same figure, for example, how can we identify one and the same melody played in two different keys and by different instruments. This recognition and similarity cannot depend, Mach argues, on perceptual presentational qualities since they are different in both cases. Mach's remarks can be understood in the sense of a recourse, necessary in this case, to additional elementary sensations outside the sphere of presentations, namely to sensations that he calls muscular or kinesthetic sensations: "When we hear the same melody in two different keys, our apprehension of this 'sameness' rests on the fact that, for all the differences in tone-sensations, the same feeling-sensations are involved in both cases" (Mulligan & Smith 1988. 126). It is known that Husserl studied

<sup>9</sup> On the Gestalt controversy, see M. Ash (1995); on the relationship between Mach and von Ehrenfels, see Mulligan & Smith 1988.

similar phenomena that he calls “figurative moments” already in his *Philosophy of Arithmetic* in a quite different context, namely that of the explanation of indirect apprehensions of multiplicities<sup>10</sup>. In a footnote to chapter XI, Husserl in fact mentions Ehrenfels’ article, that he had not studied at that time, but he explicitly acknowledges his debt to Mach’s *The Analysis of Sensations*: “Since I read this work by the gifted physicist right after its appearance, it is quite possible that I too was partly influenced in the progress of my thought by reminiscences from that reading” (Husserl 1970. 211). That said, in Husserl’s later works, he preferably uses the notion of moments of unity in order to designate that kind of phenomena, and it is no longer to Mach’s name that he refers in this context, but to Ehrenfels and Meinong.

#### V. MACH AND STUMPF ON LAWS OF PHYSICS AND PSYCHOPHYSICAL RELATIONS

In 1896, a year after his arrival in Vienna, Mach was invited to attend the 3rd International Congress of Psychology held in Munich, of which Stumpf and Theodor Lipps were co-presidents. But Mach declined this invitation because of his precarious health, and Brentano replaced him (see Brentano 1897). Stumpf delivered the inaugural address published under the title “Body and Soul” (Stumpf 1910) in which Stumpf summarizes his main objections against this form of neutral monism in several of his writings, and in particular in the two Academy treatises (Stumpf 1906b. 1; 1906a. 10–14)<sup>11</sup>. Stumpf’s first criticism is directed against the phenomenalist conception of physics and the empiricist interpretation of its objects in terms of “permanent possibilities of sensation”. The objects of physics, like those of psychology, are not reducible to complexes of elements since sense phenomena, although they represent indeed the starting point and the term of the research in the natural sciences, are finally “the object of none of them” (Stumpf 1906a. 16). The second criticism is directed against his conception of the laws of physics: in spite of Mach’s profound understanding of the history of the development of thought in the natural sciences as evidenced notably by his work on the economic nature of the research in phys-

<sup>10</sup> Notice, however, that even before von Ehrenfels, Husserl already used the notion of Gestalt (rather than that of figural moment) in his 1889–1890 lectures on the concept of number (Husserl 2004. 298).

<sup>11</sup> Stumpf knew Mach’s work and discusses it many times in his lectures and publications. He reviewed the first and second edition of *Analysis of Sensations* (Stumpf 1886. 1900). In the first, he is critical of Mach’s phenomenism, but relatively laudatory about the work as a whole. In his review of the second edition of the book published in 1900, Stumpf is clearly more critical and denounces the unacceptable consequences of Mach’s positivism, and in particular the reduction of mental functions to sense impressions, the conception of the world as a sum of sensations, the dissolution of the subject, etc. See also Stumpf 1890. 55 ff.



ics, the thesis according to which laws of nature are nothing more than abridged reports on facts is logically unjustifiable. Stumpf does not dispute the value of the principle of economy of thought so important in classical positivism, but he considers that it leads to bankruptcy because, by confusing laws and simple facts, it has as a direct consequence logical psychologism as defined in Husserl's *Prolegomena* (Stumpf 1906a. 53n.), which I will discuss in the next section.

The third objection against Mach (cf. Stumpf 1910. 86) bears on psychophysical relations to which Stumpf attaches much importance in his writings. Unlike most of his contemporaries, including Brentano and Husserl, Stumpf unequivocally rejects the doctrine of parallelism according to which the physical and the psychological are aspects of one and the same reality and he advocates, following Lotze, a form of interactionism that rejects monism in favor of dualism. The position that Stumpf advocates in "Leib und Seele" is nicely summed up in the following quote taken from his posthumous book *Erkenntnislehre*:

The discredited dualism however, according to which everything in the world, including the mental and physical, stands in thoroughgoing interaction (directly or indirectly), now appears as the true monism. According to interactionism, the world is, despite the diversity of its parts, a unified organic whole. Thus the parallelistic view proves to be impractical and contradictory, and therefore the theory of interaction remains, for the time being, the best guide through the maze of this great problem. (Stumpf 1939–1940. 822.)

One of Stumpf's arguments in favor of interactionism and against parallelism is Darwin's theory of evolution (Stumpf 1910. 78–79) to which he attaches great importance since the Prague period, and notably in his studies on the origins of music and the psychology of sounds.

Mach awaited the publication of the second edition of Stumpf's talk in 1910 to respond to these objections<sup>12</sup>. In a short notice entitled "Sensory Elements and Scientific Concepts", Mach (1992. 121) summarizes Stumpf's objection in saying "that relations by means of scientific laws 'absolutely never' exist between immediately given sensory appearances; what scientists mean by lawfulness is always completely different" (Mach 1992. 121). In response to Stumpf's objections, Mach argues that the purely mathematical world to which Stumpf (1910. 84–85) refers is a metaphysical postulate foreign to a physicist who adheres to the descriptivist point of view and who refrains from crossing the threshold of appearances. Mach indeed argues that everything beyond the immediate data of experience is metaphysical, and any science that does not conform to pure

<sup>12</sup> The discussion with Mach was in fact introduced in the 1909 version of "Body and Soul" and repeated, with significant additions, in his 1910 collection of essays *Philosophische und Reden Vorträge*, in which he makes more explicit his criticism of Mach (Stumpf 1910. 83–87).

description has to deal with *Scheinprobleme*. Hence the monism of sensations according to which the world is made neither of matter nor of mind, but of a neutral material that can be treated according to the context, interest, and direction of research, as psychical or physical<sup>13</sup>.

#### VI. THE OBJECTION OF PSYCHOLOGISM IN HUSSERL'S PROLEGOMENA<sup>14</sup>

Let us finally examine Husserl's objection of logical psychologism that he imputes to Mach in chapter IX of his *Prolegomena to Pure Logic* entitled "The principle of economy of thought and logic", in which he denounces any attempt to base logic and the theory of knowledge on the principle of economy of thought. But let us bear in mind that Husserl's objection in the *Prolegomena* does not directly relate to the theories based on that principle as Husserl confirms in his correspondence with Mach. On the contrary, he recognizes the "extraordinarily successful" nature of Mach's research on the biological and psycho-cognitive aspect of science and the merits of a "genetico-psychological und biological" approach to science (Husserl 1994/VI. 255). These theories are perfectly legitimate and fruitful, Husserl says, "in their due limits" (Husserl 1982a. 123). The distinction in the *Prolegomena* between logic as a theoretical science (as a theory of science) and as a practical science (as *Kunstlehre*) is important to understand the meaning of this limitation. Indeed, in ignoring the difference between the actual content of logical propositions and their practical application, logical psychologism systematically confuses the use of a proposition for normative purposes with its theoretical content, and its main mistake consists precisely in claiming to provide logic as a whole with a foundation. Only then can an empiricist like Mach be called a psychologist. For whoever recognizes the merits of the division within logic between its theoretical and its practical aspect is quite justified to resort to physiological psychology, for example, to explain the mechanical use of methodological rules. In other words, the use of psychology in the theory of knowledge can only be considered psychologist insofar as these two aspects of logic are confused and the theory of knowledge be reduced to a *Kunstlehre* of knowledge.

<sup>13</sup> One of Stumpf's famous students who contributed significantly to the reception of Mach is the author of the novel *Man ohne Eigenschaften*, Robert Musil. Musil traveled to Berlin in 1903 to study philosophy, physics and mathematics, and in 1908, under the direction of Stumpf, he defended a doctoral thesis on Mach (Musil 1908). See R. Haller (2003) who summarizes some general aspects of the complex relationship between Mach, Stumpf and Musil's dissertation.

<sup>14</sup> On Husserl's criticism of Mach based on the objection of psychologism, see Fissette (2012).

This is confirmed by Husserl's analyzes in § 55 of the *Prolegomena*, which deals more specifically with this form of empiricist foundation of logic that uses the principle of economy of thought. In its most general sense, this principle is formulated as follows: "This tendency of obtaining a survey of a given province with the least expenditure of thought, and of representing all its facts by some one single mental process, may be justly termed an economical one" (Mach 1903b. 211). This principle can be understood either as a psychological principle, as Cornelius does, or as a biological principle. What Husserl calls the Avenarius–Mach principle is considered in this section a biological principle that is associated with the principles of evolution of species, their adaptation to the natural conditions of their environment, and their conservation. In addition to its recognized applications in the field of biology, the field in which this principle is the most fruitful is precisely that of the methods in mathematical logic that serve practical needs such as the system of decimal numbers and in general all the standard mechanical and algorithmic processes that are used in mathematics. For all these technical and mechanical processes, continues Husserl, are methodological artifices which serve essentially to the economy of thought, i.e., they are used in order to compensate for "the defects of our mental constitution" or the severe limitations of "men's intellectual powers" (Husserl 1982a. 126). In fact, all these methodological artifices are due to the very nature of our mental constitution and they are the result of a natural evolution or "certain natural processes of thought-economy" (Husserl 1982a. 126).

One can see that Husserl's interest in the *Prolegomena* for the theory of the economy of thought in explaining the methodology of scientific research is not incidental. However, Husserl considers that this interest depends on the role of this theory in the larger and much more ambitious program of a theory of science. Therefore, this is not the place where psychologism lies. For logical psychologism is only imputable to Mach in so far as it takes into account only one aspect of logic (practical and technological). Mach's main mistake, therefore, boils down to the limitation of knowledge to "the empirical aspect of science", especially to science as a biological phenomenon, and to the fact that he does not take into account the true "epistemological problem of science as ideally unified, objective truth" (Husserl 1982a. 133). For the theory of knowledge that Husserl advocates in the *Logical Investigations* "wishes to grasp perspicuously, from an objectively ideal standpoint, in what the possibility of perspicuous knowledge of the real consists, the possibility of science and of knowledge in general" (Husserl 1982a. 131). This task is an essential philosophical complement to the *mathesis* and the overall theory of science. In that respect, as a theory of knowledge,<sup>15</sup> phenomenology has nothing to expect philosophically from a

<sup>15</sup> In the introduction to the second *Investigation*, Husserl clearly indicates that his theory of knowledge differs from that of classical empiricism in that "it recognizes the 'ideal' as a con-

genetic explanation as Husserl points out in his discussion of the work of Külpe and Elsenhans regarding the meaning of his criticism of logical psychologism (Husserl 1982a. 319).

Mach responded to Husserl's criticism in the fourth edition of his book *The Science of Mechanics: A Critical and Historical Account of Its Development* in which he admits that his scientific approach is indeed "a psycho-cognitive sketch" (Mach 1919. 582), while denying of having confused "natural or blind thought and logical thinking" and much less logical and psychological issues (Mach 1919. 582). He conceives of his dispute with Husserl as a difference of method: Mach's method is inductive and proceeds from particular phenomena to the general laws (bottom-up) whereas, with his general theory of science, Husserl proceeds deductively from main principles and laws, which he defines as ideal entities, to particular cases. But Mach does not take into account in his response Husserl's phenomenological investigations in the second volume of his *Logical Investigations* and ignores, it seems, Husserl's phenomenology and the use of a descriptive approach in his analysis of conscious experiences. Mach further argues that even a theory of all possible theories in Husserl's program cannot do without research in the field of biology: "Even if the logical analysis of all the sciences were complete, the biologico-psychological investigation of their development would continue to remain a necessity to me (Mach 1919. 582).

In a letter dated June 18, 1901, Husserl (1994/VI. 255–256) acknowledges receipt of the new edition of Mach's work and reminds him that his criticism of psychologism in no way challenges the right of a "genetic-psychological and biological" approach to science, but he opposes, as we saw, "the subordination of the epistemological explanation of the purely logical in science under the points of view of psychological genesis and biological adaptation" (Husserl 1994/VI. 255). Husserl recalls, moreover, that the chapter on the economy of thought does not primarily target Mach's use of the principle of economy of thought, but rather Cornelius' use of this principle in a psychological sense (Husserl 1982b. 303; see Cornelius 1897). What Husserl more specifically criticizes in Mach is the one-sidedness of his empirical descriptions, and the fact that he does not take into account the ideal and purely logical content of science, as if the genetical point of view were enough for epistemological needs (Husserl 1994/V. 256). Now, we saw that Husserl's argument in the *Prolegomena* against logical psychologism was based precisely on the ideality of the laws of logic. That said, Husserl claims that there is no contradiction between these two approaches that are mutually compatible and complementary (Husserl 1994/VI. 257). Husserl's

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dition for the possibility of objective knowledge in general, and does not 'interpret it away' in psychologistic fashion" (Husserl 1982b. 238).

clarification seems to have dispelled Mach's concerns as evidenced by Mach's short letter of 23 June 1901 in which he says that he has nothing further to add to Husserl's clarification and he hopes that this dispute is past history.<sup>16</sup>

## VII. FINAL REMARKS

We know that Mach renounced his chair in Vienna in 1901 and that one of the candidates to fill this chair was none other than Husserl who even visited Mach thereupon during the Easter holidays of 1901.<sup>17</sup> Alois Riehl, a colleague of Husserl at Halle, seems to have been one of the serious candidates for the succession of Mach in Vienna. But since Riehl was not interested in that position, he strongly recommended Husserl's candidacy to Mach. According to Husserl, Mach would have positively received Riehl's recommendation and would have shown a preference for Husserl's candidacy for this position<sup>18</sup>. However, after numerous negotiations within the Faculty, the Commission took the opportunity to repatriate the physicist Ludwig Boltzmann to Vienna by offering him Mach's chair (see Blackmore 1995). Husserl's disappointment is manifest in a nostalgic letter to his compatriot T. Masaryk, in which he admits of having abandoned the long-cherished hope of obtaining a position in Austria:

Von der alten Heimat bleibe ich nun wohl dauernd getrennt, die in früheren Jahren gehegte Hoffnung, einmal nach Österreich berufen zu werden, habe ich längst aufgegeben – obschon ich mit Freude erst im letzten Jahre hörte, daß E. Mach, als er sich zurückzog neben Riehl auch mich als ihm erwünschten Nachfolger für Wien nannte (Husserl 1994/I. 107).

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<sup>16</sup> However, in a letter to W. Jerusalem from June 8, 1913, Mach wrote: "I became acquainted with Husserl through his *Logical Investigations*. I cannot discover in it anything other than psychological investigations. Nor can I understand how it could be regarded as anything else" (Mach in Blackmore 2001. 222).

<sup>17</sup> Husserl describes this meeting with Mach to his friend Albrecht in a letter dated from August of the same year (Husserl 1994/IX. 23–24).

<sup>18</sup> In Mach's own words: „Unter den von Ihnen Genannten möchte ich mir von Husserl das meiste versprechen." (Husserl 1994/IX. 23–24.)

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