ORIGINAL RESEARCH

Points of convergence between logical empiricism and inductive metaphysics: Hans Reichenbach and Erich Becher in comparison

Ansgar Seide[1]

Abstract

In this paper, I take a closer look at Hans Reichenbach's relation to metaphysics and work out some interesting parallels between his account and that of the proponents of inductive metaphysics, a tradition that emerged in the mid- and late 19th century and the early 20th century in Germany. It is in particular Hans Reichenbach's conception of the relation between the natural sciences and metaphysics, as displayed in his treatment of the question of the existence of the external world, that shows some very interesting similarities with inductive metaphysics. By a comparison with the position of the inductive metaphysician Erich Becher and his handling of the problem of realism, I work out the parallels between Reichenbach's program and inductive metaphysics. I come to the conclusion that while there are certainly some respects in which Reichenbach's logical empiricism is closer to the positions of the representatives of the Vienna Circle, it turns out that with regard to his views on metaphysics there is a greater affinity with the program of inductive metaphysics.

1 Introduction

In this paper, I investigate points of convergence between two different philosophical programs at the beginning of the 20th century which, at first glance, may not look as if they have much in common: inductive metaphysics and logical empiricism. In

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✉ Ansgar Seide
  ansgar.seide@uni-muenster.de

1 Westfälische Wilhelms-Universität Münster, Philosophisches Seminar, Domplatz 23, 48143 Münster, Germany

particular, I will take a closer look at Hans Reichenbach's relation to metaphysics and work out some interesting parallels between his account and that of inductive metaphysics.

At first sight, it may look as if inductive metaphysics and logical empiricism are completely contrary positions. While the proponents of inductive metaphysics took metaphysical questions very seriously and tried to reform and resurrect metaphysics after the decline of German Idealism, the logical positivists, on the other hand, are famous for being harsh critics of metaphysics and for denying the meaningfulness of metaphysical questions and metaphysical theses.

But a closer look reveals that there are many interesting connecting points between inductive metaphysics and logical empiricism. Especially with regard to the initial motivations for the respective positions, there are many overlaps: Both groups took their point of departure in distancing themselves from German Idealism and in particular from its a priori methods in metaphysics. Both groups, on the other hand, rated the successful empirical and inductive methods of the natural sciences very highly. In a way, both inductive metaphysics and logical empiricism can be described as attempts to renew and revive philosophy after the decline of German Idealism by finding a new role that philosophy could play in relation to the natural sciences.

The points of convergence become even more apparent when one does not restrict logical empiricism to the narrow phase of the Vienna Circle and its protagonists. Indeed, as has been pointed out in the literature, Hans Reichenbach, the leading member of the Berlin Group and one of the most important proponents of logical empiricism, brought forward a variant of logical empiricism that distinguishes him from the Vienna Circle, especially by his attitude to certain metaphysical questions:

> Reichenbach is now often lumped together with the logical positivists of the Vienna Circle, but his ideas, especially those in *Experience and Prediction*, were often developed in opposition to positivism. Reichenbach frequently sought to save concepts and problems from the many positivists who sought to discredit them. For example, he thought that causality has a place in science and that the problem of the external world is not a pseudo-problem. Indeed, Reichenbach always defended realism against positivism, and his defense was truly ingenious. (Irzık & Sober, 2011, p. 2).

As I will argue in this article, Reichenbach presents an idea of the relation between metaphysics and science which is strongly reminiscent of certain core features of inductive metaphysics. In particular, it is his treatment of the metaphysical question of the existence of the external world which bears many resemblances to the way the inductive metaphysicians deal with the same problem. While there are certainly some respects in which Reichenbach's logical empiricism is closer to the positions of the representatives of the Vienna Circle,[1] it turns out that with regard to

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[1] In particular, of course, Reichenbach shares with the representatives of the Vienna Circle an affinity for modern logic and a close examination of the language of science.

his views on metaphysics there is a greater affinity with the program of inductive metaphysics.[2]

To bring out the convergences between Reichenbach's position and inductive metaphysics, I will compare Reichenbach's approach, as presented in his early paper "Metaphysik und Naturwissenschaft" (1925)[3] and in his book *Experience and Prediction* (1938),[4] with the position of Erich Becher. Becher, a later representative of inductive metaphysics, was Reichenbach's contemporary and developed his version of inductive metaphysics at about the same time. I will use some space in Sect. 2 to first describe Becher's position in detail, because Becher (as well as the tradition of inductive metaphysics in general) is widely unknown today.[5] Against the background of the careful reconstruction of Becher's position, Sect. 3 will then show how much Reichenbach formulates thoughts that come very close to the ideas of inductive metaphysics or even correspond to them one-to-one.

2 Becher's inductive metaphysics

2.1 Historical background: inductive metaphysics in 19th century and early 20th century philosophy

Erich Becher (1882–1929) can be placed in the tradition of inductive metaphysics, a tradition that emerged in the mid- and late nineteenth century and the early twentieth century in Germany.[6] Besides Becher himself, representatives of inductive

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[2] In a sense, this is reflected by a conflict that arose between Reichenbach and members of the Vienna Circle in the late 1920s and early 1930s. As Carus (2007, p. 107, n. 18) points out, Carnap, in 1929, compiled a list of "metaphysicians 'according to their degree of badness'", on which Reichenbach, together with Russell, was listed in the category of "more modest offenders" (Carus 2007, p. 107, n. 18). See also Verhaegh (2020, p. 27 f.) for an account of the tensions between Reichenbach and the Vienna Circle in the late 1920s and early 1930s.

[3] I will refer to the translated version (Reichenbach 1978a [1925]).

[4] It may seem a bit strange that I give the 1925 article more space than the more complex and well-known book. There are three reasons for this. First, the article was written at around the same time as Becher's books, which makes it a natural comparison case. Second, as far as I can see, the article receives little attention in the secondary literature and, in my opinion, deserves to be highlighted. And (most importantly) third, as the title of the article expresses, it deals mainly with the very subject that will be the focus of the following investigation, namely, Reichenbach's views on the relation of metaphysics to the natural sciences.

[5] This was completely different in Becher's own time. As a matter of fact, it was Becher who first received a call to the chair in Philosophy of the Inductive Sciences at the University of Vienna, the chair that was finally appointed to Moritz Schlick in 1922. It was only after Becher turned down the call that the path was cleared for Schlick, whose appointment was supported by Becher (cf. Friedl & Rutte 2008, 11 f.). There are also approving references to Becher's works in Rudolf Carnap's *Der logische Aufbau der Welt* (1928) and especially in Schlick's early book *Allgemeine Erkenntnislehre* (1918, 1925² [2009]; see [2009], 358, 458 n., 582 n., 593, 627, 656, 677, 687 and 698). Schlick also reviewed Becher's book *Weltgebäude, Weltgesetze, Weltentwicklung. Ein Bild der unbelebten Natur* (1915) and was in personal contact with Becher, as witnessed by their (as yet unpublished) correspondence.

[6] For a general historical overview of the program of inductive metaphysics, see Scholz (2018b). Engelhard, Feldbacher-Escamilla, Gebharter & Seide (2021) set the basic ideas of this tradition in relation to

metaphysics include Gustav Theodor Fechner (1801–1887), Rudolph Hermann Lotze (1817–1881), Wilhelm Wundt (1832–1920), Oswald Külpe (1862–1915) and Eduard von Hartmann (1842–1906). One way of telling the story of the beginning of inductive metaphysics in mid-nineteenth century is to describe it as a counter-reaction to German Idealism,[7] which consisted in particular in redefining the relationship of metaphysics to the natural sciences. The idealist *Naturphilosophie* – especially Hegel's, the dominating *Naturphilosophie* at that time – came to be seen as a failure, especially in the eyes of the natural scientists of the time (e.g. Schleiden, 1844; Helmholtz, 1862, p. 164; cf. Külpe, 1904 [1902], p. 6; Schnädelbach, 1984, p. 77). The advocates of inductive metaphysics primarily held the dialectical method of the idealists responsible for this.[8] They proposed a different method for metaphysics. Their program is based on the idea of remodeling metaphysics according to the empirical sciences; in particular, they propose to use empirical sources and inductive forms of inference in metaphysics, just as empirical sciences have been doing for a long time.

Becher situates himself into this tradition of inductive metaphysics, and just like other proponents of inductive metaphysics before him,[9] Becher looks out for deeper connections between metaphysics and the natural sciences, with the goal of remodeling metaphysics according to the natural sciences. Let us take a closer look at his particular way of unfolding this program.

2.2 Metaphysics and the natural sciences

Becher develops his version of inductive metaphysic in several writings. A good starting point is his small book *Metaphysik und Naturwissenschaften* (1926b), which has the goal to synoptically summarize his position concerning the relationship between metaphysics and the natural sciences. I will use this book as the basis for presenting Becher's position, but will use other writings—in particular, his more detailed presentations *Naturphilosophie* (1914) and *Geisteswissenschaften und*

Footnote 6 (continued)

current debates in metaphysics. For case studies of the inductive metaphysics of Fechner and Wundt, see Seide (2021) and (forthcoming).

[7] To be sure, the inductive metaphysicians also distinguish themselves from other traditions and from competing contemporary programs. To name a few examples: Some inductive metaphysicians criticize Kant and also some Neo-Kantians for the strong idealistic tendencies of their positions and, in contrast, advocate a so-called critical (or transcendental) realism (von Hartmann 1885 [1871]; Külpe 1912–1923; Becher 1926b, 10 ff.). Although the inductive metaphysicians share with the positivists the criticism of traditional methods of metaphysics and a respect for the methods of the individual sciences (Külpe 1904 [1902], p. 14), they criticize that the positivists reject any metaphysics that extends the individual sciences (Külpe 1928 [1895], p. 183; 1904 [1902], p. 33). This criticism is also made in part against representatives of Neo-Kantianism (Külpe 1928 [1895], p. 28).

[8] A critical attitude of the inductive metaphysicians towards German Idealism, especially with regard to its dialectical method, is expressed very clearly in many writings. See for example Fechner (1851, vol. I: VIII; XIX f.; XXVI), von Hartmann (1868), Wundt (1883, p. 618), Külpe (1904 [1902], pp. 6–8 and 1912, 193 f.) and Becher (1926b, 20 f.).

[9] Becher (1921, p. 324; 1926b, 1) names Fechner, Lotze and von Hartmann as forerunners.

Naturwissenschaften ([1921](#)) – in some places to deepen the understanding of Becher's position.[10]

Becher begins his investigation of the relationship between metaphysics and the natural sciences with a systematic comparison between them.[11] According to his approach, sciences can essentially be characterized and distinguished by three aspects: (1) their objects, (2) their methods, and (3) their ultimate basis of knowledge (Becher, [1926b](#), p. 3). Let us take a look at these three aspects in turn.

2.2.1 The objects of the natural sciences and the object of metaphysics

As the *objects of knowledge of the natural sciences*, Becher identifies the natural objects, which he regards as real physical objects,[12] and their properties, their relationships and the processes in which they are involved (Becher, [1926b](#), p. 4). But individual natural sciences always deal only with *certain parts or aspects* of the physical world: botany, for example, studies other parts of nature than geology; and even physics, which seems to affect all areas of nature, only examines certain aspects of natural objects, and these aspects are different from those examined by chemistry, for example (Becher, [1926b](#), p. 5). Accordingly, Becher calls the natural sciences *partial real sciences* [*Partialrealwissenschaften*].

Metaphysics, on the other hand, takes an all-encompassing perspective on the world. As the object of metaphysics Becher determines the total reality [*das Gesamtwirkliche*]. Accordingly, metaphysics is the science of the total reality, or *total real science* [*Totalrealwissenschaft*] (Becher, [1921](#), p. 323; [1926b](#), p. 5).[13] This perspective opens the view to more fundamental questions than those considered in the individual sciences, for example, the questions of the emergence and the meaning of the overall reality (Becher, [1921](#), p. 319; [1926b](#), p. 6).

Metaphysics, too, sometimes considers certain parts or aspects of reality, but, unlike the natural sciences, always in relation to the overall reality. Biology, for example, is concerned with organic life, while metaphysics deals with the question of how organic life is related to other parts of the overall reality, e.g., to the soul or consciousness. In this way, it can be said that metaphysics and the natural sciences touch or even overlap each other with regard to their objects. However, through its perspective on the overall reality, metaphysics makes a claim that goes beyond a

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[10] In *Metaphysik und Naturwissenschaften*, Becher frequently refers to the two earlier and more detailed books, implying that he has not changed his position in the meantime.

[11] The comparison between the natural sciences and metaphysics outlined here is part of a comparative theory of science [*vergleichende Wissenschaftslehre*], as it is elaborated especially in Becher ([1921](#)). The idea of a comparative theory of science was also pursued by Kurt Lewin ([1922](#)) and Paul Oppenheim ([1926](#)), two members of the Berlin Group.

[12] We will take a closer look at Becher's position of realism and his justification of it below in Sect. [2.2.3](#).

[13] Similar conceptions of the object of metaphysics can be found in Wundt ([1883](#), p. 619) and Külpe ([1912](#), p. 194). In a way, this is also a demarcation from the tradition going back to Leibniz and Wolff, according to which the object of metaphysics also includes the realm of possible worlds.

mere juxtaposition of the results of the individual sciences (Becher, 1921, p. 319).[14] But, as Becher (1926b, p. 7) emphasizes, these overlaps mean that metaphysics can base its investigations on the results of the individual sciences, which is of course entirely in line with the idea of inductive metaphysics.

2.2.2 The basis of knowledge and the method of the natural sciences

After this determination of the relationship between the natural sciences and metaphysics with respect to their objects, the next question that arises is how they relate to each other in terms of their *basis of knowledge* and their *methods*. Becher discusses these two points together and first focuses on the natural sciences. As we will see in Sect. 2.2.4, according to Becher the method of metaphysics can be derived directly from the analysis of the method of the natural sciences.

As he points out, the natural sciences are characterized by a particular method, namely the *empirical-inductive method* (Becher, 1926b, p. 16), which he analyses in detail. Within this method, the natural sciences take their starting point from *perceptions*, as their *ultimate basis of knowledge*. The reason for this, according to Becher, is simply that the process of perception is the only way we can directly grasp what is real (Becher, 1921, p. 116). Strictly speaking, he holds that we only have direct access to our own present consciousness content. But he points out that we can transcend the realm of our present consciousness by using certain principles of cognition, which play an important role in the empirical-inductive method of the natural sciences, as well as in everyday life.

He names three such principles as being most important for the natural sciences (Becher, 1926b, p. 17): the presumption of the trust in memory [*Voraussetzung des Erinnerungvertrauens*], the presumption of lawfulness [*Gesetzmäßigkeitsvoraussetzung*], and the causal principle [*Kausalprinzip*].[15] The presumption of the trust in memory is a basic principle which we also rely on in everyday life. The presumption of lawfulness and the causal principle, on the other hand, are based on a more fundamental presumption, the presumption of regularity [*Regelmäßigkeitsvoraussetzung*] (Becher, 1921, p. 231). As Becher points out, the weaker presumption of regularity is in play in our pre-scientific, everyday perception of reality. The stronger presumption of lawfulness and the causal principle are strengthened versions of the presumption of regularity and they are a product of science, in particular of natural science.

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[14] To name a few more examples: In his book *Einführung in die Philosophie* (1926a), Becher discusses under the rubric "metaphysics" the question of the building material of the world (materialism vs. spiritualism vs. dualism), the question of the interaction between body and mind, the question of the existence of an unconscious, the position of vitalism and the question of the existence of a supra-individual soul.

[15] I translate Becher's term "Voraussetzung" (as in "Voraussetzung des Erinnerungsvertrauens", "Gesetzmäßigkeitsvoraussetzung" etc.) as "presumption" instead of the more direct translation "presupposition" because, as the following analysis will show, the rules Becher refers to as *Voraussetzungen* are exactly what is termed "presumption rules with rebuttable presumptions" (Scholz 2009, p. 175; see also Scholz 1999, ch. II.2) in the literature: Instead of just being presupposed, these principles are presumed in the sense that we hold them true until there are reasons to the contrary. This point will become clearer in the following discussion of the examples of Becher's presumption rules.

We will confine ourselves to a closer look at the two basic presumptions, the presumption of trust in memory and the presumption of regularity.[16]

According to the *presumption of the trust in memory*, we presume that our memory of the past is at least in principle reliable. Memories are present contents of consciousness, which we understand as reproductions of past experiences (Becher, 1914, p. 80; 1921, p. 223). In the absence of counter-reasons,[17] we usually trust these representations. But as Becher points out, it is not possible to rule out the possibility that our memory always deceives us—there is no way to prove the reliability of memory a priori. Furthermore, the reliability of memory cannot be empirically justified, either: we cannot empirically test the reliability of our memories without making recourse to the past. In order to do so, we would therefore have to presuppose the reliability of our memory, so that such an empirical justification of the reliability of memory would always be circular (Becher, 1914, p. 81).

In the absence of any a priori or empirical justification, we have no choice but to generally trust the reliability of our memory without being able to prove or justify it. The reason why we still have to trust the reliability of our memory is that it is a presumption that is *necessary for the attainment of knowledge* [*erkenntnisnotwendig*]. Without it, we could not transcend the realm of our present consciousness; in particular, we could not gain any knowledge of the past. That is, we rely on it because it is indispensable for our cognitive purposes (Becher, 1914, p. 81; 1921, p. 224).

But without the inclusion of further principles, our knowledge would still be enclosed in the realm of our present and past consciousness. In order to transcend this realm, we are dependent on another principle, namely the *presumption of regularity* (Becher, 1914, p. 84; 1921, p. 227). First of all, this principle is a presumption of regularity *regarding our own experiences*.[18] If we want to infer from our past experiences something about experiences that we will make in the future, then we

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[16] According to the *presumption of regularity*, the world and its course are by and large regular. The *presumption of lawfulness*, on the other hand, is the stronger presumption that nature is governed by strict laws. The difference between strict laws and mere rules is that strict laws apply without exception (Becher 1914, p. 114; 1921, p. 231). According to the presumption of lawfulness, nature is governed by strict laws, and can therefore be explained in its course in principle in every detail (Becher 1914, p. 118). It is a necessary presumption for the scientific ideal of complete explainability and controllability of nature (Becher 1914, pp. 112–118). But unlike the weaker presumption of regularity, it is not necessary for the attainment of knowledge [*erkenntnisnotwendig*] in a general sense (Becher 1921, p. 232).

Something similar applies to the causal principle. According to the *causal principle*, every event has a cause. Becher advocates a regularity theory of causation, according to which causation can be analyzed in terms of regular immediate succession. Against this background, a close relationship between the causal principle and the presumption of lawfulness becomes apparent: The causal principle claims that there is a cause to every change, which is connected to this change by a general law (Becher 1914, p. 148).

The upshot of this is that while only the weaker presumption of regularity is indispensable for knowledge in general, Becher holds that no harm is done when this principle is strengthened to the presumption of lawfulness and to the causal principle. While the latter two principles stand on a weaker foot when it comes to their justification, their only consequence is that natural scientists always continue to search for explanations for surprising phenomena.

[17] We will see below in more detail what form such counter-reasons can take.

[18] As we will see in Sect. 2.2.3, this principle also enables us, in a second step, to transcend the realm of our (past, present and future) consciousness contents and to reach out to a mind-independent external world.

rely on the principle that rules which we could observe in the realm of the experiences made so far will also hold true in the future. Without such a presumption, we could never transcend the realm of our present and past consciousness. This is why this presumption too is indispensable for our knowledge [*Erkenntnis*], both in everyday life and in the sciences. But just as in the case of the presumption of trust in memory, Becher states that the presumption of regularity can neither be justified a priori nor (without circular reasoning) empirically (Becher, 1914, 88 ff.).[19] It is a principle on which we have to *trust* if we want to gain knowledge about the future at all. So we cannot say that the principle can be justified in the sense that we can give reasons for its truth. Nevertheless, we are in a certain way *justified in applying this principle*, because it is the only way to gain empirical knowledge at all (Becher, 1921, p. 228).

As can easily be seen, this principle is very fruitful in that it licenses several forms of inferences. Becher explicitly mentions *analogical inferences* and *inductive generalizations*, which, according to him, are closely related forms of inference (Becher, 1914, p. 87). An analogical inference is for example when I first determine that certain states of my consciousness, e.g. pain, are correlated with certain reactions of my body,[20] e.g. screaming, and then, when I hear another person screaming, I infer by analogy that she also has a corresponding sensation of pain. An inductive generalization is for instance when I infer from the observation that mercury has always expanded when heated, that this will also happen in the future when mercury is heated (or more generally: in all unobserved cases). It is clear that both kinds of inference rely on the presumption of regularity. The last example also makes clear how important the presumption of regularity is for the natural sciences: every inference to a law of nature is based on an inductive generalization and thus on the presumption of regularity (Becher, 1914, p. 88).

Becher also notes that the presumption of regularity allows us to draw inferences to the past. For example, I can infer that I experienced summer and winter as a five-year-old, even if I cannot remember it (Becher, 1921, p. 227). However, this also means that sometimes the results I obtain on the basis of the presumption of trust in memory and those I obtain on the basis of the presumption of regularity can conflict with each other. Then we have to decide which of the knowledge principles involved should be given priority in the present case.[21] This means that these principles, which are necessary for gaining knowledge, are not presuppositions that are incontestable in every instance. In particular, conflicts with the results of other principles of cognition—or even with other results based on the same principle—can call certain applications into question. In this sense, these principles are not presuppositions

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[19] The arguments Becher brings forward for this are strongly reminiscent of David Hume's arguments against the justification of inductive inferences (Hume 1999 [1748], Sect. 4), which I assume to be generally familiar.

[20] As mentioned above, we have not yet seen how, according to Becher's position, it is possible to gain knowledge about the existence of external world objects (including our own bodies). This step, which is also based on an application of the presumption of regularity, is analyzed separately in Sect. 2.2.3.

[21] Becher considers both the case where a belief based on the presumption of trust in memory gives way to a belief based on the presumption of regularity (1914, 101), and the converse case (1914, 101 f.).

we hold on to come what may, but presumption rules with rebuttable presumptions[22]: we hold them true until there are reasons to the contrary.

2.2.3 Becher's realism and its empirical-inductive justification

So far, strictly speaking, we have not gone beyond the realm of our own consciousness: The presumption of the trust in memory allows us to infer to past states of our own consciousness; the presumption of regularity allows us to infer from past experiences to future experiences. While this makes it possible to transcend the present contents of consciousness, we have not yet taken a step out into the external world. But as we have seen above, Becher holds that the natural sciences, as well as metaphysics, have real physical objects as their objects of knowledge. In fact, Becher explicitly holds that we can have knowledge of real objects, and that this is a kind of knowledge that is not limited to metaphysics, but also can be found in the natural sciences and to a certain extent also in everyday life. We must therefore ask how it is possible to expand our knowledge of our own present, past and future consciousness in such a way that we can gain knowledge of objects of the external world.

We have already seen above that Becher bases inductive generalizations and analogical inferences on the presumption of regularity. We will now see that in the justification of his realism, he implicitly relies on another form of inductive inference,[23] namely Inference to the Best Explanation,[24] without explicitly reflecting on this form. As will become clear, his usage of this inference form in the justification of his realism shows that inferences to the best explanations are based on the presumption of regularity, just like inductive generalizations and analogical inferences. This is particularly interesting because it is an instructive example that shows how central the inference form Inference to the Best Explanation can be for inductive metaphysics.[25]

Becher points out that knowledge of real objects is, like knowledge of the future, based on the presumption of regularity.[26] According to his reconstruction, we introduce the assumption of the existence of real objects in order to be able to view the

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[22] See above, n. 15.

[23] I use "inductive" here in a wide sense of the term. Inductive inferences in this sense include all kinds of non-deductive inferences, and in particular inductive generalizations (also called "enumerative induction"), analogical inferences, and inferences to the best explanation.

[24] The label "Inference to the Best Explanation" goes back to Harman (1965). Also common is the term "Abduction" introduced by Charles S. Peirce. Cf. Schurz (2008, 202 f.).

  I write "Inductive Generalization", "Analogy" and "Inference to the Best Explanation" with capital letters when I am talking about the inference form. I use lower case letters when I mean particular inferences of the respective form.

[25] For a defense of Inference to the Best Explanation as the central form of justification within inductive metaphysics, see Scholz (2018a). See also Seide (forthcoming) for an analysis of Wilhelm Wundt's use of an inference to the best explanation within inductive metaphysics.

[26] Sometimes Becher also presents it as if the postulation of external objects was based on the stronger presumption of lawfulness (see n. 16 above), not the presumption of regularity (Becher 1914, p. 164). This depends on whether or not the regularity to be achieved by the postulation of external objects is a strict regularity.

overall reality as more regular (Becher, 1914, p. 163). If we assumed that only our own consciousness existed, much of what happened – which would then be limited to our own states of consciousness – would not follow any rules. If I concentrate on the content of my consciousness, a sudden loud noise, for example, is an occurrence that is not related to any previous content of my consciousness according to any rule. If, on the other hand, I expand the context by postulating the existence of external objects, which I can then understand as causes of my perceptual experiences, I can thereby embed my experience of a loud noise into a regular overall context. The loud noise can then be *causally explained* by an external process that regularly results in loud noises, such as the unloading of wooden planks (Becher, 1914, p. 86). And the same with many more of my experiences. Becher also points out that we do not have to start from scratch to create such a theory about how external objects cause our perceptions. Already our pre-scientific cognition accomplishes a great deal in this respect; the natural sciences have even expanded the picture created by pre-scientific cognition into a very powerful theory (Becher, 1914, p. 175).

I now want to argue that this postulation of external objects is supported by an inference to the best explanation. As I want to show, this is made clear by several passages.

First of all, the method of Inference to the Best Explanation[27] starts with a set of observed phenomena that require an explanation. In a second step, various hypotheses are considered which, if they were true, would explain the observed phenomena. These hypotheses are then compared to determine which of them explains the phenomena best. When it is determined which hypothesis offers the best explanation, the inference is drawn: We infer to the hypothesis which is considered to be the best explanation of the observed phenomena (Lipton, 2004 [1991], p. 56; Bartelborth, 1996, p. 141).

As we have just seen, Becher introduces the hypothesis that there are real external objects as a causal explanation for our sequences of perceptions, in order to make the overall world as regular as possible. The explanation is therefore based on the presumption of regularity: against the background of the presumption of regularity, this hypothesis is the best explanation of the (otherwise irregular) sequence of our perceptions.[28] It is a *good explanation* exactly because—and to the extent that –, in accordance with the presumption of regularity, it displays the overall world (including our sequences of perceptions) as highly regular.

Let us now take a look at passages in which Becher rules out alternative hypotheses because they cannot (or at least not sufficiently) explain the emergence of our

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[27] I distinguish here between the *method* of Inference to the Best Explanation and the actual *inference* to the best explanation. The inference is part of the method, but the method comprises more, e. g. making observations, building and comparing hypothesis etc. See Scholz (2015, p. 149; 156 ff.) for this distinction.

[28] As we will see in Sect. 2.2.4, this step is not as simple as it seems at first. We will see that when a good counter-candidate for the best explanation comes into play, it is necessary to develop a standard for comparing and ranking explanations in more detail than Becher does.

sequences of perceptions.[29] For example, Becher considers the fictionalist position that the external world is merely a fiction that we use for orientation and as a means to predict future perceptions (Becher, 1914, p. 171). He dismisses it, however, because the advocates of such a position admit that our perceptions appear *as if there were external objects*—a fact for which this position, in contrast to realism, then offers no satisfying explanation (Becher, 1914, p. 172).[30]

In a similar way he excludes the idealist positions of Kant and Fichte, according to which the understanding or the I constructs the sensual world of appearance. Becher emphasizes that the idealist theories do not offer a good explanation for the fact that children, despite their ignorance of astronomical laws, see the moon in the right place, i.e. exactly in the position in the sky that it must occupy according to the calculations of astronomers (Becher, 1926b, p. 12). The idealists would have to hold that the understanding or the I of children places the appearance of the moon exactly in the right position, and it is not understandable how they should be able to do this. Idealism is therefore inferior to realism, which offers a straightforward explanation for the fact that even children see the moon in the right place. As Becher puts it, the hypothesis that the perceived objects are real things in themselves is an *incomparably more powerful hypothesis* [*eine unvergleichlich leistungsfähigere Hypothese*] than the idealist competitor (Becher, 1926b, p. 13). I read this as an argument for dismissing idealism and accepting realism, because realism offers the best explanation for our sequence of perceptions.[31]

2.2.4 An alternative to Becher's realism

As we have seen, Becher dismisses certain idealist positions because they are not able to explain the series of our perceptions as well as the realist hypothesis that there are real external objects. It will be instructive to look more closely at another theory that cannot be so easily dismissed in the context of Becher's inductive

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[29] To be sure, it is possible to read Becher alternatively in such a way that he uses a still stronger inference form, namely "Inference to the Only Explanation" (cf. Bird 2007). For he seems to argue that the competing theories not only fail to provide *good* explanations, but even *completely fail to explain* the sequence of our perceptions. This, one might think, is a particularly attractive form of inference, because by excluding all alternative explanations, the only remaining hypothesis has to be accepted as true (as opposed to only likely to be true), making the inference conclusive. But as Bird (2007, p. 425) points out correctly, such an inference requires the additional assumption that there *actually is* an explanation of the phenomenon in question. And as the reconstruction so far shows, Becher holds that this assumption has to be backed up by the presumption of regularity (or even by the stronger presumption of lawfulness): Without the presumption of regularity we would have to be satisfied with the possibility – or even consider it probable – that there simply is no rule under which the occurrence of our perceptions falls, thus that there is no explanation for their occurrence. But the presumption of regularity is itself not evident. Therefore, even if we reconstruct Becher's argument for the existence of real objects as an inference to the *only* explanation, this inference can – by Becher's own standards – make the conclusion only probable.

[30] Obviously, Becher's argument bears some resemblances with the so-called "no miracle argument" for the real existence of theoretical entities, which was heavily discussed in the philosophy of science in the second half of the twentieth century. (For overviews, see Boyd 1989, p. 7 ff., and Psillos 1999, chap. 4.).

[31] See Becher (1926b, pp. 12 f.; 15; 24; 26) for more formulations which strongly suggest that Becher holds that realism is justified by the fact that it is the best explanation of the sequence of our perceptions.

metaphysics. It is a theory brought forward by Bertrand Russell. Although it falls in a similar period to Becher's writings, Becher does not seem to have been aware of it. Russell's theory is also an interesting case of contrast because, as we will see below, it is a theory Reichenbach contrasts with his own account of realism.[32]

Russell's theory can best be introduced as an improvement of a theory Becher does discuss: Becher considers the idea that objects are mere perceptual possibilities, a theory he attributes to John Stuart Mill and ultimately traces back to George Berkeley (Becher, 1921, p. 94). According to this theory, there are no real objects, but only our perceptions and certain *perceptual possibilities* that can become actual. For example, the wall behind my back, which I do not perceive right now, is a perceptual possibility that becomes actual as soon as I turn around. Becher's objection against this theory is that it does not accomplish what is required: what is not real, but merely an unrealized possibility, cannot have a causal effect, thus cannot be embedded in an actual causal nexus. The postulation of such mere perceptual possibilities can thus contribute nothing to considering the course of the world as a course governed by actual laws (Becher 1922, p. 94).[33]

Bertrand Russell's version of phenomenalism, which he advocates in several writings,[34] can be seen as an improvement of the theory of mere perceptual possibilities. Russell's initial aim is to construct the objects of physics out of sense-data (1918 [1914], p. 146). By sense-data he means the immediate objects of our sensations, for example particular patches of color or particular noises (1918 [1914], p. 147). But Russell recognizes that it is not possible to construct the objects of physics solely out of sense-data that are actually sensed.[35] For this reason, he introduces additional entities, which he calls "sensibilia". Sensibilia are just like sense-data, only that they are not necessarily actually sensed (1918 [1914], p. 148).[36] The appearances of an object can be divided into actual appearances (sense-data), and possible appearances

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[32] Thanks to an anonymous reviewer for *Synthese* for drawing my attention to the question of how Russel's position relates to Becher's argument for realism.

[33] Becher admits that Berkley's version of this theory adds an important twist to it: Berkley regards perceptual possibilities not as unactualized mere possibilities, but as ideas in God's mind. Thus, they are actual even while we do not perceive the respective object. Becher criticizes, however, that within this theory it remains incomprehensible *why* God produces the appearances just in such a way as if they were produced by real objects. One gets the impression that God intentionally deceives us into believing in a real world which does not exist at all (Becher 1926b, 12f.) – and, as I understand Becher at this point, thereby *something remains unexplained* by the theory, which leads to the fact that it is inferior to realism.

[34] Most relevant are the article "The Relation of Sense-Data to Physics" (1918 [1914]) and the book *Our Knowledge of the External World* (1926 [1914]). A good overview is given by Leerhoff (2008, Sect. 4.2). For reasons of brevity, I must limit myself here to the basic idea of the approach.

[35] This is at least the impression one gets when reading "The Relation of Sense-Data to Physics" (1918 [1914]). In *Our Knowledge of the External World* (1926 [1914]), on the other hand, Russell does not seem to be sure about whether it is necessary to postulate the actual existence of unsensed sensibilia (which he calls "ideal appearances" in (1926 [1914])). Sometimes he suggests that unsensed sensibilia actually exist (1926 [1914], p. 95), sometimes he denies the necessity of the postulation of their actual existence (1926 [1914], p. 117). This will turn out to be interesting below with regard to Reichenbach's interpretation of Russell's theory.

[36] To be precise, "sensibilia" is the general term that subsumes both sense-data (sensed sensibilia) und unsensed sensibila.

(unsensed sensibilia). The objects of common sense are then defined as the class of their actual and possible appearances (1918 [1914], p. 154).

The difference to a theory of mere perceptual possibilities consists in the claim that sensibilia are entities that exist independently of being sensed. This means that, ontologically speaking, the possible appearances of objects are *actually existing sensibilia*, which only are not actually sensed. In a way, then, Russell's phenomenalism turns out to be a sophisticated form of realism, because Russell postulates the existence of sensibilia which are entities existing independently of being sensed by anyone.[37]

There is a remarkable similarity between the ways Becher and Russell proceed when developing their respective theories. Just like Becher, who postulates real objects in order to expand the range of our perceptions to the overall picture of a world that follows certain comprehensible regularities, Russell postulates unsensed sensibilia in order to fill the gaps in our series of perceptions. And I think that Becher, had he become aware of Russel's position, would have had to concede that it too offers an explanation for the series of our perceptions, albeit a different one. The pressing question, then, is how to decide between different possible explanations of the same data.

Russell, again like Becher, acknowledges that his theory is only a hypothesis which, just like the hypotheses of the sciences, cannot claim any certainty and can possibly be overthrown by further evidence or a better alternative in the future (Russell, 1918 [1914], p. 158; 1926 [1914], p. 103). It is also instructive to see what he brings forward as a reason for preferring his theory over the competing realist alternative: Russell refers to Occam's razor as a principle to support his theory (Russell, 1918 [1914], p. 155; 1926 [1914], p. 112). The reasoning behind this is that the unsensed sensibilia postulated by Russell are *entities of the same kind* as sense-data, the only difference being that they are unsensed. Becher's realism, on the other hand, postulates objects—things in themselves—which are of a *completely different kind* than the perceptions we have immediate access to. So Russell seems to claim that his hypothesis leads to a *better* explanation of the series of our perceptions because the hypothesis is *simpler* with regard to its general ontological commitments.[38]

On the other hand, Becher could point out that things are not that clear: While Russell's theory is simpler with regard to the *types* of postulated entities, the *particular physical objects* constructed from the sensibilia look much more complicated than the objects postulated by Becher. According to Russell's theory, each physical object consists at any time t of *infinitely many* sensibilia, each of them representing a different potential perspective of a potential observer on the constructed object at that time (cf. Leerhoff, 2008, p. 131). Also, Russell has to go to great lengths to explain how the construction of the objects from sensibilia actually works, which

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[37] In this sense, Merrilee H. Salmon (1974, p. 17) holds that, strictly speaking, Russell's position is not a phenomenalism at all. But see note 35 above.

[38] For the role of Occam's razor in today's conceptions of Inference to the Best Explanation, see Schurz (2008, p. 219). According to Schurz, new entities should only be introduced if they yield a causal or explanatory unification of the phenomena.

adds to the impression that his theory is not that simple after all.[39] And if we accept simplicity as a criterion for ranking explanations,[40] it is not clear which of the two theories ranks better on this criterion.

To put it in a nutshell, I think this discussion shows that while Becher presents an interesting outlook on the basic idea of an argument for a realist ontology, it has to be said that many details have to be worked out for it to succeed. In particular, we need to work out concrete criteria for evaluating explanations in order to be able to weigh which explanation should be distinguished as the best (based on the current evidence). An obvious first step for this, in line with the basic idea of inductive metaphysics, would be to take a look at how explanations work in the sciences and to make a deep analysis of the way competing possible explanations are weighed in scientific practice.[41]

2.2.5 The empirical-inductive method as the method of metaphysics

As we have seen, the empirical-inductive method of the natural sciences is a complex method which incorporates several different partial steps. It is an *empirical* method, because it builds on perceptions as its ultimate basis of knowledge. It is an *inductive* method, because it includes various forms of inductive reasoning (Inductive Generalization, Analogy, and Inference to the Best Explanation). But the name of the method must not hide the fact that it also contains *deductive and* a priori *elements*: The natural sciences also make considerable use of *mathematical knowledge*, which is not based on experience (Becher, 1926b, p. 17 f.). Becher also notes that besides inductive inferences, *deductive inferences* play an important role in the natural sciences: on the one hand, further more concrete laws are deductively derived from inductively inferred general laws. On the other hand, hypotheses that are not yet considered to be confirmed can be verified by deductively deriving consequences

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[39] Among other things, Russell points out that according to his theory, space has six dimensions instead of only three, because at each point in the three-dimensional physical space there is a three-dimensional perspective (1918 [1914], p. 162), which in turn consists of the appearance which the universe presents from this particular point of view (1918 [1914], p. 160).

 Richard Swinburne (1918) holds a conception of Inference to the Best Explanation according to which simplicity is one central (but not the only) criterion for supposing that an explanation is better, and therefore more likely to be true, than another explanation. He distinguishes various facets of simplicity (1999, 23 ff.), a version of Occam's razor among them. While Russell's theory might have the upper hand with regard to this facet (the number of kinds of objects being postulated), I think it is to be expected that it does not fare well with regard to other facets of simplicity listed by Swinburne, such as the number of *things* (as opposed to the number of *kinds* of things) postulated or facets that regard the simplicity of the *laws* to be postulated by the theory.

[40] As we will see in Sect. 3.4, simplicity is also a central criterion for Reichenbach when it comes to evaluating hypotheses.

[41] It might, of course, be asked from a generally skeptical perspective why the best explanation can claim to be likely true, or why we should regard inferences to the best explanation as truth-conducive at all. I do not think that Becher has a conclusive answer to this question. Becher's strategy on this issue seems to be to point out that inferences of this kind are central to the sciences, and that if this practice is accepted in the sciences, it is good enough for metaphysics. We will come back to this topic in Sect. 3.6, where we will see how Reichenbach struggles with a similar question in *Experience and Prediction*. See in particular n. 60.

from them, which can then be tested on the basis of experience (Becher, 1926b, pp. 19–26). And last but not least, as we have seen above, the inductive inferences that allow us to transcend the realm of our own present consciousness content are based on *presumptions that cannot be empirically justified*. Even if they cannot be justified a priori either, Becher calls them a priori *principles* (Becher, 1914, p. 81; 1921, pp. 222–229; 1926b, p. 17), since they necessarily precede any empirical knowledge.

So that is the method of the natural sciences. The next question is how the method of metaphysics should be designed. Becher's position on this is—in keeping with the basic idea of inductive metaphysics—that the empirical-inductive method just outlined should also be applied in metaphysics.

First of all, Becher is very critical of the a priori methods of classical metaphysics. The impression that metaphysics must follow an a priori method is, according to him, created by the fact that the total reality to be investigated in metaphysics far exceeds the limits of our experience (Becher, 1926b, p. 20). But, as he points out, none of the great metaphysical systems has ultimately proved tenable. Moreover, Becher notes that unacknowledged empirical elements have always been incorporated into the construction of these systems—the alleged a priori systems have never been completely free of empirical input (Becher, 1926b, p. 21). It is therefore time to officially admit empirical foundations also in metaphysics.

As he points out, the empirical-inductive method, which has proven itself in the natural sciences and has been used successfully for a long time, can also be applied in the field of metaphysics. The above analysis has shown that this method proves to be so powerful because it combines many different elements: First of all, perceptions as the ultimate basis of knowledge are also indispensable in metaphysics, simply because it is the only way in which we can have any contact at all with the reality that metaphysics seeks to explore (Becher, 1921, 323 f.; 1926b, p. 21). The fear that the limits of experience cannot be exceeded within the framework of the empirical-inductive method has already proved to be unfounded above. It has become clear that the natural sciences also rely on a priori elements and principles in their empirical-inductive method, especially in the form of a priori presumptions necessary for cognition. Thus, especially by using inferences to the best explanation, which are based on the presumption of regularity, the limits of experience can be transcended and insights can be gained in the area transcending immediate experience. The idea of inductive metaphysics is that this can be done in the same way within the framework of metaphysics (Becher, 1921, p. 324). The result is a metaphysics that can never be considered complete and whose results, because they are based on experience and on unprovable principles of cognition, can never be considered certain. However, these are points which also apply to the natural sciences and which do not prevent us from considering the enterprise as fruitful in this area. So they should not bother us in metaphysics either (Becher, 1926b, pp. 22–27).

In a way, we have already seen above an example of a metaphysical use of this method[42]: Although the question of realism occurs in the natural sciences and also in everyday life, it is certainly a metaphysical question because of its generality. The individual sciences determine the reality of certain entities, e.g. electrons, within the framework of their theories. The claim that there is, in fact, an external world with objects that are in a way that is independent of our way of perceiving them is a general observation that transcends the individual sciences and therefore falls within the realm of metaphysics.[43] At the same time this example also shows that the boundaries between metaphysics and the individual sciences are fluid.

With these points in mind, let us now take a look at Reichenbach's position.

3 Reichenbach's inductive metaphysics

In his paper "Metaphysics and Natural Science" (1978a [1925]), Reichenbach, just like Becher at about the same time, investigates the relationship between metaphysics and the natural sciences and strives to develop a new connection between these fields. At a time when other logical empiricists, in particular key members of the Vienna Circle, declared that metaphysics is impossible because metaphysical propositions are not only false or unjustified, but strictly speaking meaningless (Schlick, 1926, p. 158; Carnap, 1932, p. 233)[44], Reichenbach shows himself open-minded towards metaphysical questions. In this way he strongly dissociates himself from the Vienna Circle. The position he develops, on the other hand, brings him very close to the tradition of inductive metaphysics.

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[42] Becher applies this method in various publications to numerous problems in metaphysics. For some examples, see n. 14 above.

[43] As we will see in Sect. 3.3, this is also for Reichenbach one of the central questions of metaphysics.

[44] In Carnap's case, one has to be careful, though. In a note he added in 1957 to his 1932 paper, he explicitly limits his critique of metaphysics to the great systems of traditional metaphysics, excluding from his criticism those approaches which aim at a synthesis and generalization of the results of the empirical sciences (Carnap 1959, p. 80). This leaves open the possibility that he (at least at a later stage) considered forms of inductive metaphysics possible. Schlick's paper, on the other hand, contains an explicit critique of inductive metaphysics (1926, 153 ff).

Schlick's critique of inductive metaphysics rests mainly on a very narrow understanding of inductive inferences. He argues that by inductive reasoning we can only ever extend our knowledge from observed instances to instances of the same kind. According to him, it follows that an inductive inference can never advance into a new domain (Schlick 1926, p. 143). This reveals that all he has in mind are what today is called *enumerative inductive inferences*. But as we have seen above (Sect. 2.2.3) and will see in the following, both Becher and Reichenbach argue that, in Reichenbach's terminology, "overreaching inferences" (Reichenbach 1938, p. 127) to a new domain are possible. In particular, as I will argue, both can be read as applying an *inference to the best explanation*, by which they in fact claim to be able to reach over to a new domain: Both want to defend that, starting from our perceptions, one can use an inference to the best explanation to infer the existence of objects that are independent of our perceptions. To be sure, as we will see, an inference of this kind does bring some problems with it. But Schlick's criticism seems to me to be too simplistic, insofar as it does not even consider the possibility of such inferences from the outset.

3.1 The critique of traditional metaphysics and its systems

In his paper "Metaphysics and Natural Science", Reichenbach begins his overview of the relationship between metaphysics and the natural sciences with the observation that metaphysics is traditionally associated with the demand to construct a system (Reichenbach, 1978a [1925], p. 283). However, he notes the failure of the traditional systems—such as those of Spinoza, Kant and Hegel—and points out that attempts to save parts of these systems also fail because the parts only have value within the framework of the whole.[45] His conclusion is that the goal of designing an ultimate system must be given up. If we want to do metaphysics, we have to do it in a different way, because the traditional way of doing metaphysics has failed.

In this respect, Reichenbach's position does not differ from that of the inductive metaphysicians and in particular not from Becher's position. He rejects traditional metaphysics, especially the metaphysics of the German Idealists and their claim to create a complete metaphysical system a priori. This is of course not surprising. Also other logical empiricists, especially of course the representatives of the Vienna Circle (Carnap et al., 1929, p. 18), share this diagnosis as the starting point of their own program with the inductive metaphysicians. The differences to the Vienna Circle, and at the same time the interesting parallels to inductive metaphysics, become apparent when one looks at what, according to Reichenbach, the alternative to traditional metaphysics is. Instead of completely abandoning the enterprise of metaphysics, Reichenbach proposes to put metaphysics into a new relationship with the natural sciences.

3.2 The alternative: building a system from below

In order to find a new method for metaphysics, Reichenbach suggests to take a look at the successful natural sciences:

> This much, at least, philosophy ought to have learned from science: the way to find a system is not to construct it before the individual problems are solved. The exact sciences today are in possession of a system of a magnificence and a certainty that philosophy might well envy. They are indebted for this system, however, not to the speculative efforts of the so-called natural philosophers of all ages, but to the modest investigators of nature, each of whom, singly, has concentrated on an individual problem. (Reichenbach, 1978a [1925], p. 284)

So according to Reichenbach, it is not a mistake per se to strive for a system. The mistake of traditional metaphysics was the idea of building a system *before*

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[45] In his later article "Kant and Natural Science", Reichenbach points out that Kant's philosophical system was deeply influenced by his interests in the natural sciences. He criticizes that Kant, however, pursued the ambition to construct a system from pure reason: "Even in his day, Kant had the possibility of constructing philosophical analysis upon the basis of natural science in accordance with the available factual material, similarly to the way in which science itself rests in turn upon the facts of perception. But he fails to see this inductive route; he never calls philosophy a philosophy of science." (Reichenbach 1978b [1933], p. 393) This description of what Kant could have done is interesting because it actually sounds as if Reichenbach wanted to suggest to Kant to do inductive metaphysics.

individual problems were tackled, as a general template for the solution of all individual problems. The natural scientists did it exactly the other way around: Without the background of an already finished system, they began to solve individual problems, and by doing so, they slowly built a system from below. According to Reichenbach's idea, metaphysics should take this as a model:

> [M]etaphysics can learn a great deal from natural science about working methods and the degrees of possible precision and possible discretion. I certainly do not want to express the opinion that the methodology of the natural sciences can be adopted without modification for uses in metaphysics. But once metaphysics has attained the plane of scientific method, it has taken the biggest step forward. (Reichenbach, 1978a [1925], p. 284).

Just like Becher, Reichenbach sees the most promising way to tackle the problems of metaphysics in learning from the approach of the natural scientists. To be sure, while Becher brings forward the idea that the method can be transferred in a direct way, without modification (see Sect. 2.2.4 above), Reichenbach sounds more cautious here. He seems to promote the idea of adjusting the method of the natural sciences to the problems of metaphysics.[46] The question is what he exactly means by this. Before we approach the answer to this question by means of a central example, however, we must first clarify what, according to Reichenbach, is metaphysics and which are the central metaphysical problems that the new method is intended to solve.

3.3 Metaphysics after the breakdown of the traditional systems

Reichenbach's general explanation of what metaphysics is is very brief:

> Metaphysical inquiry wishes to proceed beyond what is known in science, asking for the transcendent[47] significance of scientific results and wanting to learn something about the relation of the knower to things in themselves. (Reichenbach, 1978a [1925], p. 285)

We can extract from this that metaphysics somehow tries to find out more about what is behind the phenomena, and does so by reflecting on the results of the natural sciences. What he means by this becomes clearer when one takes a look at the particular problems Reichenbach has in mind. He highlights three problems (or problem areas), which according to him are central to metaphysics (1978a [1925], p. 285):

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[46] As we will see in Sect. 3.6, this changes in *Experience and Prediction*. In this later book, Reichenbach seems to have a more direct transfer of the method of the natural sciences to metaphysics in mind.

[47] I changed the translation in Reichenbach (1978a) here, which reads "transcendental" instead of "transcendent". In the original text, Reichenbach (1925, 160) writes: "Die Metaphysische Fragestellung […] fragt nach der *transzendenten* Bedeutung wissenschaftlicher Resultate […]" (my italics). Since Reichenbach was very familiar with Kant's philosophy, I suppose he does not make a mistake here. What he means is a significance of scientific results that *transcends* the realm of our experience. This also fits to his position of realism, which is discussed in more detail below, according to which we can have a (albeit limited) knowledge about things in themselves.

The first is the *problem of existence*, or the question of the reality of the external world, the second is the *problem of the freedom of the will*, and the third is the *question of life*, which is the question of the special place of life among the phenomena of nature. As we can see here, Reichenbach, in accordance with Becher's definition of metaphysics as the science of total reality (see above, Sect. 2.2.1), sees one of the main tasks of metaphysics in a unification and integration of different scientific and pre-scientific fields, such as our everyday life perspective and the natural sciences (problem of the freedom of the will), or biology and physics (question of life). The problem of existence, which, as we have seen above, is also central for Becher, provides a unification through the fact that the underlying question of the existence of the external world concerns many different scientific and pre-scientific fields at the same time and has a generality that exceeds the fields of the individual sciences. All in all, it seems that Reichenbach's conception of metaphysics corresponds quite well to that of Becher.

In "Metaphysics and Natural Science", Reichenbach concentrates on the problem of existence. Before we take a closer look at his version of realism and the justification he provides for it, we must first consider his analysis of the method of the natural sciences. The solution to the problem of existence, which is to consist in a justification of realism with regard to the external world, is supposed to be based on the insights we gain when we study the method of the natural sciences more closely.

3.4 The method of natural science

Reichenbach presents the method of the natural sciences, or one interesting aspect of it, using an example known today as the "curve-fitting problem"[48]:

> Think, for instance, of the process of making a graph: a row of points, established by measurement, are marked in, and the physicist joins them together by drawing the most continuous curve possible, the 'simplest' curve. He then asserts that this curve represents the law governing the phenomenon that is confirmed by experience. Why does he select just this curve – why not one that fluctuates widely between the observed points? (Reichenbach, 1978a [1925], p. 290)

There are infinitely many different curves that would be compatible with the recorded measurements, but the scientist chooses the one that is the simplest. The interesting point now is that this is not usually for purely instrumental reasons. In fact, we consider the law that corresponds to the simplest curve to be more probable than the laws that would correspond to much more complicated curves. Of course, the probability we ascribe never reaches the level of certainty. It is always possible that further measurements will subsequently refute an assumed law. But even in such a case we do not give up the idea that the simplest law is the most likely. Instead, we next choose as the most probable law the one that corresponds to the simplest curve that is compatible with the new measurements (Reichenbach, 1978a [1925], p. 290).

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[48] For a general overview of the curve-fitting problem, see Forster (1999).

Reichenbach points out that the inference involved in curve-fitting is based on what he calls "a metaphysical axiom, a belief in the uniformity of the world" (Reichenbach, 1978a [1925], p. 292). He also calls this principle a "probability axiom" regarding the contents of our perceptions:

> The probability axiom asserts that a certain statistical regularity is to be found in the contents of perceptions. Ultimately, it is an assertion of the form, "If I have seen green with blue seven times, then, on the eighth occasion, I will also see green with blue." (Reichenbach, 1978a [1925], p. 292)

The corresponding inference from observed cases (the measurements) to unobserved cases (the other points of the curve) is called a "probability inference" (Reichenbach, 1978a [1925], p. 290), because we do not know the conclusion with certainty. Rather, the simplest theory, the one that projects an observed regularity to unobserved cases in the simplest way, is considered the most probable.

Reichenbach formulates three remarks regarding the inference involved in this: The first point is that the inference made is an inductive inference in that it goes from observed cases to unobserved cases. As such, there is no a priori justification for it. The second point is that the inference cannot be justified empirically, either. There is no non-circular way of justifying inferences from observed to unobserved cases. And the third point, which is particularly interesting in the present context, is that this kind of inference is indispensable for the natural sciences. Without it, it would be completely impossible to make a decision between different possible theories (Reichenbach, 1978a [1925], p. 291). These remarks clearly correspond to statements made by Becher with regard to the principle of regularity (and at least the first two, of course, go back to Hume), which, according to him, is the basis of inductive inferences (see Sect. 2.2.2 above).

The parallel becomes even more apparent when Reichenbach reflects on the question what consequence the third point has for the epistemological status of the principle. Given that it is a necessary condition of a large amount of our knowledge [*Erkenntnis*], can we justly call it a synthetic a priori principle? Reichenbach's answer is double-edged:

> The probability principle is indeed a synthetic a priori judgment – if there is any such thing. There is no other principle that could be more justly so called—but it, too, is not a synthetic a priori judgment. (Reichenbach, 1978a [1925], p. 291; italics in original)

In one sense, Reichenbach is tempted to call it a synthetic a priori principle, since it is a necessary principle that precedes our empirical knowledge. On the other hand, however, he points out that, strictly speaking, we cannot conceive of it as a synthetic a priori principle. The problem is that there is no way to guarantee that the principle turns out to be true:

> The probability axiom asserts that a certain statistical regularity is to be found in the contents of perceptions. […] But the knowing mind has not the least influence upon whether this will or will not happen. (Reichenbach, 1978a [1925], 291 f.)

Reichenbach's point here is that the contents of our perceptions are independent of us, in the sense that we cannot completely freely decide how our perceptions will turn out in the future. Thus, there is something independent of the knowing subject that decides whether the principle turns out to be true. In this sense, the principle is not knowable a priori.

Reichenbach summarizes this point by saying that the principle, since it depends on something independent of the knowing subject, says something about things in themselves (Reichenbach, 1978a [1925], p. 292). This point foreshadows Reichenbach's thoughts concerning the question of realism, to which we turn in the next section. Just as Becher, Reichenbach first formulates the principle of regularity with regard to our perceptions. Before it is applicable to things in themselves, it has to be asked on what our belief in the existence of things in themselves is based. And it turns out that Reichenbach thinks that the belief in the existence of external objects is based on the principle of regularity, just like our practice of inductive reasoning: "Both problems contain the same metaphysical axiom, for the assumption of the existence of physical objects can be traced back to the assumption of the probability inference" (Reichenbach, 1978a [1925], p. 292). In this sense, the method used by scientists in the process of curve-fitting, namely the use of certain inductive (or as Reichenbach calls them: probability) inferences, can shed light on the metaphysical problem of the existence of the external world.

Let us now take a closer look at Reichenbach's rationale for realism, which, at least in "Metaphysics and Natural Science", takes an interesting twist that distinguishes his account from Becher's.

3.5 Reichenbach's definition of realism in "Metaphysics and Natural Science"

At first, Reichenbach seems to go the same route as proposed by Becher. As seen above, he, just as Becher, holds that the claim of the existence of external objects is based on the principle of regularity. This lets one expect that on the basis of this principle we infer the existence of external objects from our perceptions. And this is exactly what Reichenbach seems to suggest:

> Our primary experience is solely of perceptions, from which we then infer the existence of things. This is, at any rate, the way in which the relation is usually presented. What is the nature of this inference? (Reichenbach, 1978a [1925], p. 292)

The first sentence of this passage seems to indicate the expected inference. But the second sentence, which sounds a bit like Reichenbach wants to distance himself from this idea, should give us some doubts. And as we will see, he indeed conceives the relationship between our perceptions, the principle of regularity and the assumption of the existence of external objects somewhat differently.

In order to develop his realism, he first considers a phenomenalistic position as a contrast foil, which he attributes to Ernst Mach and Bertrand Russell (Reichenbach,

[1978a](1978a) [1925], p. 293).[49] The basic idea of this position, which Reichenbach calls "scientific solipsism", is that since our primary experience consists only of perceptions, we can in principle replace all assertions about the existence of external objects by combinations of assertions about perceptions. For example, the existential assertion "The light of the sun provides warmth" could be substituted by the perceptual assertion "Whenever I notice certain sensations of light I also notice sensations of warmth" (Reichenbach, [1978a](1978a) [1925], p. 292). The idea of scientific solipsism is that in this way all assertions about real things can be understood as abbreviated expressions of perceptual assertions, so that the entire system *a* of existential assertions can be reduced to the system *a'* of perceptual assertions.

Against this view, Reichenbach points out that the systems *a* and *a'* cannot be said to be equivalent, because something important is missing if we replace all our assertions about real objects solely by assertions about perceptions. In order to make *a'* be equivalent to *a*, we have to add the principle of regularity (or, as he calls it, the probability axiom) to it, which is so deeply entrenched in our everyday as well as in our scientific world view of real objects:

> Scientific solipsism cannot completely take the place of the concept of existence unless the probability axiom is added to it; but when this transcendent assumption is added, it loses its solipsistic nature, for the probability axiom is an assertion that cannot be derived from experienced sensations; it is a metaphysical proposition that contains right within itself the whole problem of a transcendent reality. (Reichenbach, [1978a](1978a) [1925], p. 293)[50]

As we have seen above, the inductive practice of our everyday life and of the sciences necessarily relies on the probability axiom, which cannot be based on perceptions, but points to something beyond our perceptions. Reichenbach proposes to regard the system *a* of all assertions about real objects as being equivalent to the system *a'* of all assertions about perceptions *plus* the probability axiom P: $a \equiv a' + P$.

The important point is that Reichenbach does not regard this as a *proof or a justification* of realism. He has a weaker point in mind: The equivalence "$a \equiv a' + P$" can be understood as a *definition* of realism:

> Our definition runs, " 'Things exist' is logically equivalent to 'I have sensations, and the probability axiom applies to them'." (Reichenbach, [1978a](1978a) [1925], p. 294)

This definition does not come down to a *solution* of the problem of existence, since the existence of real objects is not shown in this way. But Reichenbach counts this as a *logical progress*, a progress that "consists in the fact that the metaphysical element in the problem of existence is shown to be the same one that is contained in the problem of probability" (Reichenbach, [1978a](1978a) [1925], p. 294). His reasoning is that the analysis of the scientific method as presented above shows that realism

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[49] Reichenbach's interpretation of Russell deviates from my presentation in Sect. 2.2.4 in that he reads Russell as a pure phenomenalist. I will address this point at the end of this section.

[50] Again, I changed the translation from "transcendental" to "transcendent". See n. 47 above.

as defined by him has always been implicitly presupposed by the natural sciences, a point that even positivists like Mach must admit (Reichenbach, 1978a [1925], p. 294). Therefore, if we want to take the natural sciences seriously, we cannot discard realism.

That this is a different strategy than the one Becher pursues with regard to the justification of realism becomes clear in a very interesting remark that is hidden in a footnote of Reichenbach's text. Becher, we recall, infers the existence of external objects from our series of perceptions, namely as the best explanation of this series (see above, Sect. 2.2.3). Reichenbach, on the other hand, explicitly excludes such an inference:

> Note that no probability inference is drawn from the fact of sensations about the existence of things; rather, probability inference takes place entirely on the sensation side and moves from experienced sensations to those to be experienced in the future. On the contrary, we are asserting here that this process as a whole is equivalent to the metaphysical hypothesis of the existence of the external world. (Reichenbach, 1978a [1925], p. 297, n. 2)

Reichenbach explicitly holds that probability inferences, which are based on the principle of regularity, do not reach over from the domain of sensations to the domain of real objects. They are only inferences from past or present to future sensations. By drawing these inferences, natural scientists kind of *show* that they presume the existence of the external world.

As Reichenbach himself points out, his definition of realism is very closely tied to what is immediately given in perception (1978a [1925]). It may seem, therefore, that the position he wishes to advocate does not go beyond Mach's and Russell's phenomenalist positions in any significant way. This impression can be reinforced by the fact that Russell, as we saw above in Sect. 2.2.4, actually holds a position that also contains certain realist elements.[51] Russell postulates the existence of unsensed sensibilia, which exist mind-independently. And one could even argue that this position is completely in line with Reichenbach's definition of realism.[52] As we have seen above, Russell introduces unsensed sensibilia exactly in order to expand the range of our perceptions to the overall picture of a world that follows certain regularities, which in Reichenbach's terms means that the probability axiom applies.

My impression, however, is that Reichenbach clearly wanted to distance himself from Russell's (and Mach's) position, which in part has to do with the fact that he read Russell in a different, more phenomenalist and less realist, way. As I will now argue, this led Reichenbach to fail to see that Russell could be read in a way that would make his position a defensible competitor to the position Reichenbach wanted to justify.

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[51] Russell's position is the relevant point of reference here, because while Reichenbach mentions Mach alongside Russell and ascribes the position of phenomenalism to them jointly, he only explicitly cites one of Russell's writings, namely *Our Knowledge of the External World* (1926 [1914]).

[52] Thanks to an anonymous reviewer for *Synthese* for pointing this out to me.

First of all, the realism Reichenbach wants to establish clearly is a position closely related to common-sense realism. At the beginning of the discussion of the problem of realism he introduces what he calls "naive realism", which is the "standpoint of the naive person who believes simply in the existence of things", and he sides with this position (or a very similar one) by stating that he "cannot see that anyone has found any better explanations" (1978a [1925], 285). In the rest of the paper, he repeatedly commits himself to the thesis that things-in-themselves exist (1978a [1925], pp. 286; 288; 292). And this is exactly the thesis he thinks Mach and Russell want to deny.[53] It becomes clear, though, that he reads Russell in a different way than I presented it in Sect. 2.2.4 above. According to the position he jointly ascribes to Mach and Russell, which he tellingly calls "scientific solipsism", all existential propositions have to be coordinated with a combination of perceptual propositions (Reichenbach, 1978a [1925], p. 292). Reichenbach does not mention or discuss Russell's hypothesis that besides the directly sensed sense-data there are also unsensed sensibilia, which exist independently of the mind.[54] So it seems to me that Reichenbach wanted to bring forward an anti-phenomenalist position which is close to common-sense realism in that it assumes the existence of things-in-themselves, a position he holds up against the purely phenomenalist position he ascribes to Russell (and Mach). What he failed to realize is that Russell can be read in a more realistic way and that Russell's position is then arguably consistent with Reichenbach's definition of realism.

The interesting point then is that if Russell's position can in fact be shown to be consistent with Reichenbach's definition of realism, Reichenbach (at least in 1978a [1925]) has no resources to rule Russell's position out and to argue for his common-sense related form of realism as the only tenable form of realism. The reason for this is that, as we have seen, he rules out inferences that reach over from the domain of sensations to the domain of real objects and instead gives a definition of realism on the basis of our practice of making probability inferences *within* the realm of sensations. This leads to a very thin concept of realism that leaves a lot undetermined. According to this concept, what we commit to is that there is *something* that goes beyond our perceptions and that is the basis for the correctness of our probability inferences within the realm of our sensations. But it deliberately leaves completely undetermined what this something is, and just like Reichenbach's things-in-themselves, Russell's sensibilia are a possible candidate.

Therefore, while both Becher and Reichenbach see a deep connection between the problem of existence and the principle of regularity (or probability), the connection is set up by them in very different ways: Becher uses the principle of regularity as the *basis for an inference to the best explanation*, which infers from our perceptions to the existence of external objects as the best explanation of them. While

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[53] In another paper, Reichenbach refers to Mach's "critique of the concept of the thing-in-itself" (Reichenbach 1987b [1933], p. 389).

[54] As already pointed out in n. 35 above, there are passages in *Our Knowledge of the External World* (1926 [1914]) which support a strictly phenomenalist reading. It is therefore important to note that this is the only writing Reichenbach explicitly refers to in this context (Reichenbach 1978a [1925], p. 296, n. 1).

Becher does not discuss this point explicitly, we have seen in Sect. 2.2.4 that this strategy can in principle be extended by developing a concrete standard for the evaluation of explanations in such a way that a (fallible) decision can be made in favor of one hypothesis—the presumed best explanation—and against possible competitors. Reichenbach, on the other hand, argues that realism can be *defined* in terms of the principle of regularity, so that the problem of existence is *reduced* to the problem of the presumption of regularity. This is tied to the problem that he gets a very thin concept of realism, which leaves undetermined to a large degree how realism is actually implemented in the world. But as we will see in the next section, Reichenbach, in his later book *Experience and Prediction* (1938), comes to a position concerning the problem of existence which is similar to the position of Becher.

3.6 Reichenbach's justification of realism in *Experience and Prediction*

In his book *Experience and Prediction* (1938), Reichenbach revisits the scene of the debate between realism and positivism. Again, he argues for a realist position. Again, he draws the main idea for his argument from an observation concerning the method of the natural sciences. But this time, the transfer of the method from the natural sciences to the metaphysical question of the existence of real objects is more direct than in the earlier paper.

Reichenbach begins his argument by describing a fictitious example in which scientists infer the existence of unobservable entities from observations. This is supposed to show, against positivism, that it is in principle possible to infer from the domain of immediately observable objects to a domain of not immediately observable objects, or, in Reichenbach's terminology, that overreaching inferences are possible (Reichenbach, 1938, p. 127).[55] In a second step, he then transfers the kind of inference made by the scientists in the example to the relationship between our perceptions and external objects (cf. Psillos, 2011, p. 23). I.e., Reichenbach applies the idea of an overreaching inference to the metaphysical problem of the existence of the external world. In this way he wants to make plausible that the *metaphysical* assumption of external objects, i.e. realism, can be justified by an argument of a form that is also used in the *natural sciences*.

Let us first take a look at the fictitious example, which is the example of a cubical world:

> We imagine a world in which the whole of mankind is imprisoned in a huge cube, the walls of which are made of sheets of white cloth, translucent as the screen of a cinema but not permeable by direct light rays. Outside this cube there live birds, the shadows of which are projected on the ceiling of the cube by the sun rays; on account of the translucent character of this screen, the shadow-figures of the birds can be seen by the men within the cube. The birds themselves cannot be seen, and their singing cannot be heard. (Reichenbach, 1938, 115 f.)

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[55] As we have seen in Sect. 2.5, Reichenbach tries to avoid overreaching inferences in (1978a [1925]).

The people living in this cube cannot observe the birds in a direct way; all they can see are the shadows of the birds. Reichenbach further enriches the example: There is a hidden mechanism, constructed by a "friendly ghost", that ensures that each bird creates not only one shadow on the ceiling, but also another shadow, correlated with the first one, on one of the side walls of the cube. The question then is: Will the people living inside the cube come up with the idea that there is something behind the walls of the cube that causes the shadows, or will they remain in the belief that there are only the directly observable shadows?

Reichenbach considers it very plausible that one day a scientist—whom he calls "a Copernicus"—will first discover through observations that there are corresponding pairs of shadows, each pair consisting of one shadow on the ceiling and one shadow on one of the side walls, and that the motions of these shadows are correlated in a regular way. He will then come up with the following theory:

> He will maintain that the strange correspondence between the two shades of one pair cannot be a matter of chance but that these two shades are nothing but effects caused by one individual thing situated outside the cube within free space. (Reichenbach, 1938, p. 118)

That is, Copernicus postulates the existence of unobservable entities as causes of the observable shadows.

Reichenbach then imagines the objection of a positivist who argues that it is wrong to assume that the assertion of the existence of the objects outside the cube has a meaning beyond the statements about the movements of the shadows themselves. The positivist is of the opinion that the statements about the supposedly independent existing objects can be *reduced* to statements about the shadows and their movements (Reichenbach, 1938, p. 119). So why suppose that there are objects outside the cube?

Reichenbach, unconvinced by the positivist objection, thinks that it *does* make a difference to postulate unobservable objects as causes of the shadows, and that there is a good reason to believe in the theory proposed by Copernicus:

> Judged from the facts observed the hypothesis of Copernicus appears highly probable. It seems highly improbable that the strange coincidences observed for one pair of dots are an effect of pure chance. […] [A]ny physicist who sees this will not believe in a matter of chance but will look for a causal connection. (Reichenbach, 1938, 120 f.)

The difference between the positivist position and the proponent of the hypothesis of the existence of unobservable objects is that the first leaves the correlations between the corresponding shadows unexplained, while the latter offers a *causal explanation* for the correlations. This, Reichenbach holds, makes the hypothesis of Copernicus highly probable. The inference Reichenbach indicates here is an *inference to the best explanation* (cf. Psillos, 2011, p. 30): The scientists infer to the high probability of the hypothesis of Copernicus because it is the best explanation

of the observed movements of the shadows.[56] Reichenbach obviously believes that we need an explanation for the phenomena at hand because it is not satisfactory to accept it as mere coincidence that they occur in the way they do: "It seems highly improbable that the strange coincidences observed for one pair of dots are an effect of pure chance" (Reichenbach, 1938, p. 120). He holds that the hypothesis that real objects exist independently of our minds is the best explanation of the phenomena. And he takes this as a good reason to accept this hypothesis as probably true. This, in a nutshell, is an inference to the best explanation.

It is particularly interesting for our comparison with Becher that Psillos rephrases the basic idea of Reichenbach's inference in the following way:

> Copernicus, in other words, posits an entity (better: a type of entity) that brings some causal-nomological order in the world-view of the inhabitants of the C-world. (Psillos, 2011, p. 30)

This is in fact the way Reichenbach describes the situation. As he explains, the inhabitants of the cubical world, prior to the introduction of the hypothesis of Copernicus, "observe black figures running on the screens *quite irregularly*, disappearing at the edges and reappearing" (1938, p. 116; my emphasis). The postulation of unobservable entities as the causes of the shadows establishes a certain kind of regularity among the phenomena. This brings out the parallel to Becher's implementation of the inference to the existence of real objects (see Sect. 2.2.3): As a basic inductive principle it is presumed that the world is regular.[57] Since the immediate observations, if regarded in isolation, suggest a certain irregularity, the scientists postulate the existence of entities which make it possible to regard our immediate observations as *part of a regular causal nexus*. In this way, the hypothesis provides a causal explanation of our observations, which is the best explanation because it paints a picture of the world that is simple in the sense that it displays a large degree

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[56] As Psillos (2011, p. 33) adds, "[t]his claim might not amount to much – since IBE needs articulation." The point is that the inference form Inference to the Best Explanation was not explicitly developed by Reichenbach. (The same holds for Becher.) As I want to argue in the following, we can view some of Reichenbach's remarks as showing that the inference outlined here is implicitly guided by thoughts that can most plausibly be interpreted as an inference to the best explanation. Seen from today's standpoint, however, it must be conceded that Reichenbach's use of this inference form leaves many details in the dark.

[57] To be more precise, the principle in the background in Reichenbach's case is the probabilistic inductive principle, according to which observed relative frequencies of events (e.g., the frequency with which a six was rolled in a finite number of rolls with a die) can be assumed to hold for any future prolongation of the series (Reichenbach 1938, p. 340). Reichenbach admits that this principle is based on an assumption about the world which cannot be shown to be true, namely the assumption that the world is *sufficiently ordered or "predictable"*: "We must admit then, that we do not know whether the world is predictable" (1938, p. 350). Reichenbach's more modest aim in vindicating his principle is to show that it is *the best assumption concerning the future* because it is a *necessary condition of the possibility of predictions* (1938, p. 357). I.e., Reichenbach brings forward a pragmatic justification of the principle of induction. As we have seen above, both Becher (see Sect. 2.2.2) and the early Reichenbach (see Sect. 3.4) also justify their inductive principles in a pragmatic way, namely as (unprovable) necessary assumptions for the possibility of scientific research. The main difference is that Reichenbach (1938, p. 348) elaborates his pragmatic justification in much more detail.

of regularity. In this regard, there is a clear parallel between the ways Becher and Reichenbach implement their respective inference to the best explanation.

The upshot of this first step of Reichenbach's argument is that in the natural sciences, there are probability inferences from the domain of observable objects to the domain of unobservable objects.[58] This, Reichenbach suggests, occurs not only occasionally in the natural sciences. Quite the contrary: "This *overreaching* character of probability inference is the basic method of the knowledge of nature." (Reichenbach, 1938, p. 127; italics in original)

In the second step of his argument, which can be dubbed the metaphysical step, he then proposes that we can transfer this way of reasoning to the situation of our perceptions and the general metaphysical question of the existence of external objects. That is, Reichenbach, in accordance with one of the main ideas of inductive metaphysics, proposes to transfer what he takes to be the *basic method of the natural sciences* (worked out in step 1) to the field of *metaphysics* (step 2):

> By analogy with the example of the cubical world our contention reads: Impressions are only effects produced within our body by physical things, in the same sense as the shadows are effects of the birds. […] The "external world" therefore has an existence of its own, independent of our impressions. (Reichenbach, 1938, p. 129)

The example of the cubical world has shown that it is not in principle impossible to infer from the domain of observables to the domain of unobservable objects. Scientists are used to make inferences of this kind, via the inference form Inference to the Best Explanation, as the example in the first step of the argument has illustrated. Reichenbach suggests that the same can be done in the case of the *metaphysical problem of existence*: The hypothesis of the existence of external objects is highly probable because it is the best explanation of the series of my perceptions.

While this is a very natural reading of Reichenbach's argument in §§ 14–15 of *Experience and Prediction*, it has to be added that the argument read in this way is not without problems. I cannot go into the details here, but it should not go unnoticed that it has been pointed out repeatedly by critics that there is a problem in particular in connection with Reichenbach's concept of probability in play here (cf. Coffa, 1983, 270 ff.; Psillos, 2011, 31 ff.; Neuber, 2018, 96 ff.). Reichenbach interprets probabilities as limiting relative frequencies, and under this interpretation it is not clear how it can be justified that the inference from observables to unobservables confers probability to the conclusion. Herbert Feigl sums up the criticism as follows:

> The crux of the problem lies in the justification of applying the concept of inductive probability to the inference from the directly verifiable to directly unverifi-

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[58] Again, just as in the case of Becher's inductive justification of realism, there are clear resemblances to the "no miracle argument". See n. 30 above. Maybe it should not surprise us that the basic idea of the "no miracle argument" can be found in Reichenbach: As Psillos (1999, 70 f.) remarks, the "no miracle argument" has been given its textbook formulation by Hilary Putnam (1975, p. 73). Putnam studied with Reichenbach at the University of California, Los Angeles and received his PhD from Reichenbach in 1951.

able assertions. Any straightforward frequency interpretation of probability could serve here only if the success frequencies of such inferences were ascertainable. This is outright impossible if independent access to the "Illata" [the inferred objects; A. S.] is barred. […] [T]he legitimacy of applying the probability concept to the whole realistic frame, instead of merely to inferences within it, remains painfully questionable. (Feigl, 1950, p. 53)

To put it in a nutshell, there is no way to determine a track record for inferences of the kind in question, because there is no independent way of verifying the conclusions. Therefore, it is not clear how to determine the probability conferred to the conclusions of such inferences if probability is understood as relative frequency.[59]

This problem highlights a question that any defense of metaphysical realism based on an inference to the best explanation must answer: How can an inference to the best explanation that reaches over into the realm of the principally unobservable be justified? While Becher does not seem to regard the inference as problematic, Reichenbach's text suggests that he saw a problem, but could not resolve it in a completely satisfactory way on the basis of his conception of probability as relative frequency.[60]

4 Conclusion

In closing, I would like to emphasize once again the most striking parallels between the two approaches:

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[59] For a much deeper analysis of the problem at issue, see Psillos (2011, 31 ff.). Psillos discusses the possibility of solving the problem by ascribing prior probabilities to the competing realist and positivist hypotheses. But as he points out, this strategy fails within an argument for realism because it "requires that there is another framework in place in which these two hypotheses are compared in terms of plausibility", which means that Reichenbach's argument "requires the realist framework and cannot be a proof of it" (Psillos 2011, 36 f.). Coffa (1983, 271 ff.) argues that the best interpretation of *Experience and Prediction* is that Reichenbach in fact gave up the project of an inductive argument for realism in this book.

[60] The debate over how to justify the inferential form Inference to the Best Explanation is a debate that continues today, and it also (at least indirectly) touches on the question of whether this inferential form can be successfully used at all to make arguments for metaphysical realism. For example, Fumerton (1980) argues that inferences to the best explanation, if they are to be justified, must always be reducible to an enumerative inductive inference. On the basis of the considerations in this section, it seems to me that, if true, this would significantly dim the prospects for an inductive argument for metaphysical realism. But on the other hand, there are, for example, the positions of Harman (1965) and Armstrong (1983), who argue that, conversely, enumerative inductive inferences are a subform of inferences to the best explanation. This leaves again open the justification of the inference form Inference to the Best Explanation. In particular, Armstrong is an interesting comparison case, because he uses an inference to the best explanation to argue for a metaphysical claim, which is also a form of realism, namely the claim that laws of nature are relations between universals, and thus themselves universals of higher order. As for the justification of the inference principle, he seems to take the position that it is simply an a priori principle: "To infer to the best explanation is part of what it is to be rational. If that is not rational, what is?" (Armstrong 1983: p. 59) Whether this is a satisfactory defense of the inference principle, and whether this is sufficient to use the inference principle successfully in the field of metaphysics, is a question that I must leave open for further investigation.

1   Both Becher and Reichenbach reject traditional metaphysics, especially the meta-
    physics of the German Idealists and their claim to create a complete metaphysical
    system a priori.

2   Both have a high regard for the natural sciences and in particular for their empir-
    ical-inductive method. While Becher unequivocally proposes a direct transfer of
    this method to metaphysics, the transfer of the inductive method to metaphysics in
    Reichenbach's "Metaphysics and Natural Science" is not as straightforward. But
    in *Experience and Prediction*, Reichenbach proposes a direct application of the
    method of the natural sciences to the metaphysical problem of existence, thereby
    bringing his position closer to that of Becher.

3   Becher's analysis takes its starting point from our own perceptions, which he takes
    to be the only way through which we can have direct access to something real.
    While Reichenbach, too, holds this position in "Metaphysics and Natural Science"
    (1978a [1925], p. 292), he gives it up in *Experience and Prediction*, claiming that
    strictly speaking, we do not have direct access to our own perceptions. Instead, he
    now holds the position that we directly observe external objects and that impres-
    sions, similarly to theoretical entities in the sciences, are only inferred.[61]

4   Both hold the metaphysical position of realism, according to which there are real
    objects which are the causes of our perceptions.

5   According to Becher, the justification of realism is based on an inference to
    the best explanation, which in turn is based on a presumption of regularity. In
    "Metaphysics and Natural Science", Reichenbach does not infer the existence of
    real objects on the basis of an inference to the best explanation, but *defines* real
    objects on the basis of the presumption of regularity. In *Experience and Predic-
    tion*, on the other hand, he does make use of an inference to the best explanation
    in his argument against positivism, which bears interesting similarities to Becher's
    argument.

6   Both hold that the presumption of regularity can neither be justified a priori nor
    empirically. We rely on this presumption because it is indispensable for gaining
    scientific and everyday knowledge [*Erkenntnis*].[62]

Reichenbach's and Becher's positions on metaphysics and its relationship to the
natural sciences are obviously very similar. Reichenbach's position slightly changes
over time, bringing it closer to Becher's position in some respects and moving away
from it somewhat in others. But all in all, it can certainly be said that Reichenbach
shares many of the basic ideas of the program of inductive metaphysics.

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[61] In *Experience and Prediction*, Reichenbach, while arguing against positivism, only temporarily grants
the positivist the position that we have direct access to our own perceptions. But later in the book, he
explains that while he "believed in it for a long time", he now "cannot admit that impressions have the
character of observables" (1938, 163 f.). This of course creates a few puzzles regarding the exact under-
standing of his inductive argument for the existence of the outside world (cf. Coffa 1983, p. 272).

[62] As we have seen above, Becher calls this principle an a priori principle because it necessari-
ly precedes all empirical knowledge (Sect. 2.2.4), while Reichenbach refrains from calling it a priori
(Sect. 3.4). But that is only a difference in the name. In fact, both agree on the status of this principle.

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