

The idea of a pseudo-problem in Mach, Hertz, and Boltzmann.

Article

Published Version

Creative Commons: Attribution 4.0 (CC-BY)

Open Access

Preston, J. ORCID: <https://orcid.org/0000-0002-3740-2308>
(2023) The idea of a pseudo-problem in Mach, Hertz, and Boltzmann. *Journal for General Philosophy of Science*, 54. pp. 55-77. ISSN 0925-4560 doi: 10.1007/s10838-021-09569-z
Available at <https://centaur.reading.ac.uk/92470/>

It is advisable to refer to the publisher's version if you intend to cite from the work. See [Guidance on citing](#).

To link to this article DOI: <http://dx.doi.org/10.1007/s10838-021-09569-z>

Publisher: Springer

All outputs in CentAUR are protected by Intellectual Property Rights law, including copyright law. Copyright and IPR is retained by the creators or other copyright holders. Terms and conditions for use of this material are defined in the [End User Agreement](#).

www.reading.ac.uk/centaur

CentAUR

Central Archive at the University of Reading



The Idea of a Pseudo-Problem in Mach, Hertz, and Boltzmann

John Preston¹ 

Accepted: 11 May 2021
© The Author(s) 2022

Abstract

Identifications, diagnoses, and treatments of pseudo-problems form a family of classic methodologies in later nineteenth century philosophy and at least partly, I shall argue, in the philosophy of science. They were devised, not by academic philosophers, but by three of the greatest philosopher-scientists. Here I show how Ernst Mach, Heinrich Hertz and Ludwig Boltzmann each deployed methods of this general kind, how they identified different pseudo-problems, gave different diagnoses of such problems, and suggested quite different treatments for them. I argue that it was Mach who really first *developed* the idea of a pseudo-problem, that he did so in a relatively focussed way on the basis of two kinds of examples. Hertz's contribution was much more limited, identifying two specific pseudo-problems concerning physics, and suggesting a way in which they might be treated. Boltzmann's conception of pseudo-problems, though, was far less focussed, being applied to a very wide range of problems in philosophy and physics. However, his conception was certainly more influential, and perhaps ultimately more fruitful and suggestive. I argue for the originality and continuing interest of such approaches, and I try to dissociate them from any problematic 'positivism'.

Keywords Pseudo-problems · Ernst Mach · Heinrich Hertz · Ludwig Boltzmann · Positivism

1 Introduction

Ernst Mach seems to have been the person who introduced the two terms '*Scheinproblem*', and '*Pseudoproblem*', as well as the idea of a pseudo-problem. He made liberal use of both in his published writings from 1886 onwards.

Neither Heinrich Hertz nor Ludwig Boltzmann used the term '*Scheinproblem*' or any close relative of it, but as we will see the same general idea can be ascribed to them: the

I would like to thank Moritz Cordes, María de Paz, and two anonymous referees for helpful comments on earlier versions of this paper.

✉ John Preston
j.m.preston@reading.ac.uk

¹ Department of Philosophy, School of Humanities, Edith Morley Building, Shinfield Road, Whiteknights, Reading RG6 6EL, UK

way the relevant problems are identified and diagnosed, and their suggested treatments, can all be seen as falling within the same family.

2 Ernst Mach on Pseudo-Problems

Although related terms had occasionally been used by previous philosophical thinkers,¹ Mach should, I believe, get the credit not only for introducing the term ‘*Scheinproblem*’ into philosophy but also for fixing its use there. To see how he did this, we must look in some detail at the notorious first chapter of his 1886 book *Contributions to the Analysis of the Sensations*,² a book which subsequently went through a further seven editions (in German), several of which add to the picture. Looking at how this chapter unfolds brings out aspects of it that have been little remarked on (and also helps in avoiding some of the usual misunderstandings of that text).

2.1 Contributions to the Analysis of the Sensations (1st Edition, 1886)

In the first chapter of the first edition of this book, entitled ‘Introductory Remarks. Anti-metaphysical’,³ Mach begins by explaining that sensory physiology has recently developed an inappropriate tendency to become almost exclusively physical, rather than investigating sensations as phenomena in their own right. He undertakes to illustrate a more balanced relation between physics and sensory physiology, in which the latter could lend assistance to the former. He then starts expounding what he will later call a ‘first survey’ (p. 4) [*erste Orientierung* (S. 14)] of the relevant concepts.

A first instance of our *natural* or *usual* way of thinking, Mach explains, involves prioritising whatever relations among ‘colours, sounds, temperatures, pressures, spaces, times, and so forth’ (p. 2) are more fixed and permanent. These relations get engraved on the memory, and subsequently expressed in language, through our giving names to the ‘objects’ in question. We then invest in certain concepts, notably our concepts of bodies and of the self—‘substance’ concepts—a kind of *permanence*. This permanence, though, is a permanence that the ‘objects’ in question do not have, and Mach proceeds to give examples of what we would normally think of as objects whose properties change over time, despite the fact that we think of them as the *same* objects.

His first examples are of familiar physical things such as tables, people, and their clothes. The relative preponderance of unchanging features in these cases means that the changing ones are, as he puts it, ‘overlooked’ (p. 3), and we instead focus on what he calls the ‘sum-total of permanency’ (p. 3) [*Summe von Beständigem* (S. 12)]. Mach

¹ Moritz Cordes, whose PhD thesis included an historical investigation of uses of the relevant terms, draws attention to one use of ‘*Scheinbegriff*’ and one of ‘*scheinbarer Begriff*’, each of which might be translated ‘pseudo-concept’, in Johann Heinrich Lambert’s *Phenomenology* of 1764, although he notes that their context makes ‘apparent concept’ the better translation (Cordes 2020, 140).

² Note also that Mach had shelved his own manuscript of this book for twenty years after Gustav Theodor Fechner had reacted badly to it. So his own first private uses of the concept of a *Scheinproblem* might even be as early as 1866.

³ All references that follow in this section are to Mach (1886a/1897), i.e. the *first* edition of his ever-evolving book on ‘sensations’. Where I give Mach’s German words, the quotations (in the form (S.n)) are from the most recent edition of the book in the *Ernst Mach Studienausgabe* (Mach 1886a; 1886b/2008).

then explains that our greater familiarity with this sum-total of permanency impels us to a ‘partly instinctive, partly voluntary and conscious economy of mental presentation and designation, as expressed in ordinary thought and speech’ (p. 3), any physical thing which is presented in a single image receiving a single name.

Moving now to his second instance, Mach suggests that the same is true in the psychological realm, where ‘that complex of memories, moods and feelings, joined to a particular body (the human body), which is denominated the “I” or “Ego”, manifests itself as relatively permanent’ (p. 3). Like physical things, though, the ego is really of *only* relative permanence. Its apparent absolute permanence derives from its continuity, the slowness of its changes. But the egos of one person considered in their infancy and then in their mature years will share very few features. The ego, he concludes, is as little absolutely permanent as are physical bodies.

So much for what Mach calls the ‘first survey’, obtained (in the life-history of each person) by the formation of the substance-concepts ‘body’ and ‘ego’ (p. 4). The results of this survey are, at least, part of our natural or ordinary way of thinking. But what follows, he argues, is a movement of thought of a *different* kind, ‘a more exact examination of the *changes* that take place in these relatively permanent existences’ (p. 4). In this examination, the component parts of each complex (colours, sounds, pressures, etc., or of memories, moods and feelings) are first presented as its *properties*. Individual things can have one property now, another later. Other individuals of the same kind can share some properties, but can differ in others. Thus, gradually, different complexes are found to be composed of common elements. ‘The visible, the audible, the tangible, are separated from bodies’ (p. 5). ‘The complexes are disintegrated into *elements*’ (p. 5), that is, those component parts which we have not yet been able to subdivide further.

So far, then, we have seen two movements of thought: the first survey, and the more exact examination. Mach associates the second movement with *science*, and is often concerned with its superiority, but this is *not* to say that he thinks that the first movement is worthless, or the source of pseudo-problems. (He is not critiquing our everyday conceptual scheme). What he does at this point (the beginning of Sect. 3 of this first chapter) is to draw attention to a certain *conflict* between these two movements. Our tendency to designate relatively permanent compounds by single names, and to conceive them in single thoughts, which is of course useful, not least in evolutionary terms, comes into ‘strange conflict’ (p. 5) [*eigentümlichen Widerstreit* (S. 15)], he tells us, with our tendency to isolate their component parts:

The vague image which we have of a given permanent complex, being an image which does not perceptibly change when one or another of the component parts is taken away, seems to be something which exists *by itself*. Inasmuch as it is possible to take away *singly* every constituent part without destroying the capacity of the image to *stand for* the totality and of being recognised again, it is imagined that it is possible to subtract *all* the parts and to have something still remaining. Thus arises the monstrous notion of a ‘thing-in-itself’, unknowable and different from its ‘phenomenal’ existence (pp. 5–6). [*ungeheuerlich erkannte philosophische Gedanke eines... Dinges an sich* (S. 15)].

This is Mach’s *first* suggestion that a problem arises from a *conflict* between movements of thought. (His second occurs on p. 13). We will see in a moment how Mach later identifies it as a *pseudo-problem*.

Mach next introduces what I shall call his first *constitution thesis*, that physical things and matter ‘are nothing apart from their complexes of colours, sounds, and so

forth—nothing apart from their so-called attributes' (p. 6). The first (but weaker) indication that the problem he has been considering is a pseudo-problem comes when he contrasts this conception with the one that generates '[t]hat protean suppositious philosophical problem of a *single* thing with *many* attributes, [which] arises wholly from a mistaking of the fact, that summary comprehension and precise analysis, [...] cannot and must not be carried on *simultaneously*' (p. 6). Mach's own words here are '*Das vielgestaltige vermeintliche philosophische Problem...*' (S. 15), so we do not here have an occurrence of the term '*Scheinproblem*'. Nevertheless '*vermeintlich*' means 'putative' or 'alleged' and its ending here indicates that it is the '*Problem*' (rather than the '*philosophische*') which is putative. This is another part of Mach's *first* suggestion that pseudo-problems arise from a *conflict* between movements of thought. The 'summary comprehension' of the 'first survey' cannot co-exist with the 'precise analysis' of the 'more exact examination'. That this generates a pseudo-problem becomes clearer when we turn back to the *second* pseudo-problem, as Mach then does at the beginning of Sect. 5.

There he explains that just as the relation of bodies to the ego gives rise to pseudo-problems, 'the ego, and the relation of bodies to the ego, give rise to similar pseudo-problems' (p. 8) And here his own words are '*analoger Scheinprobleme*' (S. 17). This is why I say that, via this link, Mach identifies the first problem, the notion of the *physical* thing-in-itself, as a pseudo-problem.

It is at this point that Mach introduces his monist apparatus for referring to what he calls 'elements', an apparatus that has attracted considerable attention (but will not be discussed in depth here. See, e.g., Banks 2003; Preston 2021). Mach argues that the alternative to thinking of the properties of bodies as 'effects' of permanent nuclei is to accept his monist view that 'the world consists only of our sensations', and that 'we have knowledge *only* of sensations' (p. 10).⁴ This is the first occurrence of what I call Mach's *second* constitution-thesis (about the constitution of the *world*). The assumptions of nuclei, and of reactions between them from which sensations proceed, become 'quite idle and superfluous' (p. 10), fitting only with a 'half-hearted realism or a half-hearted philosophical criticism' (p. 10, the latter being Kantianism, presumably). So Mach's argument is that monism and sensationalist epistemology comprise the *only* acceptable alternative to starting down the 'nuclei and their effects' path, which leads inexorably to the monstrous notion of the thing-in-itself.

Let us turn next to Sect. 7 of this same first chapter. There Mach explains the advantage of his own 'monistic standpoint' [*monistische Standpunkt* (SS. 21-22)] over what he thinks of as 'one-sided' views such as materialism and idealism ('spiritualism'). The difficulty these views share, he argues, comes into view when we consider inquiring after the sensations or feelings belonging to another person, which 'we no longer find... in the province of sense', but which 'we add [...] in thought' (p. 13). This, in our terms, is the 'problem of other minds'. Mach urges that people who adopt this way of thinking can never rid themselves of that 'sense of insecurity, which is a fertile source of illusive problems' (p. 13). Again his own term here is '*Scheinprobleme*' (S. 22). So his idea is that one-sided philosophical ways of thinking, because of the epistemic insecurity they generate, make the problem of other minds utterly insoluble, and thus a pseudo-problem.

These are *by no means* Mach's only examples of pseudo-problems. Another from this same first edition of the text is the question 'How the percept of a large tree could find

⁴ This view is monist, but not phenomenalist, at least in the modern sense of that term.

room in the little head of a man?", which he deems a "“problem” that is no problem', and an absurdity (p. 21 note).

2.1.1 'Facts and Mental Symbols' (1892)

A further list of pseudo-problems occurs in Mach's article 'Facts and Mental Symbols', published in *The Monist* for 1892. Here though, not only are the examples new, but in addition a different account of their origin is given.

These pseudo-problems are discussed in the context of Mach's urging that the *theoretical* apparatus of physics can only really constitute mere helps or expedients to facilitate our viewing things (Mach 1892, 202). Theories, he cautions, must be handled carefully, especially where the attempt is made to transfer them from one department of thought to another.⁵ Mach then gives his examples, arguing that there exists (1) no 'problem' of why we see inverted retinal images the right way up (p. 202), (2) no 'problem' to which the theory of external projection⁶ is the solution (p. 202), and (3) no 'problem' of how the blind-spot is filled (p. 203). If one was in any doubt as to whether Mach thought of himself as having identified pseudo-problems here, one only has to turn to the article's conclusion, where Mach says 'This whole train of reasoning has for me simply the significance of negative orientation for the avoidance of pseudo-problems' (1892, 208).

His discussions here add something to those we saw from his *Contributions to the Analysis of the Sensations*, though. He suggests that the first pseudo-problem involves 'only obscurity' (1892, 202), and the question (of why we see the inverted retinal image upright), he tells us 'has no meaning as a psychological problem' (p. 202). This is a new idea. Perhaps we should not leap to the conclusion that the lack of 'meaning' he refers to is a *semantic* phenomenon (as some of his successors would eventually suggest); he may only have intended it in a more loose or pragmatic way, intending to say that it has no purpose or end. But he presents it alongside the idea that in the examples in question there is simply *no problem*: 'no problem exists at all here' (1892, 203).

Mach's diagnosis of what has gone wrong here is quite different from the one he gave of the two principal pseudo-problems in chapter I of *Contributions to the Analysis of the Sensations*. What he says here is that the confusions result from 'the direct transference of theories, methods, and inquiries that were legitimate in physics, into the field of psychology' (1892, 202). Subsequently, when these same three examples of pseudo-problems made it into later editions of his book, now re-titled *The Analysis of Sensations and the Relation of the Physical to the Psychical* (Mach 1900/1959, chapter II, Sect. 1, 38–39), he generalised this diagnosis, suggesting that that they result from 'thoughtless transference of a conception or mode of thought which is valid and serviceable in one field, into another quite different field' (1900/1959, 40).

Later in the same 1892 article we find another example, of more relevance to our current philosophical scene. Mach says:

Long before there was any scientific physiology people perceived that the behavior of an animal confronted by physical influences is much better viewed, that is

⁵ The problematic nature of such 'transfers' was later recognized by the leading members of the Vienna Circle: Carnap, Schlick, Neurath, and Waismann. (See Cordes 2020, 143, note 15, item [2.13]).

⁶ This 'theory' seems to have been that the external world results from the outward 'projection' of sensations. Mach takes it to have been disposed of by Johannes Müller (Mach 1900/1892, 39, 54, 123).

understood, by attributing to the animal *sensations* like our own. To that which I see, to *my sensations*, I have to *supply mentally* the sensations of the *animal*, which are not to be found in the province of my own sensation. This contrariety appears still more abrupt to the scientific inquirer who is investigating a nervous process by the aid of colorless abstract notions, and is required for example to add mentally to that process the sensation green. This last can actually appear as something entirely novel, and we can ask ourselves how it is that this miraculous thing is produced from chemical processes, electrical currents, and the like (Mach 1892, 205–206).

What is this if not the so-called ‘hard problem’ of consciousness, recently the subject of so much attention in philosophy of mind? Mach’s verdict is that it is a pseudo-problem. His first move is to explain that there is no occasion for surprise here, ‘since the physicist deals with sensations in everything on which he employs himself’ (1892, 206). In fact, he argues, physicists are continually making mental additions by analogy, such as when they think of the moon as an inert heavy mass, even though they cannot touch it. This is supposed to show that the appearance that mental supplementation of behaviour by (what we would now call) ‘qualia’ is in no way special or ‘strange’.

Mach’s next move is to argue that, when considered from the perspective of his own ‘scheme of elements’, the supposed illusion disappears. Taking the observation of a plant’s leaf as an example, Mach first points out that one might make a great number of *physical* observations (of the green of the leaf’s being ‘united with a certain optical sensation of space’, with a certain tactical sensation, with the visibility of some light source, that its green will become brown if a light source such as the sun is replaced by a sodium lamp, etc.). He next argues that a number of *psycho-physiological* observations can also be made. The green of the leaf, for example, is ‘united with a certain process on my retina. There is nothing to prevent me in principle from physically investigating this process on my own eye in exactly the same manner as in the cases previously set forth, and from reducing it to its elements’ (1892, 206–207). In its dependence on *physical* phenomena the green of the leaf is what he calls ‘a physical element’. But at the very same time in its dependence on *psycho-physiological* phenomena it is what he calls a ‘sensation’. This is Mach’s ‘monism’.

Finally, Mach tells us what has gone wrong, what generates the pseudo-problem now known as the ‘hard problem of consciousness’. His diagnosis is that we have here another case of an illegitimate transference:

The obscurity of this intellectual situation has arisen according to my conviction solely from the transference of a physical prepossession into the domain of psychology. The physicist says: I find everywhere bodies and the motions of bodies only, no sensations; sensation therefore must be something *entirely different* from the physical objects I deal with. The psychologist accepts the second portion of this declaration. To him, it is true, sensation is *given*, but there corresponds to it a mysterious physical something which conformably to physical prepossession must be *different* from sensation. But what is it that is the really mysterious thing? Is it the *Physis* or the *Psyche*? or is it perhaps *both*? It would almost appear so, as it is now the one and now the other that is intangible (1892, 207).

Mach urges that this whole train of reasoning is fallacious. Thinking of the situation in terms of his scheme of elements means, first, that the qualities which we observe (the green of the leaf, its shape, its tactile qualities, etc.) are first rendered epistemically secure, so

that ‘they can never afterwards be volatilised away by any considerations which are after all based on their existence’ (1892, 207). But it also means that all that remains to be ascertained are their functional relations, expressed in equations. And this is a task for science.

2.2 Knowledge and Error (1905)

Mach never again deployed the idea of a pseudo-problem as liberally. But this is not to say he went off the idea.⁷ His epistemological *magnum opus* *Knowledge and Error* also features it, and it is noteworthy how crucial, for his own image of his project, are the contexts in which his uses of the term ‘*Scheinproblem*’ and of a new German coinage, ‘*Pseudoproblem*’, occur.

In the first such context, from his Preface to the book, Mach’s key idea is that he is not offering a new philosophy, but removing an old one, since statements embodying philosophical errors, when injected into science, produce idle pseudo-problems:

The work I have attempted in the interest of scientific methodology and the psychology of knowledge proceeds as follows. First I have aimed not at introducing a new philosophy into science, but at removing an old and stale philosophy from science—an endeavour that even some scientists rather resent. For amongst the many philosophical statements that have been made over the years some have been recognized by philosophers themselves as errors, or have been set out so clearly that any unprejudiced person could easily recognize them as such. In science, where they met with less alert criticism, they have survived longer, just as a defenceless species might be spared on a remote island free from predators. Such dicta, which in science are not only useless but produce obnoxious and idle pseudo-problems, deserve nothing better than being discarded. (Mach 1905a; 1905b/1976, pp. XXXII–XXXIII). [The German is: ‘*schädliche müßige Pseudoprobleme*’ (S. 4). Note the different coinage]

In the second, Mach again explicitly identifies the first two issues I identified above from his *Contributions to the Analysis of the Sensations* as pseudo-problems, here giving them each a handy formulation:

In pushing the analysis of experience as far as currently untranscendable elements our main advantage is that the two problems of the ‘unfathomable’ thing and the equally ‘unexplorable’ ego are presented in their simplest and clearest form, which is precisely what makes it easy to see them as sham problems. By elimination of what it is senseless to explore, what the special sciences can really explore emerges all the more clearly: the complex interdependence of the elements (Mach 1905a; 1905b/1976, 8). [The German: ‘*eben dadurch als Scheinprobleme leicht erkennbar zu machen*’ (S. 22, Mach’s own emphasis)]

Finally, in a footnote to this same chapter, Mach explains his key idea of decomposing phenomena into ‘elements’, and says:

Our elements are thus only provisional, as those of alchemy were in the past and those of currently accepted chemistry are now. Although for our purpose of eliminating philo-

⁷ There is a single occurrence of the term ‘*Scheinproblem*’ in *Die Principien der Wärmelehre, historisch-kritisch entwickelt* (Mach 1896a, 1896b/2016, 472, and, in the English translation Mach 1896a, 1896b/1986, 385).

sophical sham problems reduction to these elements seemed the best way, it does not follow that every scientific enquiry must begin with them. What is the simplest and most natural starting point for the psychologist need not at all be so for the physicist or chemist who faces quite different problems or different aspects of the same question (Mach 1905a, 1905b/1976, 12 note 7). [The German: ‘*für unsere Zwecke, zur Ausschaltung philosophischer Scheinprobleme*’ (S. 20)]

Mach introduced his scheme of elements precisely in order to show that scientists could indeed evade obnoxious and idle philosophical pseudo-problems.

3 Mach’s Identification, Diagnosis, and Treatment of Pseudo-Problems

We have seen, then, that Mach initially gave two principal examples of what he means by ‘pseudo-problems’. Both examples are of what he calls ‘substance-concepts’ (that is, concepts of things which philosophers have taken to be ‘substances’). The first is *physical bodies*, and the second *the self* (or ego). Mach thinks metaphysics is the source of these pseudo-problems, and he thus strives to avoid it. But his more detailed diagnosis is that these pseudo-problems arise not just ‘from philosophical thinking’ but from conceptual and methodological *conflicts* between two different approaches to certain fundamental concepts (such as ‘body’ and ‘self’). When identifying them as *Scheinprobleme* he clearly means they cannot be *solved*, they are dead-ends, and his proposed treatment of them consists in the development of another entire way of thinking, one which does not even allow them to arise, this being is his monistic ‘scheme of elements’.

In addition, in both main texts that I have expounded, Mach gives a list of pseudo-problems that he thinks arise in a different way. Here, rather than a conflict between two ways of thinking (the ordinary way and a more sophisticated, scientific one), Mach sees the pseudo-problems as arising from the illegitimate transference of an idea from one discipline (in this case, physics) into another (in this case, psychology). His diagnosis, particularly in its later, generalised form, thus presents the idea that transferring theories across disciplinary boundaries can have unfortunate results.

I do not mean for anything I have said to be a *defence* of the various moves Mach makes. It seems to me that several of them are easy to challenge. But that they *are* the moves he is making seems to me clear. To round matters off, in the preface to the 1902 edition of *The Analysis of Sensations*, Mach advertises his point of view in these terms:

The opinion, which is gradually coming to the front, that science ought to be confined to the compendious representation of the actual, necessarily involves as a consequence the elimination of all superfluous assumptions which cannot be controlled by experience, and, above all, of all assumptions that are metaphysical in Kant’s sense (Mach, 1900/1959, p. xl).

If we keep this point of view firmly in mind, he then tells us, ‘A whole series of troublesome pseudo-problems at once disappears’ (1900/1959, p. xl) [*Eine Reihe von störenden Scheinproblemen fällt hiermit weg* (S. 5)]. There could be no clearer way of linking his project to the battle against pseudo-problems. Mach broke new ground in forging the concept of a pseudo-problem, in identifying pseudo-problems, in diagnosing them, and in suggesting treatments for them, which in his case constituted ways of *avoiding* them.

4 Heinrich Hertz on 'The Nature of...' Questions

The introduction to his book *The Principles of Mechanics* was Hertz's major foray into philosophy. In Sect. 1 of that introduction, on the 'customary representation of mechanics', he raised questions about the logical permissibility of that (Newtonian–Lagrangian) representation, drawing attention to a certain 'logical obscurity' it contained. As a consequence, Hertz felt, physicists sometimes find themselves embarrassed and apologetic when expounding the very introduction to or rudiments of mechanics, as conceived under this customary representation. As evidence of a contrast or disparity between this representation and a 'logically complete science', such as pure mathematics, he then famously referred to.

Statements which one hears with wearisome frequency, that the nature of force is still a mystery, that one of the chief problems of physics is the investigation of the nature of force, and so on. In the same way electricians are continually attacked as to the nature of electricity (Hertz 1894/1956, 7).

It is notable that while Hertz's focus, like that of Mach, is on concepts, in contrast to Mach the concepts here are not concepts whose use in our everyday conceptual scheme is in question, but concepts in their *scientific* development: force and electricity.

The character of Hertz's next move is not so obvious. He immediately asks 'Why is it that people never in this way ask what is the nature of gold, or what is the nature of velocity? Is the nature of gold better known to us than that of force?' (p. 7).

If Hertz took the concept of force *itself* to be the problem, he would have to reject *all* questions about it. But that does not seem to be what is going on.⁸ Instead, his own question 'Is the nature of gold better known to us than that of force?' is rhetorical, designed to cast suspicion on a range of questions of the form 'What is the nature of...?'. It would be no coincidence that questions of this form are typically asked by philosophers, possibly the same philosophers who take physicists' failure to answer the questions 'What is force/electricity?' to mean there is still a 'mystery' to be addressed.

Hertz's questions 'Why is it that people never in this way ask what is the nature of gold, or what is the nature of velocity? Is the nature of gold better known to us than that of force?' are designed to establish a contrast between the two classes of concepts and the questions about them. Again the concepts in question are scientific ones, this time what we might think of as a natural kind concept, gold (perhaps thought to be rather like that of electricity in this respect), and a magnitude concept, velocity (perhaps thought to be analogous to that of force). But the contrast is not that Hertz thought that scientists *were* in a position to answer such questions, since to his own question *what's the difference*, in this respect, between questions about the nature of gold or velocity and questions about the nature of force and electricity, he answers:

I fancy the difference must lie in this. With the terms 'velocity' and 'gold' we connect a large number of relations to other terms; and between all these relations we find no contradictions which offend us. We are therefore satisfied and ask no further questions. But we have accumulated around the terms 'force' and 'electricity' more

⁸ Here I am grateful to a referee, who drew attention to a deficiency in the way I previously argued about this matter.

relations than can be completely reconciled amongst themselves. We have an obscure feeling of this and want to have things cleared up (p. 7).

That ‘we ask no further questions’ presumably means, not that questions about the *nature* of gold or velocity are unproblematic, but that such questions never trouble us, perhaps that they never even occur to us. So while he does not explicitly say that ‘What is the nature of...?’ questions are pseudo-questions simply by virtue of having that form, Hertz does take the presence of such questions to indicate that a conceptual problem is in the offing. He clearly thinks that the question ‘What is the nature of force?’ would not be a good question even if we had clarified that concept. His view seems to be that we raise questions of the form ‘What is the nature of X?’ to the extent to which we find the concept of X obscure. If the concept is clear, or if we can succeed in *making* it clear, we are no longer tempted to raise that question about it.

Let us also look at his *picture* of the situation here. Each of the problematic terms is pictured as related to other terms, as if each term is a centre from which radiates connections to others. In the case of the non-problematic concepts, these radiating connections do not conflict with (contradict) one another. This gives us a kind of mental satisfaction, and we are not plagued with questions about (the nature of) the concepts designated by those terms. With the problematic concepts, though, we have *too many* radiating connections to be reconciled with one another. In these cases we have unknowingly ‘accumulated’ relations around the terms in question, some of which relations contradict others.

What is most crucial is what Hertz says next:

Our confused wish finds expression in the confused question as to the nature of force and electricity. But the answer which we want is not really an answer to this question. It is not by finding out more and fresh relations and connections that it can be answered; but by removing the contradictions existing between those already known, and thus perhaps by reducing their number. When these painful contradictions are removed, the question as to the nature of force will not have been answered; but our minds, no longer vexed, will cease to ask illegitimate questions (1894/1956, 7–8).

So, Hertz thinks the very *questions* ‘What is the nature of force?’ and ‘What is the nature of electricity?’ are confused. In effect, he thinks that *they cannot possibly be answered*, but must therefore be rejected, because they are symptoms of our mental dissatisfaction. This is certainly suggested by his calling the question of the nature of force ‘illegitimate’ or ‘unjustified’ [*unberechtigte*], and by his saying that it ‘will not have been answered’.

Should we count this as the identification, diagnosis, and suggested treatment of a pseudo-problem? There is certainly room for debate.⁹ Hertz did not use the term ‘*Scheinproblem*’, and neither did he deploy the notion of nonsense, or absurdity, or unintelligibility in this connection. The nearest he got to that was the notion of illegitimacy. Nevertheless we have here the classic marks of an alleged pseudo-problem. On the side of the problem itself, as it were, we have an apparently well-formed *question*, a question of maximum generality, ‘What is the nature of force?’. In fact we have two such questions, since Hertz treats the question ‘What is the nature of electricity?’ in parallel. These look like the *kinds* of question a philosopher might raise, even though they are questions about concepts *from* science, not (or not stereotypically) *from* philosophy. (This is not to deny

⁹ In the major recent volume on Hertz (Baird et al. 1998), only Gerd Grasshoff mentions Hertz’s identification of pseudo-problems (244, 252).

that philosophers have had plenty to say about them, of course). Hertz does not say *who* raises these questions, but since he takes physicists dealing with electricity to be ‘continually attacked’ with the question about its nature, perhaps he thinks of them as questions put to physicists by outsiders, such as philosophers. (This is not to deny that physicists themselves have had doubts about them, of course).¹⁰ And the questions are taken to be of great *significance*, those raising them thinking that they are of central importance to physics, and taking physicists’ failure to answer them to mean that there is still a ‘mystery’ in each case.

On the side of the person dealing with the problem, we have first the idea that the question in question is one which is raised ‘with wearisome frequency’. (Hertz’s German, ‘*Als ein sehr belastendes Zeugnis aber erscheinen mir auch die über Gebühr oft gehörten Behauptungen:...*’ actually conveys more the idea of an often-heard and stressful testimony). No ordinary question, then, but one which is troubling or stressful to those on the receiving end. And of course we also have the suggestion that the original question, the question about the relation-encrusted notion of force, cannot be *answered*, but must be dealt with in some other way. This ‘dealing with’ is not simply *rejection* of the concept, though, but, as we saw, the substitution of a clarified and streamlined concept for the encrusted original. (For whether this is the right way to think of what Hertz actually did in his book, and the extent to which it is successful, see Preston 2008, but also Eisenthal forthcoming).

These features are enough, I suggest, for us to count Hertz’s treatment of the notion of force as the treatment of a supposed pseudo-problem, despite the obvious absence of Mach’s term from Hertz’s text. Hertz takes our inclination even to *raise* ‘What is the nature of...?’ questions to be an unfortunate sign, the sign of a conceptual problem. To address this situation, he proposes to clarify the concept with respect to which we are tempted to ask such questions. The original pseudo-question is not thereby answered, but our inclination to raise it is dissipated.

5 Ludwig Boltzmann’s Plurality of Problems

In Boltzmann’s case, even more so than in Mach’s, we can see his ideas about pseudo-problems developing over time. My treatment here will follow the course of that development, concentrating on a handful of Boltzmann’s most philosophical papers, all from his *Populäre Schriften* (and included in its partial English translation, Boltzmann 1905/1974).

5.1 ‘The Second Law of Thermodynamics’ (1886)

Boltzmann begins his lecture ‘The Second Law of Thermodynamics’, an address to a formal meeting of the Viennese Imperial Academy of Science, by explaining that in choosing a scientific subject (rather than the more customary philosophical subject) for his lecture he does not want to provoke suspicion that he thinks topics of philosophical or metaphysical interest are insignificant or unimportant, compared with the special problems raised by the sciences. It is only the *manner* in which they have so far been treated, or in some cases *the fact that they have been treated at all*, that seems to him mistaken. This would have been quite a radical idea in 1886, since anti-metaphysical (we might even say anti-philosophical)

¹⁰ Here I am grateful to María de Paz.

thinkers like Mach and Gustav Kirchhoff were then still very much in the minority among scientists.

Boltzmann proposes that the methods of physics and chemistry are ‘the true means for unveiling the nature of things’, even though ‘many problems are like the question once put to a painter, what picture he was hiding behind the curtain, to which he replied “the curtain *is* the picture”’ (1905/1974, 15). The problems of *philosophy*, he is suggesting, are premised on the idea that a veil conceals the nature of things from us. But this is not so. His attitude is that while philosophers have either attempted to discern the nature of things but failed, or have declared that the nature of things is forever indiscernible, science *can* discern the nature of things.

Boltzmann sympathetically sketches Kirchhoff’s descriptivism, which portrayed physical sciences as purely descriptive and altogether renounced the task of *explaining* physical phenomena. But he then says:

If one seeks to explain motions from forces and these from the essences of things, that is phenomena from things in themselves, one always seems to start from the view that explanation requires reducing the *explicandum* to some quite new principle external to it. This view is alien to natural science, which merely resolves complex things into components that are simpler but the same in kind, or reduces complicated laws to more fundamental ones. If now this process is often successful it becomes so much a habit that we have no wish to stop even at its natural end (1905/1974, 16).

Here Boltzmann is setting himself against a *metaphysical* conception of explanation, a conception ‘alien to natural science’. The conception in question starts with legitimate scientific explanations, but becomes a metaphysical tendency when it turns, as it inevitably does, into a mental habit that *overreaches*. This is an important anticipation of Boltzmann’s later line of argument, and thus of Boltzmann’s anti-metaphysical stance.

The usual way of thinking about these matters, Boltzmann feels, is confused:

Usually one even regards it as a limitation of our intellect that, assuming we had succeeded in finding the simplest basic laws, we could then not explain or ground them further, that is resolve them into simpler ones; that as regards the existence of the most elementary constituents we are in any case unable to comprehend them, that is reduce them to simpler ones still. Are we not here once more placed in front of that painted curtain mentioned earlier? [...] We shall be able to retain the word ‘explain’ if from the outset all such reservations are kept at a distance (p. 16).

What Boltzmann is renouncing here is the idea of explaining our ultimate explainers. But Boltzmann (unlike Kirchhoff) wants to *retain* the idea of explanation. Science can and does explain, but it can never meet the exaggerated and inappropriate *metaphysical* demand for explanation.

5.2 ‘On the Fundamental Principles and Equations of Mechanics, I’ (1899)

More than a decade elapsed before Boltzmann returned to these fledgling ideas and elaborated them. In the first of his two lectures ‘On the Fundamental Principles and Equations of Mechanics’, delivered to an American audience, Boltzmann begins by mentioning recent controversies, especially in Germany, about the fundamental principles of mechanics, controversies of a philosophical or epistemological nature. Germans, he notes, have often been laughed at for their fondness for philosophical speculation, and in earlier times such a

reaction was justified. But there does seem to be ‘an invincible streak in the human spirit, prompting it to analyse the simplest concepts and to render an account of the fundamental operations of our own thinking’ (p. 104). Instead of rubbishing this tendency or method of analysis, though, Boltzmann allows that it *has* been improved, so that today it is not nearly as empty as philosophy used to be, even if it is not yet of immediate practical use.

Boltzmann takes us through various reservations about the fundamental concepts of mechanics (space, time, mass and force) from ‘German’ physicists such as Franz Neumann, Heinrich Streintz, Ludwig Lange, and Mach. But the one he runs with is Kirchhoff’s objection to the very *question* ‘Does mass alone exist, force being merely a property of it, or conversely, is force alone truly existent, or must we assume a dualism of two separate existents (mass and force), force existing independently of matter and causing its motion?’.

Why is Boltzmann so sympathetic to Kirchhoff’s rejection of such questions?

He is so because he has a general idea about our ‘conceptual signs’ (words and thoughts). The idea in question is that *all* our ideas and concepts are only ‘internal mental pictures’, and thus that the task of our thinking can only be ‘so to use and combine them that by their means we always most readily hit upon the correct actions and guide others likewise’ (p. 104). ‘The conceptual signs that we form thus exist only within us, we cannot measure external phenomena by the standard of our ideas’ (p. 104). He immediately takes this to mean that certain existence-questions are deeply problematic:

We can therefore pose such formal questions as whether only matter exists and force is a property of it, or whether force exists independently of matter or conversely whether matter is a product of force; but none of these questions are significant since all these concepts are only mental pictures whose purpose is to represent phenomena correctly (p. 104).

In other words we *should not* pose such questions. Boltzmann takes this to have been stated ‘with special clarity’ by Hertz in *The Principles of Mechanics*. What it rules out is not, as we shall see, *only* these most general questions of existence.¹¹ But it also ascribes to thought and language a strong pragmatic dimension, in a way reminiscent of Mach.

Boltzmann is soon led to a new criterion for the appropriateness of our scientific mental pictures: whether they represent experience as simply and appropriately as possible (pp. 105, 107). In considering how we reach such pictures, he contrasts the ‘Euclidean’ method of derivation, which has gradually been discredited, with what he calls the purely deductive method of representation (p. 107), which he takes both Hertz and himself to have used (pp. 108–109). What principally recommends the latter method to them both is the *clarity* it lends our pictures.

However, and again following Hertz, Boltzmann insists that the original question about the nature of matter, mass, or force is not *solved* by using the deductive method. Rather,

we have circumvented it by making a prior consideration of it quite superfluous. In our conceptual scheme these concepts are quite definite numbers and directions for geometrical constructions which we know how to consider and execute in order to obtain a useful picture of the phenomenal world. What might be the true cause for this world to run as it does, what is as it were concealed behind it and acts as its motor, these things we do not regard as the business of natural science to explore.

¹¹ This might be thought to anticipate Carnap’s treatment of ‘external questions’ (although Carnap did not reject those outright, as Boltzmann does here).

Whether it might or could be the task of some other science, or whether following the analogy of other, sensible collocations of words we have perhaps merely strung together words that express no clear thought in these combinations, all this may be left entirely open here (pp. 109–110).

This paper, then, introduces the idea of questions that have *no* significance, identifying as such questions about the existence and the ‘nature’ of matter, mass, and force, along with questions of causes and hidden mechanisms. While trying his best to respect Hertz’s pedagogical concerns, notably by aiming at ‘perfect clarity’ (p. 108), Boltzmann generalises Hertz’s ideas considerably here, and he is more explicit than Hertz in declaring that questions about the nature of fundamental concepts can only be *circumvented*, not *solved*. He makes (but does not follow up) the suggestions that such questions are not within the purview of science, and that they might be *combinations of words that express no clear thought*. He also offers a new account of the nature of those problematic concepts as ‘directions for constructions’, although this is hardly fleshed out. All the time, I would suggest, Boltzmann is working with the idea of pseudo-problems, giving his most explicitly *semantic* diagnoses of them, and suggestions for their (non-) treatment.

One might also feel, though, that this paper is something of a strange and unsatisfactory half-way house. While it has a strong drift towards the diagnosis of pseudo-problems (rejecting certain metaphysical questions as insignificant), Boltzmann nevertheless thinks that the method of ‘analysis of the simplest foundations of knowledge’ (p. 104) has been improved, so presumably he is not proposing its outright rejection. And the ‘invincible streak’ he mentions, our psychological tendency to analyse even the simplest concepts, is not clearly resisted here, as we will soon see it is in his next papers. One might also want to know how Boltzmann might have squared his rejection of these questions with his scientific realism (that science *can* tell us the nature of things). We shall return to this issue below.

5.3 ‘On the Principles of Mechanics, I’ (1900)

In his inaugural lecture at Leipzig, in 1900, a new element informs Boltzmann’s thinking when he produces a general diagnosis of how pseudo-problems arise:

Darwin’s theory explains by no means merely the appropriate character of human and animal bodily organs, but also gives an account why often inappropriate and rudimentary organs or even errors of organisation could and must occur. It is no different in the field of our drives and passions. [...] Our innate drives often overshoot the mark as it were. The force with which for the sake of certain results they have linked themselves with our minds is so enormous that we cannot easily rid ourselves of it if these results are not achieved and the now habitual drive is superfluous or harmful (Boltzmann 1905/1974, 136).

He immediately went on to identify such errors in the history of the organism, in the mental sphere, and in philosophy. There, our tendency to judge the value of things according to whether they help or hinder our own existence becomes so habitual that ‘in the end we imagine we can judge as to the value or otherwise of life itself, and indeed whole books are written about this mistaken topic’ (p. 136).

This is not supposed to imply that life has *no* value (or meaning). On the contrary, the assertion that life has no value is, as it were, merely the *null* answer to the question of what

value it has. What Boltzmann is proposing is that the question about ‘the value of life’ is nonsense, and thereby unanswerable, even by the null answer.

He also identifies other examples from philosophy, including the ‘antinomies’ in Immanuel Kant’s *Critique of Pure Reason* (p. 137), certain supposed ‘riddles of the universe’ (probably a reference to Ernst Haeckel’s 1895–1899 book *Die Welträtsel (The World-Riddle)*¹²), and the question ‘Why is there something rather than nothing?’. He then suggests how we go wrong:

We must constantly dismantle concepts into simpler elements and explain phenomena by means of laws we know already. This highly useful and necessary activity becomes so much a habit as to produce the compelling appearance that the simplest concepts themselves must be dismantled into their elements and the elementary laws reduced to even simpler ones (p. 137)

This repeats his earlier diagnosis, in which our scientific tendency to ‘resolve complex things into their simpler components’ is pushed so far as to overreach itself. And it *does* look as if it might explain certain pseudo-problems. Some philosophers have, after all, tried to further analyse concepts which others have declared to be primitive and unanalysable, such as knowledge, goodness, and causation. But there is a problem with Boltzmann’s dialectic here: this diagnosis does not seem relevant to the pseudo-problem with which he began (of ‘the value or otherwise of life itself’), where the question of primitivity or analysability does not seem pertinent. However, Boltzmann does then give some examples where it seems a better fit:

Questions like what is the definition of the number concept, the cause of the law of causality, the nature of matter, force, energy and so on, always irresistibly recur, even to the person who is philosophically trained. He is convinced that these concepts are taken straight from experience and not explicable further, so that here the now irresistible mental habit of asking for the cause and definition overshoots the mark, but still he cannot overcome a certain residual dissatisfaction that such important concepts as number or causality defy all attempts at definition (Boltzmann 1905/1974, p. 137)

Here we also have two new ideas, firstly, that these questions are *irresistible*, even to trained philosophers. And secondly that *we cannot be satisfied with* the indefinability of the concepts in question. (It is worth noting, too, that Boltzmann has again here moved to something very like those ‘What is the nature of...?’ questions, maybe under Hertz’s influence).¹³

Boltzmann then compares the situation here with optical illusions: ‘It is as when an optical illusion fails to vanish even after one has clarified its mechanical cause’ (p. 137). Even when we have realised that these philosophical questions are illegitimate, confused, unanswerable, we *still* feel their pull and we are *still* tempted to *try* to answer them—realising that they are nonsense *does not* free us from their grip.

¹² Boltzmann may also have had in mind Emil du Bois-Reymond’s 1880 lecture ‘The Seven World-Riddles’, which expresses what Boltzmann calls ‘the view that certain questions fall outside the boundaries of human cognition’ (see below). However, Boltzmann mentions du Bois-Reymond only once in his *Populäre Schriften*, and not in this connection.

¹³ Has any philosopher been daft enough to ask after ‘the cause of the law of causality’, though? Who could he have had in mind?

This is worth comparing with Hertz who, as we saw, said that ‘our minds, no longer vexed, will cease to ask illegitimate questions’. Where Hertz holds out the hope for intellectual calm, Boltzmann at this point apparently *does not*. This is surely because of the biological/psychological slant to his thinking here—since we are *always* still subject to our bio-psychological drives, we can never (more than momentarily) escape the temptation to try to answer these questions.

Finally, he gives yet another example from philosophy: ‘that old aberration we now call solipsism’ (p. 137). Here, Boltzmann thinks, the perfectly legitimate idea that individual sensations can sometimes be explained without postulating an ‘outer’ object can, when over-generalised as far as possible, lead inappropriately to the solipsist conclusion:

By pushing this habit to excess and applying it even where it does not belong, one arrives at the notion that all our ideas are dreams and nothing exists except the person that has them, that is one single dreamer (p. 138).

The solipsist’s excess is to take a useful mental habit and, by fixating on it and failing to realise its limitations, misuse it. One can meaningfully ask whether each individual experience shows one what is real, or whether it is illusory. But one cannot meaningfully ask the same question about the *entire* totality of our experience.

Boltzmann, then, considers certain questions about *totalities* (in his examples: the *entire* realm of causality, the *entire* realm of life, and the *entire* realm of one’s experience) problematic, and problematic in such a way that they cannot possibly have answers. His idea seems to be that we ask ourselves such questions because our natural tendency to generalise overreaches itself, but that while we can legitimately ask certain questions about each member of a totality, we can’t meaningfully ask the *same* question about the *entire* totality.

5.4 ‘On Statistical Mechanics’ (1904)

In the fourth paper in question, Boltzmann explicitly settled on describing the problematic intellectual tendency he had in mind as ‘overshooting the mark’ [*über das Ziel hinausschießen*]¹⁴:

Many inappropriate features in the habits and behaviour of living beings are provoked by the fact that a mode of action that is appropriate in most cases becomes so habitual and second nature that it can no longer be relinquished if somewhere it ceases to be appropriate. I express this by saying that adaptation overshoots the mark. This happens especially often with mental habits and becomes a source of apparent contradictions between the laws of thought and the world, and between those laws themselves (1905/1974, 166).

He gives another example, of ‘the question whether cause and effect represent a necessary link or merely an adventitious sequence’, urging that one can meaningfully ask only ‘whether a specific phenomenon is always linked with a definite group of others, being their necessary consequence, or whether this group may at times be absent’ (p. 166).

¹⁴ We already saw him use that term, but in this paper it seems to become his official diagnosis. Might it have derived from Mach’s remark that ‘The question, “Why?” which is always appropriate where the explanation of a contradiction is concerned, like all proper habitudes of thought, can overreach itself [*über den Zweck hinausgehen*] and be asked where nothing remains to be understood’ (Mach 1895/1896, 199)?

This question of whether causality is a relation of necessity is certainly one that philosophers have asked. But it does not look like a question of *any* of the kinds Boltzmann has mentioned so far, and its status as introducing a pseudo-problem is surely far more contentious. Unfortunately, we hear no more of why Boltzmann counts it as such. Instead, he returns to his favourite examples from philosophy, the question of the value of life itself, our urge to resolve even the simplest existing concepts into yet simpler ones, and attempts to explain even the simplest fundamental laws. He then produces a very vivid general characterisation of the situation:

My present theory is totally different from the view that certain questions fall outside the boundaries of human cognition. For according to that latter theory this is a defect or imperfection of man's cognitive capacity, whereas I regard the existence of these questions and problems themselves as an illusion. On superficial reflection it may of course be surprising that after recognition of the illusion the drive towards answering these questions does not cease. The mental habit is much too powerful to loosen its hold on us (1905/1974, 167).

Boltzmann's declaration that these problems and questions are themselves illusory clearly places him in the pseudo-problem tradition, even though he never uses Mach's term '*Scheinproblem*'. This passage also explains how that tradition is distanced from the more familiar, mainstream epistemic view that the questions in question *do* have answers, even if those answers are humanly unknowable. This was implicit in Mach, but Boltzmann makes it absolutely explicit.

Boltzmann again compares the situation with optical illusions, which 'continue to exist even after their cause has been recognized', but he then sounds a more personal note: 'Hence the feeling of insecurity, the lack of satisfaction that grips the scientist when he philosophizes' (p. 167). Philosophers themselves, though, are clearly on no firmer ground than scientists, in his view:

Only very slowly and gradually will all these illusions recede and I regard it as a central task of philosophy to give a clear account of the inappropriateness of this overshooting the mark on the part of our thinking habits; and further, in choosing and linking concepts and words, to aim only at the most appropriate expression of the given, irrespective of our inherited habits. Then, gradually, these tangles and contradictions must disappear (p. 167).

These passages do put the conclusion he drew back in 1900 in a more optimistic perspective. His view seems to be that although the questions that generate pseudo-problems are *irresistible*, and that we cannot help *trying* to address them, the illusions could eventually be made to recede, with the help of philosophy. This conclusion is not so different from that which Hertz drew. But *how* might philosophy perform these tasks?

If therefore philosophy were to succeed in creating a system such that in all cases mentioned it stood out clearly when a question is not justified so that the drive towards asking it would gradually die away, we should at one stroke have resolved the most obscure riddles and philosophy would become worthy of the name of queen of the sciences (p. 167).

I have argued elsewhere that one can see Ludwig Wittgenstein as responding to Boltzmann's proposed 'central task of philosophy', and as trying to create something which would satisfy the perceived need for such a 'system' in his *Tractatus Logico-Philosophicus* (Preston 2017).

5.5 ‘On a Thesis of Schopenhauer’s’ (1905)

Finally, in one of his very last publications, ‘On a Thesis of Schopenhauer’s’, Boltzmann really warms to his idea of overshooting the mark, and the notion runs riot. He uses examples of questions which overshoot the mark which we have seen before, such as the questions of whether life as such has value, and should be promoted or inhibited (pp. 192, 196), the question of why (that is, for what *cause*) the law of cause and effect itself holds (p. 194), the questions not only of why the world exists at all, but also of ‘why it is as it is, why we exist at all and why precisely now and so on’ (p. 194).¹⁵

Again we see the idea that we have a *need* to ask the problematic questions (p. 196), that we are *tormented* by not finding answers to them, and that this torment ‘does not cease once we have recognized that the framing of the question is in itself misguided’ (1905/1974, 196). Confirmation that Boltzmann’s diagnosis is a *bio-psychological* one comes from his appeal to Darwin:

[P]recisely this phenomenon is perfectly explicable on Darwin’s theory; habit is simply stronger than recognition that the question is useless. Deceptions of the senses likewise do not cease even when they have been completely explained in terms of physics and physiology (p. 196).

And Boltzmann’s sarcasm about philosophy itself also gets an airing. Because we have such a strong instinct for classification, he thinks,

we take a lot of concepts to be clear or even *a priori* when they are really mere empty words. We imagine ourselves to be heaven knows how learned if without linking the words in question with clear concepts we ask whether something is synthetic or analytic, transcendental or empirical, real or ideal or material, quantitative or qualitative. About such questions philosophers are apt to write whole treatises; only, whether they are completely clear as to the meaning of their questions, about that they do not ask (p. 196).

The *semantic* aspect of Boltzmann’s conception grows more prominent, too. The question of whether life itself has a value he declares to be ‘one of those questions utterly devoid of sense’ (p. 196). His treatment here is not quite stable, though. He immediately goes on to contradict the idea that the question has no sense by saying ‘Life itself we must accept as that which has value, and whether something else does can only be judged relatively to life, namely whether it is apt to promote life or not’ (p. 196). But then, only a few lines later, we find him saying again that.

[I]f we ask whether life itself has value, this means whether life is apt to promote life, a question that has no sense. According to the definition we can ask only how life can be promoted. The valuable is simply what promotes life, the question as to the value of life itself is senseless, although according to Darwin’s theory it is readily explicable why it obtrudes itself. It is another mental habit that overshoots the mark (pp. 196–197).

In this article we also get an important and radical new theme. Previously we saw that Boltzmann had the idea that the problematic mental habits in question lead to apparent

¹⁵ He also has fun with the idea that a behavioural habit, such as the habit of drinking fermented fruit juice, can overshoot the mark (in leading to alcoholism, that is) (p. 194).

contradictions with, and among, the ‘laws of thought’ (that is, the laws of logic, as he conceived them). Here, that idea develops into the new theme that those laws *themselves* are such firmly established habits that *they* overshoot the mark (p. 195). Boltzmann introduces this theme via considering again how philosophy might help us avoid overshooting the mark:

The task of philosophy for the future is, in my view, to formulate the fundamental concepts in such a way that in all cases we obtain as precise instructions as possible for appropriate interventions in the world of phenomena. This requires first that if we follow different paths we never reach different rules for further thought and action, that is we never meet internal inconsistencies, such as if one path led us to the conclusion that matter was not infinitely divisible and another that it must be. That sort of event is always a sign that the laws of thought still lack the last finish, that we have placed our words badly. In that case we must alter the laws of thought that lead to such absurd consequences (p. 197).

Not only do philosophers overshoot the mark, then, the laws of logic *themselves* do so, or tempt us to do so. Boltzmann ends his article by suggesting that we should *alter* the laws of thought. In altering them, he suggests, we can get closer and closer to keeping our habit of overshooting the mark within proper bounds. The payoff he then describes thus:

[T]his would ensure cessation of the disquiet and the embarrassing feeling that it is a riddle that we are here, that the world is at all and is as it is, that it is incomprehensible what is the cause of this regular connection between cause and effect, and so on. Men would be freed from the spiritual migraine that is called metaphysics (p. 198).

6 Survey of the Idea, from Mach to Boltzmann

Let us survey what we have seen. First, these thinkers apply their methods to a wide range of problems. Understandably, as philosopher-scientists, they apply such methods primarily to problems which can be thought of *either* as problems in the philosophy of science *or* as problems in specific sciences, including physics (force, electricity, matter, energy) and psychology (introjection, blind-spot, etc.). Equally obviously, though, they suggest the application of these methods to classic *philosophical* problems, including problems concerning natural laws and causation (philosophy of science), the problem of the meaning or value of life (ethics), the question of why there is something rather than nothing (metaphysics), the problem of the nature of number (philosophy of mathematics), the problem of other minds, and the ‘hard problem’ of consciousness (philosophy of mind).

Second, they suggest somewhat different ways of *identifying* pseudo-problems. Sometimes it is particular *concepts* that are deemed pseudo-problematic, and the concepts they have in mind are concepts from science. At other times what is pseudo-problematic is a specific *question* or a philosophical ‘problem’, such as those listed above.

Third, they also offer different *diagnoses* of the pseudo-problems: some are thought to arise from a *conflict* between the relations surrounding a concept (Hertz), or a conflict between movements of thought (Mach), whereas in other cases what causes the pseudo-problem is supposed to be the transfer of ideas from one branch of science to another (Mach), or the over-extension of a meaningful question, an over-extension imposed on us by an almost irresistible mental habit (Boltzmann).

Finally, different *treatments* for pseudo-problems are suggested, although none of these treatments implies that the original problem can be solved. Where the pseudo-problematic item is a concept, it needs *streamlining*, which ensures that it is *clarified*. As a consequence, *certain* questions framed in terms of the original, encrusted concept are rejected, but legitimate questions can be framed using the clarified concept. Where what is pseudo-problematic is itself a question, rather than a concept, the question must be shown to be illegitimate (and thus gets rejected, rather than clarified), or at least illegitimate where it has been over-extended.

Notice also that the suggested treatments vary greatly in terms of how drastic they are. The most modest proposal is that of Hertz, who intends to clarify the concept of force and undertakes that clarification by forging a new, *ersatz* concept to be inserted into his radical new ‘representation’ of mechanics. We are thereby relieved of our temptation to raise the question ‘What is (the nature of) force?’. Boltzmann, for his part, suggests that philosophy, with which he was not generally impressed, would at last be worthy of the epithet ‘Queen of the sciences’ if it came up with a system which achieved a single task, a task having both a positive and a negative aspect. The positive aspect would be its formulating fundamental concepts clearly enough for us to tell how to make appropriate interventions in the world of phenomena. And the corresponding negative task would be to clearly identify when a proposed question is inappropriate, so that the drive towards asking it would gradually die away. Mach, though, makes what (after more than an extra century of rather different scientific ontologies) looks to us like the most radical proposal: that both the physical and the psychological sciences should work with an entirely new ontology, his ‘scheme of elements’.

7 Pseudo-Problems and the Realism/Anti-realism Debate

After these philosopher-physicists, the idea of a pseudo-problem was taken up by the logical positivists, most notably by Carnap (1928/1967). Carnap did know Mach’s works pretty well, so he may easily have got the concept from Mach. Because of that development (more than because of its original use by Mach, which was not much noticed), the notion has acquired a reputation as a distinctively positivist weapon.

However, it may be possible to dissociate recognising the existence and importance of pseudo-problems, and attempting to treat them in ways that do not presuppose that they can be *solved* (as genuine problems can be), from any problematic ‘positivism’, logical or otherwise. The former can, I will now briefly suggest, be combined with moderate varieties of scientific realism.

Firstly, none of the considerations I have described have anything to do with what is observable, or with what is verifiable. They have no intrinsic connection to positivism. Indeed, their only epistemic aspect is Mach’s complaint that ‘things-in-themselves’ are unknowable, and that complaint was a commonplace among Kant’s successors, whether or not they were even empiricists.

Secondly, while no-one thinks of Mach as a ‘scientific realist’,¹⁶ Hertz and Boltzmann have both been interpreted thus.

¹⁶ Erik Banks argued for Mach’s being a ‘realistic empiricist’ (Banks 2003; 2014), but the ‘realist’ component here is not easily relatable to scientific realism as usually conceived.

The example of Hertz is contentious. I would argue that he was an anti-realist, but an anti-realist of the *epistemic* kind, not the semantic kind (for a similar reading, see Eisenthal 2018). This makes him a poor candidate for being a positivist.

It is generally agreed that Boltzmann was, for a long time at least, a moderate scientific realist. He endorsed a version of *Bildtheorie* according to which the task of theory consists in constructing a picture or model (*Bild*) of the external world, which then gets increasingly adapted to that world, a theoretical picture which ‘got sifted and refined and... gained in truth to nature’ (Boltzmann 1905/1974, 34; see de Regt 2005). However, it has also been argued that he later moved to an entirely different ‘linguistic philosophy’ involving a strong and semantic form of anti-realism, causing him to reject his former scientific realism (Blackmore 1982). Even if this is correct, Boltzmann may have been wrong to think that his new linguistic philosophy was incompatible with his earlier realism. Science, after all, need not attempt to address the sorts of metaphysical questions that Boltzmann was worried about. It can quite well treat such problems as philosophical pseudo-problems while insisting that we should still understand scientific theories as attempts to give true and explanatory descriptions of aspects of reality.

Boltzmann’s take on metaphysics, indeed, was distinct from Mach’s. Boltzmann, as we have seen, thought that science *can* do some of the things that metaphysics demands but cannot *itself* do, such as telling us about the nature of reality. But, like Mach, he also thought that *other* demands that metaphysics make are nonsensical, and must be rejected as such. The ‘questions’ and ‘problems’ they agree in identifying are *still*, I would argue, plausibly treated as *philosophical* problems (rather than scientific ones), and many of them are still promising examples of pseudo-problems. Thus the shared disdain of Mach and Boltzmann for the most extreme demands of metaphysics (as they understood that discipline) might still be defensible.

8 Conclusion

Where the British empiricists had critiqued the notion of substance-in-general (the ‘substratum’ of accidents) Mach critiqued the very idea that things and selves are *substances*. He also introduced the idea that (at least some) philosophical problems are *pseudo*-problems. Hertz thought that certain ‘What is...?’ questions, questions about ‘the *nature* of’ such & such, are inherently problematic. And Boltzmann thought various philosophical questions had ‘overstepped the mark’, being ‘inappropriate’ (i.e., pseudo-questions). He also gave a bio-psychological explanation of their grip on us, and suggestions for how philosophy might rescue the situation.

While none of these philosopher-scientists can be said to have taken the ‘linguistic turn’ or to have become analytic philosophers, Boltzmann clearly does prefigure those developments. Like those who came after him he located these problems in *language*, specifically in *semantics*, and unlike his immediate successors, he gave a naturalistic explanation of why these problems inevitably arise, an explanation which at least deserves consideration.

In the work of Wittgenstein and the logical positivists, semantic approaches came to be associated with what has been called ‘nonsensicalism’, the view that philosophical problems are typically (or even always) pseudo-problems. Nonsensicalism is now thought to be deeply problematic (see Dearden 2015). But some of the approaches taken by these

philosopher-physicists might still be of interest, being far more localised, and deriving from a general theory of, or approach to, meaning only in the case of Boltzmann.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

Baird, D., Hughes, R. I. G., & Nordmann, A. (Eds.). (1998). *Heinrich Hertz: Classical physicist, Modern philosopher*. Kluwer.

Banks, E. C. (2003). *Ernst Mach's world elements: A study in natural philosophy*. Dordrecht: Kluwer.

Banks, E. C. (2014). *The realistic empiricism of Mach, James, and Russell: Neutral monism reconceived*. Cambridge: Cambridge University Press.

Blackmore, J. T. (1982). Boltzmann's concessions to Mach's philosophy of science. In R. Sexl & J. T. Blackmore (Eds.), *Ludwig Boltzmann, Gesamtausgabe, Band 8: Ausgewählte Abhandlungen* (pp. 155–190). Wiesbaden: Vieweg.

Boltzmann, L. (1905/1974). *Populäre Schriften*, (Leipzig: J.A. Barth), partly translated by Paul Foulkes as *Theoretical Physics and Philosophical Problems: Selected Writings*, ed. B. F. McGuinness. Dordrecht: D. Reidel.

Carnap, R. (1928/1967). *The logical structure of the world and pseudo-problems in philosophy*. Berkeley: University of California Press.

Cordes, M. (2020). Analysis of “(‘)Pseudo-problems(’).” *Logical Analysis and History of Philosophy*, 22, 137–159.

de Regt, H. (2005). Scientific realism in action: Molecular models and Boltzmann's *Bildtheorie*'. *Erkenntnis*, 63, 205–230.

Dearden, I. H. (2015). *The problem of philosophical nonsense: A short introduction*. London: Rellett Press.

Eisenthal, J. (forthcoming). Hertz's *Mechanics* and a Unitary Notion of Force. *Studies in History and Philosophy of Science Part B: Studies in History and Philosophy of Modern Physics*.

Eisenthal, J. (2018). Mechanics without Mechanisms. *Studies in History and Philosophy of Science Part B: Studies in History and Philosophy of Modern Physics*, 62, 45–55.

Hertz, H. (1894/1956). *Gesammelte Werke, Band III: Die Prinzipien der Mechanik in neuem Zusammenhange dargestellt*. In P. Lenard (Ed.), J.A. Barth, Leipzig, 1894, translated by D.E. Jones & J.T. Walley as *The Principles of Mechanics Presented in a New Form*, New York: Dover.

Mach, E. (1886a/1897). *Beiträge zur Analyse der Empfindungen*. Gustav Fischer, Jena (1886), translated by C.M. Williams as *Contributions to the Analysis of the Sensations*. Open Court, LaSalle, IL (1897).

Mach, E. (1886b/2008). *Die Analyse der Empfindungen (Ernst Mach Studienausgabe, Band 1)*. In G. Wolters (Ed.). Berlin: Xenomoi.

Mach, E. (1892). ‘Facts and Mental Symbols’ (translated by T.J. McCormack). *The Monist*, 2, 198–208.

Mach, E. (1895/1896). *Popular Scientific Lectures*, translated by T.J. McCormack (Chicago: Open Court, 1895) from the German edition, *Populär-wissenschaftliche Vorlesungen*, (Leipzig, 1896. Further German editions, 1897, 1903, 1910, 1923).

Mach, E. (1896/1986). *Die Prinzipien der Wärmelehre, historisch-kritisch entwickelt*, (Leipzig: J. A. Barth, 1896. Further German editions, 1900, 1919). 2nd German edition translated by T. J. McCormack, P. E. B. Jourdain & A. E. Heath as *Principles of the Theory of Heat, Historically and Critically Elucidated*, B. F. McGuinness (Eds.), Dordrecht: D. Reidel.

Mach, E. (1896/2016). *Die Prinzipien der Wärmelehre, historisch-kritisch entwickelt (Ernst Mach Studienausgabe, Band 5)*. In M. Heidelberger & W. Reiter (Eds.). Berlin: Xenomoi.

Mach, E. (1900/1959). *Die Analyse der Empfindungen und das Verhältnis des Physischen zum Psychischen*, (Jena: Gustav Fischer, 1900. Further German editions in 1902, 1903, 1906, 1911, 1918, 1919, 1922). Translation of the 1st German edition (of Mach 1886/1897) by C. M. Williams, revised and supplemented from the 5th German edition by S. Waterlow as *The Analysis of Sensations and the Relation of*

the Physical to the Psychical, (Chicago & London: The Open Court Publishing Company, 1914, reprinted New York: Dover Publications, 1959).

Mach, E. (1905a/1976). *Erkenntnis und Irrtum. Skizzen zur Psychologie der Forschung*, (Leipzig: J.A. Barth, 1905. Further German editions, 1906, 1917, 1920, 1926). 5th German edition translated by T. J. McCormack & P. Foulkes as *Knowledge and Error: Sketches on the Psychology of Enquiry*, ed. B. F. McGuinness, Dordrecht: D. Reidel.

Mach, E. (1905b/2011). *Erkenntnis und Irrtum. Skizzen zur Psychologie der Forschung, Ernst Mach Studienausgabe, Band 2*. In E. Nemeth & F. Stadler (Eds.). Berlin: Xenomoi.

Preston, J. (2008). Hertz, Wittgenstein, and Philosophical Method. *Philosophical Investigations*, 31, 48–67.

Preston, J. (2017). Wittgenstein Hertz and Boltzmann. In H.-J. Glock & J. Hyman (Eds.), *A companion to Wittgenstein* (pp. 110–123). New York: Wiley.

Preston, J. (2021). Phenomenalism, or neutral monism, in Mach's *Analysis of Sensations*? In J. M. Preston (Ed.), *Interpreting Mach: Critical essays* (pp. 235–257). Cambridge: Cambridge University Press.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.