

Bas van Fraassen

Problems of Modern Empiricism

2nd, revised and enlarged edition

Empirismus im XX. Jahrhundert

2. überarbeitete und ergänzte Ausgabe

Deutsche Übersetzung durch
C. Beckmann - K. Biermann

Fakultät für
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Foreword

No Philosophy can today get around occupying itself with questions and problems of Empiricism. The present course by the Philosopher of Science Prof. van Fraassen of Princeton University shows this in a paradigmatic way. Thus, there was no doubt that this course which has been well received by the students over many years be included in the new Study Programs. That with this course a bilingual course is offered for the first time, shows the opening-up of the Philosophy Studies Program of FernUniversity for students whose mother tongue is not German. I should like to thank Ulrike Müller-Bruhnke MA for her support in proof-reading the typoscript of this course.

Hagen, May 2003

Prof. J. P. Beckmann

Vorwort

Kein Philosophieren kann heute der Auseinandersetzung mit Fragen und Problemen des Empirismus ausweichen. Der vorliegende Kurs des Philosophen und Wissenschaftstheoretikers Prof. van Fraassen von der Universität Princeton zeigt dies auf paradigmatische Weise. So bestand denn auch kein Zweifel, dass dieser seit vielen Jahren bewährte Kurs in das Programm der neuen Studiengänge aufzunehmen war. Dass dies erstmals zweisprachig geschieht, zeigt die Öffnung des Philosophie-Studienangebots der FernUniversität für fremdsprachige Studierende. Für die tatkräftige redaktionelle Mithilfe sei Ulrike Müller-Bruhnke MA herzlich gedankt.

Hagen, im Mai 2003

Prof. J.P. Beckmann

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TEIL II: DEUTSCHE ÜBERSETZUNG

0. Introduction

0.1 Introduction to the Theme

At the beginning of a course on modern empiricism, we may wish to reflect on why we should want to turn to philosophy in general, or to this specific philosophical tradition in particular. It is possible to do so with exactly the same motive that leads one to study history or geography or literary criticism, namely to satisfy our curiosity about the development of ideas and intellectual activities that shaped our culture. This would be a passive approach, a decision to learn and be receptive, as opposed to a wish to participate. And philosophy makes a constant demand for participation. It is true that philosophers present you with theses and arguments and answers. But if you look at how *they* react to the theses and arguments their predecessors presented, you see that their practice undercuts their presentation of their ideas. On the face of it, a teacher of philosophy should be understood simultaneously as saying "Here is my position and here are my reasons for it: I advocate its acceptance" and also as saying "Here I show you my practice as philosopher, and hope to make clear why I value this practice: I advocate its imitation." But to imitate his practice will consist in approaching his ideas very critically, as a subject for your own evaluation, which may lead to very different conclusions – the very opposite of acceptance.

The approach to philosophy: curiosity, participation, criticism, evaluation, understanding of the problem

How is this paradox to be resolved? Well, if I presented you now with a way to resolve this paradox, I would be giving a philosophical answer to a philosophical question. So I would at once be offering this to you as the solution thought ought to be accepted; and inviting you to approach it critically, as a possible answer for you to evaluate. To be aware of this tension – that is to have a better understanding of the problem than any individual solution can give you. You are hereby invited, as you study this course, to keep this tension alive, by thinking critically about every thesis and argument presented.

In empiricism, we have a philosophical tradition which has always valued the critical practice of philosophy more than any answers this practice might provide. Hence empiricist philosophers have almost never been "system builders"; they have been the critics of philosophical systems. Yet no criticism of someone else's answers is effective unless you can do one of two things: (a) show that the questions he addresses were based on a mistake, or (b) suggest alternative answers that are better. Since (a) is not always possible, empiricists too have had to devise their own answers and philosophical positions. In section 1 we will look at the common elements in empiricist philosophical positions. The remaining sections will describe – in a critical and evaluative, i.e. philosophical manner – how those positions developed during modern times (mainly from the seventeenth century to the present).

Method of study of the humanities, historical and analytical

The method of study adopted is therefore typical of the humanities: the approach is at once historical and analytical. This is how you would, for example, study literary criticism, beginning with Aristotle's *Poetics*, investigating why and how Cicero and Longinus introduced changes into this theory, why these classical theories could not do justice to new literary forms emerging since the Renaissance, and so forth.

But the branch of learning outside philosophy of most concern to empiricists has always been natural science. In some broad sense, in both science and philosophy, we are trying to reach an understanding of the world we live in. But the quest for understanding takes many forms.

One form is the mechanic's or engineer's question, *how does it work?* Exactly the same curiosity leads the scientist to ask, *how does the embryo develop into a mature organism?* and leads the philosopher to ask, *how does the scientist reach and evaluate his own theories?* These are all factual questions, which cannot be answered entirely by "armchair thinking". At the same time, knowing the facts is often not enough to reach understanding. Sometimes understanding is hindered by a lack of facts, but sometimes by a lack of reflection.

A study of philosophical reflections on science

In the natural sciences we see a large scale cultural phenomenon, an enterprise that has many participants all over the world, and which involves both the collection of factual information and much speculative thought. During the last four centuries, partly through its association with powerful technologies, and partly through its intellectual challenges, science has become a major cultural force. By precept and example it transformed certain parts of the humanities into social sciences, and changed the methods of trade, production, business, and government. But in addition, in the purely intellectual sphere, its theories and world-pictures now present the challenges to understanding that myths, metaphysics, and theologies used to present.

This exploration of modern empiricism, a tradition in Western philosophy, will therefore take the form of a study of philosophical reflections on science.

0.2 Overview of the Course

Chapter 1

This course on modern empiricism will explain what distinguishes empiricism among modern philosophical traditions. First it will concentrate on the development of philosophical reflections on science through the middle of the nineteenth century, and the impact of the scientific revolutions that took place thereafter in biology and physics.

Chapter 2

The course will then concentrate on the subsequent development of empiricism in the twentieth century, and provide an introduction to current problems and debates. The second chapter discusses the nature of epistemology (literally, "the theory of knowledge"). It traces the development of empiricist epistemology from the critique of Aristotelian induction, through Cartesian and

Newtonian methodology, to the emergence of a methodological synthesis in the nineteenth century.

In the third chapter, after a brief introduction to the modern concepts of *theory* and *model*, we provide capsule introductions to three scientific revolutions: Darwin's theory of evolution, Einstein's theory of relativity, and the new quantum-mechanics. These will provide three concrete examples – in addition to the smaller examples of experiments and hypotheses provided along the way – of philosophically significant scientific developments. Chapter 3

Chapter Four deals with the thoroughgoing critique of traditional epistemology of science at the hands of Pierre Duhem, Karl Popper, and Hans Reichenbach. Chapter 4

Chapter Five approaches the question – following Hempel and Salmon – , what is meant by (scientific) explanations. This approach primary centers around the terms of information and causal relations, and finally ends in a theory of questioning, referring to Bromberger, which tries to grasp explanations as replies to the question-type of the why-question, and thus as an act depending on a certain context. Chapter 5

Chapter Six describes the development of an approach to scientific method which focuses on the concept of *probability* as the key to the notion of rational belief. This development which started in the nineteenth century, was developed in the twentieth by Keynes, Ramsey, Carnap, and Hempel. While there are differences among these philosophers, they share common disagreements with those discussed in the preceding chapter. It is not possible to do equal justice to all philosophical pursuits so near to the present. Chapter 6

But the seventh chapter will outline one possible empiricist resolution of the philosophical problems that emerged in the preceding chapters. In keeping with the empiricist tradition, this chapter will focus on a re-evaluation of the place and character of science. Chapter 7

0.3 Learning Goals

The general aim of this course is to provide the student with adequate background knowledge, and to enable the student to engage in independent thinking and inquiry in its subject matter.

After finishing the course, the student should be in a position to

- formulate the characteristic theses and problems of empiricism
- distinguish in which respects, and on what issues, various philosophers have taken empiricist or non-empiricist positions
- formulate the basic theories of scientific method advocated, criticized, and discussed by empiricist philosophers since the seventeenth century
- be able to discuss problems of scientific method
- have an understanding of, and be able to evaluate, major interconnections between philosophical and scientific developments

0.4 Study Instructions

In contrast to many books on the subject, the course presupposes no knowledge of symbolic logic or mathematics. Chapters Three and Five include some mathematical discussion, which however does not require background beyond high school mathematics, and does not involve specific calculations. For relevant literature in the area, knowledge of logic and acquaintance with more advanced mathematics may be required.

Specific exercises are assigned for certain sections of each chapter. These should be completed before the student proceeds with later material. A few sample answers to such exercises are provided.

To deepen your understanding of the material, you should do three things. The first is to read some of the original work by the philosophers whose views and arguments are discussed. The second is to read some other contemporary presentations of the same material, and to think critically about their differences and similarities to the presentation in this course. The third is to write small essays in which you discuss the issues critically, emphasizing evaluation of the arguments for and against each position. Approaching a philosophical text, it is always more important to identify the arguments than the conclusions.

A list of books for further reading is provided.

0.5 Guide to the Literature

1. Primary Sources

Bacon, Francis: Novum Organum

Descartes, René: Principles of Philosophy

Hume, David: A Treatise of Human Nature (1740)

Reid, Thomas: Essay on the Intellectual Powers of Man (1785)

Herschel, John: A Preliminary Discourse on the Study of Natural Philosophy (1830)

Whewell, William: Philosophy of the Inductive Sciences (1840)

Jevons, Stanley: The Principles of Science (1877)

Poincare, Henri: Science and Hypothesis (1902)

Duhem, Pierre: The Aim and Structure of Physical Theory (1906)

Popper, Karl: Logik der Forschung (1934)

Reichenbach, Hans: Philosophie der Raum-Zeit-Lehre (Berlin, 1928), Der Aufstieg der Wissenschaftlichen Philosophie (Berlin, 1953), Modern Philosophy of Science (London and New York, 1959)

Carnap, Rudolf: Logical Foundations of Probability (Chicago, 1962)

Hempel, Carl G.: Aspects of Scientific Explanation (New York, 1965)

2. Introductions to Philosophy of Science

Losee, John: Wissenschaftstheorie. Eine historische Einfuehrung (Muenchen, 1977)

Hempel, Carl G.: Philosophy of Natural Science (Englewood Cliffs, 1966)

Weingartner, Paul: Wissenschaftstheorie I. Einfuehrung in die Hauptprobleme (Fromman-Holzboog, Stuttgart, 1971)

Krueger, Lorenz (Hrsg.): Erkenntnisprobleme der Naturwissenschaften. Texte zur Einfuehrung in die Philosophie der Wissenschaft. Koeln/Berlin, 1970

Laudan, Larry: Science and Hypothesis. Historical Essays on Scientific Methodology (Dordrecht, Holland 1981)

3. Recent Developments

MacKinnon, E.A. (ed.): The Problem of Scientific Realism (New York, 1972)

Suppe, Frederick (ed.): The Structure of Scientific Theories (Urbana, Illinois, 1974)

van Fraassen, Bas C.: The Scientific Image (Oxford, 1980)

G. Schurz (ed.): Erklären und Verstehen in der Wissenschaft (Munich: Oldenburg, 1988).

0.6 Introduction of the Author

Bas C. van Fraassen, born 5 April 1941

1959-1963 University of Alberta, Canada
1963-1966 University of Pittsburgh, USA
1966 Ph.D.(dissertation "Foundations of the Causal Theories of Time")
1967-1968 Assistant Professor, Yale University
1968-1969 Associate Professor, Yale University;
Visiting Associate Professor, Indiana University
1969-1972 Associate Professor, University of Toronto
1972-1981 Professor, University of Toronto
1976-1981 Professor, University of Southern California
1982-present Professor, Princeton University



Awards: John Simon Guggenheim Fellowship (1970-1971), Connaught Senior Research Fellowship (1979), National Science Foundation Senior Fellowship (1982-1983), Matchette Prize (joint winner 1982) Lakatos Award (joint winner 1986)

Books: An Introduction to the Philosophy of Time and Space (1970)
Formal Semantics and Logic (1971)
Derivation and Counterexample (with K. Lambert, 1972)
The Scientific Image (1980)
Current Issues in Quantum Logic (edited with E. Beltrametti, 1981)
Laws and Symmetry (1989)
Quantum Mechanics: An Empiricist View (1991)

Professor van Fraassen's assistant for the preparation of this course was Ms. Elisabeth Lloyd, author of "The Nature of Darwin's Support for the Theory of Natural Selection", *Philosophy of Science* volume 50 (1983), pp. 112-129.

1. What Is Empiricism?¹

In an address to the Philosophical Clubs of Yale and Brown University in 1896, William James characterized his philosophy as a form of empiricism, distinguishing it from what he called *absolutism* on the one hand and *scepticism* on the other. In contrast to scepticism he asserted that we are certainly capable of arriving at the truth about what we ourselves and the world are like, but against absolutism he argued for the fallibility of all human claims to knowledge – that we cannot hope to arrive at objective certainty, or absolute security. The ground for both assertions lay in the doctrine he identified as the core of empiricism: experience is the legitimate, and only legitimate source for our factual opinions, and so all conclusions concerning matters of fact are liable to modification in the course of future experience.

Empiricism –
absolutism – scepticism

Almost exactly half a century later, in 1947, Hans Reichenbach gave his Presidential Address to the American Philosophical Association, and characterised his own *logical empiricism* in almost exactly the same terms. Earlier empiricists, he said, had mistakenly thought that to be successful, they must show that objective certainty about matters of fact (which rationalist philosophers claimed to reach on the basis of metaphysical demonstration) can be reached on the basis of experience alone. But Hume had proved once and for all that this is impossible.²

The correct response is neither the despair of scepticism, nor the impossible ideal of an empirically based metaphysics. Instead, it must be a truly empiricist theory of knowledge and rational belief which entails both the possibility and ineradicable fallibility of rational opinions about matters of fact, based on experience.

Practice exercise

Practice exercise 1

1. Formulate three theses which James and Reichenbach both list as characteristic of empiricism, and discuss their relation to scepticism.

1.1 Empiricist Critique of Metaphysics

Both these modern spokesmen for empiricism identify, therefore, as characterising this philosophical movement, a certain position in *epistemology*

¹ Cross-reference H. Schnädelbach, *Probleme der Wissenschaftstheorie*, Kurs 3302, 2.2.4 und 3.3; J.P. Beckmann, *Einführung in die Erkenntnistheorie*, Kurs 3303, KE2, 6.1.3; KE 3, 4.1

² Cross-reference H. Schnädelbach, *P.d.W.*, 3.3.2 and this course, 2.1, 2.2, 2.3.

(i.e. a philosophical position concerning knowledge and rational belief). Besides this epistemological position we must however mention also the characteristic relations of empiricism to metaphysics and to science, which further differentiate it from other philosophical currents.

Metaphysical and scientific theories

Both metaphysical and scientific theories purport to describe the world. How the two are to be distinguished is itself a difficult philosophical question, debated at length by empiricists as early as Francis Bacon and as recent as Carnap, Popper, and Reichenbach. Metaphysical theories are of greater generality and describe abstract as well as concrete entities, and they concern possibility and necessity as well as actuality.

Empiricist critique of metaphysics

Yet scientific theories have also been interpreted as doing just that. Scientific theories draw from their authority or validation on the facts of experience; yet such claims have also been made for metaphysics. Despite these difficulties of demarcation, the typical stance of the empiricists has involved a scathing and far-reaching critique of the theories, aims, and even intelligibility of metaphysics. It has also involved a strong (though by no means invariable) resistance against interpretations of science which give it some of the tasks, or credit it with the achievements, which traditional metaphysics proclaimed. We see this especially in empiricist critiques of possibility and necessity, of universals and abstract entities, but also in those of such „scientific“ metaphysics as what James called *scientific naturalism*, and others, *scientism*. For empiricists, science has a very special place in human historical development. But they have regarded it as a crucial task to show that neither science nor anything else can play the role which metaphysics was meant to have.

1.2 What Is Epistemology?

Aristotle's "theory of knowledge"

Etymologically, the word „epistemology“ means „theory of knowledge“. The classic work in this subject, for two thousand years, was Aristotle's *Posterior Analytics*, a treatise on scientific knowledge (and his term *episteme* was translated by Latin authors as *scientia*). The standards set there for what counts as knowledge are very high: known is only what can be demonstrated from self-evident principles; such principles (and hence all that can be known) are universal and necessary; and knowledge requires not only realisation *that* but also understanding *why*. Other claims concerning matters of fact, not part of science, could only have the status of *opinion* or belief. This exposition was based on a view of science which was by no means accepted by later philosophers, certainly not by empiricists. Therefore the subject of epistemology – the philosophical study of exactly those topics investigated in *Posterior Analytics* – today includes also, and often concentrates on, the evaluation of opinion and belief. It must be added that when in ordinary discourse we claim to know something, we hardly purport to have satisfied the high Aristotelian standards for scientific knowledge. We do, in such ordinary knowledge claims, express our opinion about matters of

The subject of epistemology today

fact, and also convey a claim about this opinion, namely that we have adequate justification for presenting these matters of fact as really being the case. Empiricism sees experience as the only legitimate source of information and the only court of appeal for the justification or defence of opinion. Hence empiricist epistemology concentrates on the analysis of the structure of *opinion*, its criteria of evaluation, the methods of warrant or validation, and the conditions of rationality to be met by belief concerning matters of fact.

The first question which arises here is: what are the limits of experience? To begin, the universality and necessity which according to Aristotle characterise fundamental principles, are exactly what put such principles beyond these limits. Suppose for instance that an Antarctic explorer encounters two six-toed penguins. Experience has then revealed to him that there are at least two six-toed penguins, and a fortiori that it is possible for penguins to have six toes. Now it may well be the case that these are the only six-toed penguins there are or ever have been or ever will be, but his experience does not, and cannot, reveal that fact to him. It may also be the case that it is physically impossible for penguins to ever have more than six toes (i.e. necessary that their toes do not number more than six) but his experience could not reveal that either.

The limits of experience

So with respect to generality and *modality* (that is, possibility and necessity) there are very stringent limits on any possible experience. These limits may be reflected in the dictum that *what is observable must be both finite and actual*. These limits at least pertain to any possible conditions of experience for any kind of beings like us. Further limits are set by what we (the actual community of rational beings) are like: atomic structure on the one hand, and global features of space-time on the other, may be described by our theories, but cannot be perceived.

All such reflections on the limits of experience lead to corresponding problems for empiricist epistemology. For the opinions we have may include answers to questions about the prevalence of six-toed specimens among penguins (conceived as a species existing throughout a sizeable part of world-history), about the capabilities and potentialities of this species, about atomic and cosmological structure, about angels, gods, reincarnation, forcefields, and quarks, and much more. How are we to evaluate opinions about other than singular, actual, observable matters of fact? Experience is the only legitimate touchstone; so how can we use it in the evaluation of opinions and judgements which go well beyond what can be revealed in experience?

In the next chapter we shall look at how successive philosophers dealt with this problem.