# Preface and Overview of the Book

The Swedish predecessor of this book, *Introduktion till Vetenskapsteorin*, grew out of an urgently felt need when I was teaching philosophy of science for students of engineering, physics, biology, social science, medicine and nursing. These students have normally no philosophical background and quite often little knowledge of history of science. This book has now been in print for 15 years, and three editions and its relative success in Sweden have encouraged me to make a translation to English in the hope that a wider audience also will find it useful.

This book is not *merely* a translation of the Swedish book; I have also made some changes. First, Ties Niessen suggested a slight reshuffle of the chapters and an addition of a short Chap. 14, with some actual and forward-looking reflections, which I have done. Second, I have rewritten Sect. 10.7, since I have come to understand laws better. Third, I have made a great number of minor changes as a result of comments and suggestions from two anonymous referees. Their advice was very helpful.

The prime goal for a first course in philosophy of science should be, I believe, to convey an understanding of what science is: how it has developed, what its core traits are, how to distinguish between science and pseudoscience and to know what a scientific attitude is.

In such an endeavour it is common and natural to concentrate on the development and core traits of natural science. However, students and scholars within the social sciences and humanities often think that these sciences differ profoundly from natural science and that the lessons from Galilei, Newton and other natural scientists are not relevant for them.

Here a remark about the word 'humanities' is in place. Hume and other eighteenth-century British philosophers used the word 'moral sciences' as a label for studies we now would call 'humanities'. The effect is that the word 'science' without modifier now means natural science only. This is not so in German, Swedish and other Germanistic languages, where the corresponding words ('Wissenshaft' 'vetenskap') are used for all systematic studies at universities. It seems to me that using the word 'humanities' encourages people to see the

differences rather than the similarities among different disciplines, and since I want to stress commonalities among the sciences, I suggest using the expression 'human sciences' as replacing 'humanities'.

It is commonly assumed that natural science is concerned with testing hypotheses and discovering natural laws, whereas the aim of human and some social sciences typically is to achieve understanding, i.e. understanding *the meanings* of individual's and social group's actions. Such understanding may be achieved by some interpretative method, which is seen as profoundly different from the method of testing hypotheses.

I have no objections against these two broad characterisations of respectively natural science and human and social sciences, but I disagree about the tacit assumption that testing of hypotheses and making interpretations – doing hermeneutics – are radically different activities. In fact, I think a good case can be made for the view that interpretation of texts, utterances, behaviour, cultural phenomena, etc., are species of hypothesis testing, not, of course, hypotheses about regularities, as in natural and some social sciences, but about *meanings*. The structural similarities between the hypothetico-deductive method, the hermeneutic circle and Davidson's rules for interpretation are not difficult to recognize, once one has freed oneself from the idea that hypotheses by necessity are about regularities in the world. Dagfinn Føllesdal was, as far as I know, the first to point out these similarities. However, it is still a controversial view and one aim of the book is to give some arguments for it.

But why stressing similarities between the sciences? The main reason is that we need to say something general about all sciences in order to effectively demarcate between science and pseudoscience, which in my view is a prime duty when teaching elementary philosophy of science. Pseudoscience is quite popular and many people are astonishingly credulous and/or prey of wishful thinking. And some people just dress up their activities, whatever they are, by calling them 'science' just because it enhances the prestige of what they are doing, or so they think.

So how to demarcate? It won't do to say that each particular science has its own rules of inquiry, its own criteria for being scientific, because then proponents of, for example, homeopathy could say: 'Yes, we agree that every discipline has its own criteria and that applies as well to homeopathy: our criteria differ somewhat from school medicine (an expression often used by homeopaths when they talk about medical science taught at universities) but our criteria are just as scientific as those of school medicine and we are just as scientific as they are. Proponents from school medicine act as imperialists on the market for theories about treatment of diseases when they denounce us'.

This argument we need to rebut, and the way to do that is to argue that scientific thinking, independent of domain of inquiry, ought to satisfy some fundamental and general epistemic demands. Hence, we need common criteria for any activity properly being called scientific. I believe that the hypothetico-deductive method and strictures on valid observation reports are the main components in such a list of criteria.

Some people are sceptical about the possibility of finding general criteria for science, although they see the need. In particular, it has been argued that the hypothetico-deductive method is too strong a criterion for scientific work, since there are some activities that best are described as 'data mining' or 'data collection' in some scientific disciplines, activities that are not driven by any explicit hypothesis, and we do not want to dismiss such activities as unscientific. I agree that we do not want to do that. However, hypothetico-deductive method is not a criterion for *every* activity called 'research' in a discipline; it is better viewed as a criterion on the discipline as a whole. The fact that some researchers in some disciplines sometimes engage is 'data mining' or the like doesn't entail that the discipline fails the general criterion for being a science.

The need for general criteria for scientific thinking is no more than an instance of the epistemological demand to produce reasons, acceptable to others, for your claims to know. Rational scientific discussions about methods, measurements, inferences and conclusions presuppose that it is possible to discuss and agree on epistemological and scientific norms independently of whether one accepts the conclusions of a particular theory or not. It won't do to have acceptance of the method used from only those who already believe the theory and its results. (There is indeed a problem here; some areas of research such as advanced mathematics or modern theoretical physics are understood by a very limited number of researchers, but I leave that aside for the moment.)

Hence, I believe it is very important to have some sort of general conception of all sciences when discussing the demarcation between science and pseudoscience.

A related topic is the theory-relatedness of observations; some have claimed that there are no such things as fully theory-independent observations. If true, it would undermine the possibility of objectivity of science and force us to accept strong relativism. I believe that this disastrous consequence can be avoided and that there really is a basis of theory-neutral data, also in the humanities. This is the topic of Chaps. 4 and 5.

These considerations have guided the structure of the first part of the book, consisting of Chaps. 1, 2, 3, 4, 5 and 6.

The second part consists of Chaps. 7, 8, 9, 10 and 11. In these chapters I discuss topics I have found relevant and useful to talk about even at an introductory philosophy of science course, viz. *causes*, *explanations*, *laws and models*. Causation is arguably the most important of these topics since almost all empirical disciplines contain causal idiom to some extent and the search for causes is in many disciplines a prime goal.

The notion of explanation is often connected to causation, but the use of the word 'explanation' differs profoundly from context to context and one may wonder if there really is anything in common to everything we call an 'explanation'. This is the topic of Chaps. 8 and 9.

Laws and models are core concepts in natural sciences but less so in social science and perhaps not at all in human science. The discussion about the concept of natural law is intense among philosophers of science and a lot of views have been propounded. In Chap. 10 I discuss some of them and indicate my own empiricist position.

By contrast, models are not much discussed among philosophers of science. This is a bit astonishing, since scientists very often talk about models when discussing the 'fit' between theory and reality. One is immediately prone to ask what kind of epistemological and ontological status models have. In Chap. 11 I discuss this and what scientists might mean with their talk about models.

The final part consists of some additional material that is naturally brought up in a philosophy of science course, although it does not belong to philosophy of science proper.

Chapter 12 is about some issues in philosophy of mind, a topic usually not covered in a philosophy of science course, or book. The reason I nevertheless have included a brief discussion about mind states is that in particular students in psychology and medicine are naturally confronted with difficult questions about the relations between mind and body. My experience is that these students somewhat unreflectively adopt a vocabulary reflecting substance dualism, for example, the distinction between biological and psychological causes of mental diseases and aberrant behaviour. (And neurophysiology and psychiatry are considered as two different medical subdisciplines, a distinction suggesting a traditional mind-body dualism.) However, when asked about what they think about the matter, most are prepared to say that the mind and the brain somehow are identical or two sides of the same coin. In short, their position is unstable and needs to be discussed.

Chapter 13 contains a discussion of some aspects of values in science, the most important being the discussion about the concepts *value-free* and *value-laden*, once introduced by Weber. The important point is that science is driven by values, it is value-laden, but its results can, and should, be value-free.

Chapter 14 contains some reflections on actual trends in science. It is forward-looking and much more tentative than the rest of the book.

Finally, there is a short appendix about logical form, which hopefully can be useful in discussions of hypotheses testing, and in some accounts of explanation. I have in particular experienced student's difficulties in understanding the truth conditions of the material conditional, a topic which hardly can be avoided when analysing hypothesis testing. It seems to me that students without logical training often interpret conditional statements in their context as either causal or logical statements.

Thus, the reader I have had in mind is first and foremost a student taking a course in philosophy of science without having studied philosophy earlier.

The book is also useful as textbook for an introductory course at undergraduate level for students majoring in philosophy. A number of colleagues, and myself, have used the Swedish predecessor of this book in such courses and our experience is that it is well suited also for that purpose. In such courses we normally omit Chap. 2 (knowledge) and Chap. 12 (philosophy of mind), since these topics are covered in other philosophy courses.

Two of my former students, David McVicker and George Masterton, both of which are native English speakers, have helped me with the English translation of my Swedish textbook. David did the first draft, which then was checked by George.

The result is much better than what I could have done myself. My gratitude is hereby acknowledged.

Two anonymous referees for this English version have given many valuable comments, which hereby is gratefully acknowledged. Finally, I thank Ties Nijssen for much help and encouragement in the final editing of the book.

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summer 2015

http://www.springer.com/978-3-319-26549-0

Philosophy of Science for Scientists
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2016, XV, 257 p. 28 illus. in color., Hardcover
ISBN: 978-3-319-26549-0