Critical and scientific thinking

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A Short Introdcution

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Open Press Tilburg University

ISBN 978-9-40-366878-9
DOI 10.26116/IHOX-9K96

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Cover by Mor Lumbroso
Copyediting by Meike Robaard
Coordination by Violet S. Zagt

Publishers of Trial and Error

Published by Open Press Tilburg University,
Tilburg, The Netherlands
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Preface

WHAT IS THIS BOOK ABOUT?

This book is about critical and scientific thinking. You will learn what reasoning errors we all tend to make, why we make those reasoning errors, what they lead to, and how we can improve our thinking. Finally, you will learn about the importance of critical and scientific thinking, and what characterizes the sciences, i.e. what makes them distinctive (from pseudoscience and non-scientific domains of inquiry) and reliable.

WHO IS THIS BOOK FOR?

This book is written for students taking a course on philosophy of science or critical thinking. The book provides content for seven lectures (the seven chapters) and one seminar (appendix). It can stand on its own for courses consisting of seven lectures with a study load of 3 ECTS or might be combined with a historical or thematic overview of the philosophy of science (e.g. Dooremalen et al., 2021) for courses consisting of fourteen lectures with a study load of 6 ECTS.

I use this book as part of my teaching of philosophy of science for students at Tilburg University. Hopefully, it will also find its way to other lecturers.

Ultimately, I hope that this book finds its way out of academia to reach a wider audience. Critical thinking concerns everyone. It is of great value on both a personal and societal level. Indeed, as I discuss in Chapter 6, critical thinking is a driver of progress, both with respect to knowledge and innovation as with regards to morality.

WHY READ THIS BOOK?

Critical thinking is one of the biggest hiatuses in our education system. Learning to distinguish sense from nonsense is of great importance in the information age that we live in. In a systematic way, this book helps you to gain insight into, and subsequently eliminate, the most important reasoning errors that we all tend to make. It also helps you to debunk weak and fallacious arguments and unreliable information.

In addition to understanding what critical and scientific thinking entails, you will learn more about what makes science reliable. In times of skepticism regarding science, where (sometimes dangerous) pseudoscientific and conspiracy theories run rampant, this is particularly important.

Critical thinking, as I conclude in Chapter 6, is not a matter of intellectual preference or even self-interest (although one certainly benefits from thinking critically). It is first and foremost a matter of moral and social responsibility. Better thinking leads to a better world. With this book I hope to contribute to that important goal and you, dear student or reader, can do the same!

Enjoy your reading!

1 What is Philosophy of Science?

On the importance of philosophy of science

WHAT IS SCIENCE?

The central question that philosophers of science ask is: What is science? This question may seem easy to answer at a first glance. The sciences are physics, chemistry, biology, etc., and not music, art and religion. This, of course, is true, but it raises the very same question: What distinguishes those scientific domains and activities from non-scientific domains and activities? What characteristics do the sciences share with each other and not with non-scientific domains? What, in other words, makes science science? (Okasha, 2002).

This question, too, may seem easy to answer. Sciences attempt to explain certain aspects of reality based on observations. But whilst that is certainly not a bad answer, it is not entirely satisfactory. Astrology (horoscopes), too, seeks to explain aspects of reality based on observations, as does religion. So, what is it that demarcates the sciences as science? What is it that distinguishes science from so-called pseudoscience? The latter refers to theories and practices that may appear scientific but are not (such as astrology, creationism, and certain forms of alternative healthcare). Finally, we must also ask what characteristics make science reliable or – in any case – more reliable than pseudoscience. These are the questions we will address and answer in this book.

From the question of what science is, however, follows a series of other questions that philosophers of science ask. What is the relationship between scientific theories and reality? Realists, for example, think that scientific theories represent reality truthfully or, at least that they can represent reality truthfully. Anti-realists disagree. According to

the latter, we can only claim that scientific theories can make accurate predictions, not that they actually represent reality (i.e. that they are faithful depictions of the reality they describe).

Another question often asked by philosophers of science is: How do the sciences evolve? Contemporary scientific theories are often quite different from those of, say, the nineteenth century. How did this change come about? According to the philosopher of science Karl Popper (1963) - who will be discussed later – scientific change happens in a gradual way. New theories are typically revisions of previous theories, and we may therefore assume that, in general, the sciences are improving over time. They represent the world more truthfully than the theories they replaced.

Another prominent philosopher of science, Thomas Kuhn (1970), objects. Sciences undergo 'revolutions', according to Kuhn, discarding just about everything that came before it. This debate, of course, also has important implications for the question of scientific realism. Someone like Kuhn joins the ranks of the anti-realists because he sees science as an intellectual activity within a so-called paradigm. A paradigm is built on basic assumptions for which there is no evidence. In case of a revolution, one simply discards the old paradigm and starts again in a new paradigm. Therefore, according to Kuhn, the sciences do not come closer to the truth over time, they just switch ways of looking at world (and one way is not inherently more truthful than another way).

You may wonder what use all this is to practicing specific sciences. That is a valid point. The discussion between realists and anti-realists changes little to nothing for the way scientific investigation is conducted. But philosophers of science are not just concerned with science in general, they also think about specific sciences. There is a philosophy of physics, a philosophy of biology, a philosophy of psychology, and a philosophy of economics. In the philosophy of economics, for example, philosophers question whether economic models objectively describe economic reality. Perhaps subjective values creep in? For instance, the value that economists place on freedom (and free entrepreneurship) may lead them to be slightly biased towards perceiving (free) market mechanisms as efficient (and perhaps turn a blind eye to shortcomings