

Research Methodology

Peter Pruzan

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The Aims, Practices and Ethics of Science

 Springer

Professor Emeritus Peter Pruzan, Sc.D., Ph.D.
Department of Management, Politics
and Philosophy
Copenhagen Business School
Frederiksberg
Denmark

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Foreword

To perform “good research” in the natural sciences, the practitioner must draw upon an inquisitive mind, an appreciation of the methods, aims and limitations of science, and, of course, skill in applying the “tools of the trade.”

This book provides an extremely well-written, lucid, and, quite often, thought-provoking approach to these prerequisites of “good research.” It is distinctive in the diverse sets of topics it covers and in the various examples it draws upon from the different areas of the natural sciences. Another distinguishing characteristic is its appeal to the reader’s reflection, not just on the “nuts and bolts” of science and questions of “how to,” but also on more fundamental matters as to “why,” even in sections dealing with such down-to-earth, practical matters as measurement, data collection, design of experiments, and testing of hypotheses. In addition, it provides valuable advice on a matter of importance for all researchers but particularly, graduate students in the natural sciences—how to write up one’s findings in a form suitable for publication.

There are few, if any, books that address these needs in one place. This book succeeds on all these fronts.

I can illustrate the book’s balancing the reflective with the practical by referring to the treatment of uncertainty in science. The motivation for choosing to work on a particular problem depends critically on a very good familiarity with already existing literature. The work may be done to test the predictions of a particular hypothesis, model or theory, or it may even end up in a discovery for which a new or an extended version of an existing model or theory may be required. In each case, it is necessary to know how compelling the evidence obtained is. The chapter dealing with probability and statistics is excellent from this point of view. Not only does it consider uncertainties in measurements, but also how to determine whether one’s data can be said to confirm or reject the investigation’s hypotheses. The so-called Frequentist and Bayesian approaches to probability and statistics are very clearly detailed, a rather unique feature of this book. Cautionary remarks about the pitfalls of blindly using various software for statistical analyses of data is a valuable addition.

Once a researcher has obtained new, reliable results, the next task is to present the results of the work in the form of a thesis or in the form of an article to be sent for publication in a peer-reviewed journal. In this endeavor, the Internet and other repositories of relevant information can be of great help. The author takes great pains to guide the researcher on how to acknowledge the sources one has drawn upon and how to avoid infringement of copyrights, plagiarism, etc. He even provides clear, detailed checklists to assist in the planning and writing of research proposals and dissertations, as well as in the oral defense of a thesis.

To pave the way for reflection on such more practical aspects of research methodology, the introductory sections of the book present and exemplify important topics in the philosophy of science. These include the distinction between science and non-science, the aims and claims of science, and the role of mathematics in science. The author also explains the basic concepts such as realism, reductionism, epistemology, and ontology.

These introductory sections provide a far broader and more inclusive perspective than one ordinarily meets in publications on research methodology; most books on the subject focus on a particular area of specialization, implicitly assuming as given, the efficacy and validity of the methods presented, and thereby essentially ignoring the role of the aspiring scientist's own thinking, qualifications, and motivations.

The book's closing chapter on ethics and responsibility in scientific research builds upon the preceding chapters. It combines reflection on ethics and *un*ethics in science as well as on one's personal responsibility as a scientist with practical, down-to-earth guidelines for ethical practice in research.

All in all, I can highly recommend the book, in particular to Ph.D. students in the natural sciences as well as to those interested in the philosophy of science. It describes in some detail what "good research" in natural sciences is all about. It is a unique, provocative, and illuminating read!

Dr. Mosur K. Sundaresan
Former Distinguished Research Professor
Theoretical Physics
Carleton University
Ottawa, Canada

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I note in this connection that it is one thing to receive inputs via reading and interactions, and it is quite a different matter to interpret and select amongst the enormous amount of information received. In this connection, the focus and the power to discriminate was a result of the demands to write so that my students could understand and be enriched by what they read. So I gratefully acknowledge the feedback provided by my students in several different fields and spanning a period of more than 50 years; they have taught me much of what I had to learn!

Finally, I most humbly and gratefully acknowledge the inspiration and guidance provided by Bhagavan Sri Sathya Sai Baba (1926–2011), Founder Chancellor of Sri Sathya Sai Institute of Higher Learning, India.

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