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It is my pleasure and privilege to present the third volume of the series *Philosophy of Science in a European Perspective* produced by the European Science Foundation (ESF) Research Networking Programme that runs under the same name. Like the first two volumes, *The Present Situation in the Philosophy of Science* (2010) and *Explanation, Prediction, and Confirmation* (2011), also published by Springer, it collects selected papers given at a series of workshops organized by the five teams of the programme from one year, in this case 2010. For the present volume, these workshops included the following events, all funded by the ESF with some further support from the host institutions:


**Team B**, Philosophy of the Natural and Life Sciences and **Team D**, Philosophy of the Physical Sciences, joint workshop: *Points of Contact Between the Philosophy of Physics and the Philosophy of Biology* (London School of Economics, organized by Miklos Redei, Dennis Dieks, Hanne Andersen and Marcel Weber, 13-15 December, 2010)


As in the previous years of the ESF programme, these workshops brought together scholars from all across Europe, including a substantial proportion of junior researchers as well as graduate students. The workshops generated considerable interest from local students and faculty at the respective workshop venues. While the programme’s core topic for the year 2010 was probability and statistics, most
of the five teams embraced the opportunity of building bridges to more or less closely connected issues in general philosophy of science, philosophy of physics and philosophy of the special sciences. However, papers that use or analyze the concept of probability for various philosophical purposes are clearly a major theme in this volume, as it was in the previous volume. This reflects the impressive productivity of probabilistic approaches in the philosophy of science, which form an important part of what has become known as formal epistemology (although, of course, there are non-probabilistic approaches in formal epistemology as well). It is probably fair to say that Europe has been particularly strong in this area of philosophy in recent years.

The papers from Team A focus on the foundations of statistics. While the importance of statistical methods in many areas of science is undisputed, debate on the proper foundations and the scope of these methods continues among both practitioners and philosophers. Is statistics something like a logic of inductive inference, as it was envisioned by some members of the Vienna Circle, or is it more properly viewed as a decision theory for choosing among alternative courses of action? Can null hypotheses be supported by statistical data? Does subjective Bayesianism provide a general framework for statistical testing, or should statisticians strive for objective probabilities such as Neyman-Pearson frequentist error probabilities? Should we be pluralists about the foundations of statistics? These are some of the questions discussed in the first section of this volume.

Teams B and D decided to join forces to discuss points of common interest in the philosophy of physics and philosophy of biology. When organizing the corresponding workshop, it quickly became clear that there are much more points of contact that one might have thought, given that these two areas of philosophy of science have developed largely independently of each other in recent years. Of course, the philosophy of biology has had to struggle hard to free itself from a philosophy of science that was strongly physics-centered, but it is now time to put these quarrels behind us and to take a fresh look at some problems that concern both areas of science. Probability and statistical methods are, of course, one such topic, but we decided to also take the opportunity of addressing other themes that are vital both in physics and biology, including the perennial topics of laws and natural kinds. As it became clear at the workshop, the concept of structure (as in mathematical structure) has become increasingly important in the philosophy of both areas and is at the center of exciting new developments.

Team C focused on mathematical modeling in the social sciences, construed to include economics, political science, cognitive science, and the law. With the exception of economics, these disciplines have to – my knowledge – hardly been investigated by philosophers of science with such a focus, which makes these papers particularly welcome. They reveal impressively how diverse and yet closely
connected the sciences are today, at least with respect to the role of mathematical models (including the use of “techno-mathematical” models in social sciences). One of the most difficult problems for mathematically formalized theories and models has to do with the question of how the magnitudes that feature in them are connected to the real world. Many of the considerations in the contributions may be seen as seeking answers to this question. Furthermore, this section contains papers on such topics as the use of experiments in political science or of probabilistic thinking in the courtroom.

The contributions from Team E take a new look at the formative years of modern philosophy of science, which, of course, are situated in the late 19th and early 20th Century. As these papers make clear, much of the current debates not only with respect to the foundations of statistics and probability, but also on induction, indeterminism vs. determinism, laws of nature, and the role of mathematics and formal methods in science as well as in epistemology have their historical roots in these years. Of course, members of the Vienna Circle such as Otto Neurath or Rudolf Carnap played a major role in shaping these debates, but also physicists such as Erwin Schrödinger, mathematicians such as John von Neumann, Richard von Mises and Ernst Schröder, physiologists such as Johannes von Kries or social scientists such as Adolphe Quetelet. It is fascinating to see how much of the current debates were already anticipated by these thinkers – which, of course, is not to deny that there has also been progress, which the papers of this volume jointly document.

I hope that readers will be as impressed as I am about the diversity as well as the quality and depth of current research in philosophy of science in Europe.

On behalf of all the editors, I wish to close by thanking Maria Carla Galavotti, Cristina Paoletti and Beatrice Collina for their patience and sometimes insistence in running this ESF networking programme, which is more complex than one might think and always tends toward a state of higher system entropy. Furthermore, I wish to thank Robert Kaller for producing the manuscript and the European Science Foundation and the Universities involved in the various workshops for their financial support.

Konstanz, June 2011

Marcel Weber
Team A
Formal Methods
CHAPTER 1

SEAMUS BRADLEY

DUTCH BOOK ARGUMENTS AND IMPRECISE PROBABILITIES

1.1 FOR AND AGAINST IMPRECISE PROBABILITIES

I have an urn that contains 100 marbles. 30 of those marbles are red. The remainder are yellow. What sort of bets would you be willing to make on the outcome of the next marble drawn from the urn? What odds would you accept on the event “the next marble will be yellow”? A reasonable punter should be willing to accept any betting quotient up to 0.7. I define “betting quotient” as the ratio of the stake to the total winnings. That is the punter should accept a bet that, for an outlay of 70 cents, guarantees a return of 1 euro if the next marble is yellow. And the punter should obviously accept bets that cost less for the same return, but what we are really interested in is the most the punter would pay for a bet on an event.

I am making some standard simplifying assumptions here: agents are risk neutral and have utility linear with money; the world of propositions contemplated is finite. The first assumption means that expected monetary gain is a good proxy for expected utility gain and that maximising monetary gain is the agents’ sole purpose. The second assumption is made for mathematical convenience.

Now consider a similar case. This case is due originally to Daniel Ellsberg (Ellsberg 1961), this is a slightly modified version of it due to Halpern (2003). My urn still contains 100 marbles, 30 of them red. But now the remainder are either yellow or blue, in some unknown proportion. Is it rational to accept bets on Yellow at 0.7? Presumably not, but what is the highest betting quotient the punter should find acceptable? Well, you might say, there are 70 marbles that could be yellow or blue; his evidence is symmetric so he should split the difference: a reasonable punter’s limiting betting quotient should be 0.35. Likewise for Blue. His limiting betting quotient for Red should be 0.3.

What this suggests is that this punter considers Yellow more likely than Red, since he’s willing to pay more for a bet on it. So, as a corollary, he should prefer a bet on Yellow to a bet on Red. And thus, if offered the chance to bet on Red or to bet on Yellow, for the same stakes, he should prefer the bet on Yellow.

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1 I am studiously avoiding mentioning the “principle of indifference” since I use “indifference” to mean something else in the main text.