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Review: D. Costantini, M.C. Galavotti, *Probability, Dynamics and Causality, Essays in Honour of Richard C. Jeffrey*, Kluwer, 1997. Reprinted from *Erkenntnis* Volume 45, Nos. 2/3, 1996. Pp. 422. ISBN 0–7923–4361–1. H/b £ ???.

'The frivolous, the light of brain / are banished from this stern domain'. This line from Abner Shimony's opening poem for Richard Jeffrey ("For the Birthday of a Decision Theorist") prepares the reader for much of what is to follow. Most of the 16 papers in this collection make strong demands on the reader's specialist knowledge but, in return, deliver arguments and analyses of high quality. I have found myself quoting papers from this volume of *Erkenntnis* many times. Especially for those libraries that do not subscribe to *Erkenntnis*, it is very useful to have this volume now available as an unaltered reprint. Among the papers that are accessible to a non–specialist audience, two I think stand out in the quality of their presentation. These are Hájek's paper on finite frequentism and the paper by Daumer et. al. on the interpretation of measurement operators in quantum mechanics. Both papers are, in my experience, suitable for teaching purposes. (More on these papers will follow below.)

While most papers in this collection presuppose specialist knowledge, they address at the same time very different fields of specialization, mainly statistics, physics and epistemology. The collection even contains a (very good) stray paper on game theory. This reflects Costantini's and Galavotti's ambitious and exciting project to 'bring together people working on the foundations of probability and statistics, as well as their application to science' (as they write in their Preface). No doubt, philosophy will and always has benefited from an exchange of ideas across the boundaries of traditional disciplines. Perhaps the engagement with the concepts used in specialized disciplines is even one of the defining features of philosophy. In any case, the very fruitfulness of philosophical discussions depends on such an engagement, all the more so in the case of the philosophy of probability, and Costantini and Galavotti deserve our thanks for their continued initiative. On the flip–side, the papers in this collection show little connection within or across the sections into which the book is loosely organized. The book is clearly not intended to lay out a unified perspective but provides scattered glimpses of many current trends and interests in the theory of probability. On a critical note, the title of the book is misleading because, on the one hand, it contains no papers on causality and, on the other hand, not all of its papers are on probabilities and their dynamics.

The papers in this collection were presented at a conference which took place in Luino (Italy) in June 1995. One session of this conference was dedicated to Richard Jeffrey to mark the occasion of his 70th birthday. The Italian influence of Bruno de Finetti's version of Bayesianism is noticeable both in technical work on the notion of exchangeability and in philosophical interpretations of

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probability theory. A second influence of surprising strength (documented in the papers by Festa, Zabell and Costantini/Garibaldi) is Carnap's and Johnson's work on logical probabilities. I shall now focus on one paper from each of the groups that will be of special interest for readers of this journal, namely, the statistical papers, papers on the notion of objective probability, and finally the four papers explicitly dedicated to quantum physics. I end with comments on recent work on Bayesian updating rules.

Among the *statistical papers*, I highly recommend Diaconis/Holmes's "Are there Still Things to Do in Bayesian Statistics?" to any reader who has even just a moderate interest in statistics. This short paper contrasts classical and Bayesian solutions of paradigmatic applications of probability theory. It ends with a thought–provoking discussion of the application of Bayesian methods to models with a large numbers of parameters. Diaconis and Holmes argue that priors over these parameters cannot sensibly be interpreted as an individual's prior judgement or prior information (as the founding fathers of Bayesianism, de Finetti, Ramsey and Savage, claimed). They even go further and argue that 'today's ambitious modelling attempts are a complete departure from classical[ly] focussed scientific efforts aimed at discovering basic laws of nature'. Instead, they suggest that 'large models are being used as a common language among a group of scientists to try and communicate about complex multidimensional data sets.' This paper throws out the seeds for a discussion that we can look forward to.

Among the *papers on objective probability*, I have already complimented Hájek's ""Mises Redux"–Redux: Fifteen Arguments Against Finite Frequentism" for its accessibility and style of presentation. It collects fifteen arguments drawn from the philosophical mainstream against frequentism and, in particular, its finite version. Many of these supposed arguments point to real questions and problems with frequentism. But it is not at all clear that these problems always translate into arguments against frequentism. The decisive question is whether some other theory could solve these problems any better than frequentism. Take the example of the reference class problem that is often said to be a main hurdle for frequentism: What is the probability that John (who is a smoker and who has a blue car) will contract lung cancer? Is it probability of lung cancer within the group of smokers, or within the group of male smokers with a blue car or within what group? The subjective interpretation of chance faces this problem with just as little success as frequentism. De Finetti (in *Probabilismo*) acknowledges as much when he points out that the assignment of an individual to a reference class is a subjective judgement, thus refusing even to try giving a general solution to the problem. I think the third contender, the propensity interpretation of probabilities, fares no better. Hájek's paper aptly records problems of frequentism and, indirectly, the sometimes prejudiced bias of the philosophical mainstream against this position.

Among the *papers on quantum mechanics*, the co–authors Daumer, Dürr, Goldstein and Zanghì take the prize for the most beautifully written paper in this collection ("Naive Realism about Operators"). The authors attack what they

call 'naive realism' about measurement operators. This is the view that, prior to an experiment, any measurement operator has some definite value. Instead, they claim that, for instance, in a spin measurement no system property is being measured. 'The fact that the same operator plays a role in different experiments does not imply that these experiments have much else in common, and certainly not that they involve measurements of the same thing'. The authors argue that this view can resolve many of the problems in the interpretation of quantum mechanics, notably the micro–macro relation and no–hidden–variable theorems. We here have a paper that explains a highly non–trivial view in almost trivial terms without sacrificing precision.

Finally, I would like to comment on two papers by Howson and Skyrms on *Bayesian updating rules*. In "Bayesian Rules of Updating", Howson correctly points out that the traditional rule of Conditionalization requires that the totality of the pieces of evidence that the reasoner might possibly receive in the future form a partition of the space of all logical possibilities. If this assumption is not satisfied, we need to shift to a generalized theory of updating, namely Goldstein's Iteration principle or van Fraassen's Reflection principle. This theory yields Conditionalization as a special case when and only when the totality of possible pieces of future evidence partitions the logical space. I disagree with Howson's judgement that 'as indicators of inconsistency, dynamic Dutch Books are worthless'. Instead, it can be shown (cf. Hild, 1998) that van Fraassen's general theory of updating follows from a decision–theoretic constraint (the Diachronic Sure Thing Principle) on the reasoner's preferences that is as basic as its synchronic variant (Savage's Sure Thing Principle) lying at the heart of Bayesian decision theory. In "The Structure of Radical Probabilism", Skyrms uses this generalized theory of updating to derive two of the central theorems of Bayesian epistemology, the Knowledge–Pays Theorem and the Merger–of–Opinion Theorem. The second theorem shows that, with probability 1, different prior opinions converge to each other through learning from evidence. Given some strong assumptions on evidence, the standard theory of updating by Conditionalization furthermore implies that different prior opinions not only converge to each other but also converge to the truth. This result inspires the hope in some Bayesians that the subjectivity in the choice of prior probabilities could be overcome by conditionalizing on experience since the theorem guarantees that any subjective opinion then converges to the truth. It is very important to notice that, unlike Conditionalization, the generalized theory of updating frustrates the Bayesian hopes because it can no longer give us convergence to the truth. It only gives us the convergence of opinions to each other and even this only for opinions about propositions that describe the reasoners' epistemic states like 'Tom's probability for rain on 1 January, 3000 is .4', but not for opinions about non–epistemic propositions like 'It rains on 1 January, 3000'. (I have ignored the better–known frustrations, for example, that we are only guaranteed the reasoner's a priori certainty ('with probability 1') that her probabilities will converge.)

As I hope my short, selective, report has shown, Costantini's and Galavotti's collection unites a diverse range of papers that make high demands on their

readers but also offer high quality in return.

References

Hild, M., 1998, "The Coherence Argument Against Conditionalization", Synthese 115, 229–258.