

The Philosophy of Science in a European Perspective – An ESF Research Networking Programme

Final Report of the workshop of Team A (“Formal Methods”),

Pluralism in the Foundations of Statistics

University of Kent, Canterbury, UK

Thursday 9 - Friday 10 September 2010

Organiser: Prof. Stephan Hartman

Local organiser: Dr. David Corfield

1. Summary

This workshop brought together fifteen researchers – philosophers, psychologists and statisticians – to explore various aspects of multiplicity in statistics, including methodological aspects (invoking a multiplicity of methods), evidential aspects (handling and reconciling disparate kinds of evidence, logically and psychologically) and metaphysical aspects (appealing to different interpretations of probability). The workshop also sought to explore the extent to which such multiplicities call for unification or for pluralism.

The talks took place over two full days. Despite the withdrawal of two important speakers at very short notice, and the replacement by a young researcher from the LSE, thirteen talks of very high quality were presented, revealing fascinating interconnections between the work of researchers across Europe and across disciplines. Discussions were very animated and continued over the meal intervals and in the evening restaurants. It was agreed by all participants that the small size of the workshop and the focus of the papers allowed for a more productive and enjoyable experience than is the case with conferences encompassing a greater diversity of interests. The workshop also demonstrated the importance of philosophy in providing a framework for interdisciplinary discussion.

2. Scientific Content

Franz Dietrich presented a framework which gives a unified characterization of the main probabilistic belief updating rules: Bayesian updating, Jeffrey updating, and Adams updating. The difference between the three updating rules is merely down to the kind of learning experience considered.

Gregory Wheeler explained the theory of Evidential probability (EP) and defended it against some common philosophical criticisms. In particular, he argued that we have a sound, strongly complete, and decidable version of EP and that this addresses the charge that EP is not a logic.

Jan Sprenger argued for the continuity between Fisher's objectivist program and modern objective Bayesianism, noting that the later differed from the fully Bayesian approach. He argued that the use of reference priors be seen as occupying a place on the continuum between frequentist and (proper) Bayesian methods, and defended it against the claim that it is no more than frequentist inference dressed in Bayesian formalism.

In a similar vein, Jon Williamson argued against the orthodox view in statistics that claims that frequentism and Bayesianism are diametrically opposed - two totally incompatible takes on the problem of statistical inference. Indeed, he argued that the two approaches are complementary and need to mesh if probabilistic reasoning is to be carried out correctly.

Gerhard Schurz, on the other hand, argued for maintaining a distinction between two probability functions, otherwise one finds a conflict in situations in which two uncertain conditionals have contradicting consequents and both of their antecedents are instantiated or true, respectively.

Seamus Bradley argued against the Dutch Book justification of Bayesianism, that a rational agent's degrees of belief can and should form a probability measure. He showed how two forms of this justification might be modified to give a different conclusion: that an agent's degrees of belief ought to be a Dempster-Shafer belief function.

Timothy Childers argued for the weakness of Dutch Book arguments in establishing Lewis's Principal Principle that subjective probabilities should match objective probabilities. He concluded that subjective probabilities are, indeed, subjective.

Stephan Hartmann presented a Bayesian analysis of how the reduction of a scientific theory impacts on confirmation. He formalized the relation between the reducing and the reduced theory before and after the reduction using Bayesian networks, and thereby showed that, post-reduction, the two theories are confirmatory of each other. He then compared the prior and posterior probabilities of the conjunction of both theories before and after the reduction and asked how well each is confirmed by the available evidence.

Jan-Willem Romeijn presented a refinement of the Bayesian Information Criterion (BIC). He argued that while the original BIC selects models on the basis of complexity and fit, the so-called prior-adapted BIC allows us to choose among statistical models that differ on three scores: fit, complexity, and model size. The prior-adapted BIC can therefore accommodate comparisons among statistical models that differ only in the admissible parameter space, e.g., for choosing among models with different constraints on the parameters.

Jeanne Peijnenburg and David Atkinson explained how epistemic justification of propositions supported by infinite chains of propositions may be possible if the justification is probabilistic in character. They demonstrated this for the case where the epistemic justification has the form of an infinite loop rather than an infinite linear chain, and also in the more realistic case where the one-dimensional chain is replaced by a two-dimensional network.

Ilkka Niiniluoto argued that, as a development of cognitive decision theory, and in the spirit of critical scientific realism, scientific inference is defined by the attempt to maximize expected verisimilitude. His proposal allows us to interpret Bayesian point and interval estimation in terms of decisions relative to loss functions which measure the distances of a hypothesis from the truth.

Roberto Festa explained of tendency theories that 'A-individuals tend to be B' says that the individuals characterized by the property A 'tend to have' the property B. He defined suitable measures of the verisimilitude of T-theories, allowing him to show that T-theories can be used to describe the statistical structure of cross classified populations and that their adequacy in this task can be evaluated by measuring their verisimilitude.

Finally, Ulrike Hahn presented a number of examples from the judgment and decision-making literature where people have been accused of irrationality, seeming biases, and errors on the basis of task evaluations that fail to take into account key characteristics of both participants' and experimenters' experience. She argued that, once these are properly considered, more favourable evaluations emerge.

3. Results of the Meeting

What was so striking about the contributions to this workshop was that these of each bore on so many of the others. This did not generally take the form of mutual confirmation, but one of creative tension. We

envisage many subsequent opportunities for participants to further engage with each other's thinking to stimulate their own research.

The withdrawal of Prof. Colin Howson, while preventing us from hearing such a distinguished speaker, did allow us the opportunity to hear from a young researcher, Seamus Bradley. The workshop was an excellent opportunity for both he and Jan Sprenger, as researchers at the early stages of their careers to forge very useful connections with more experienced researchers.

4. Programme

Thursday 9 September

- 9.15-9.30 **Welcome**
- 9.30-10.20 **Franz Dietrich (LSE)** Conditionalization unified. [slides](#)
- 10.20-11.10 **Gregory Wheeler (Lisbon)** Evidential Probability as Description Logic. [slides](#)
- **COFFEE**
- 11.40-12.30 **Jan Sprenger (Tilburg)** How objective and how Bayesian is Objective Bayesianism?
- **LUNCH**
- 14.00-14.50 **Jon Williamson (Kent)**, Why Bayesians and Frequentists Need Each Other. [slides](#)
- 14.50-15.40 **Gerhard Schurz (Dusseldorf)** TWEETY, or Why probabilism needs objective and evidential probabilities
- **COFFEE**
- 16.10-17.00 **Seamus Bradley (LSE)** Vague Dutch books. [slides](#) - [handout](#)
- 17.00-17.50 **Timothy Childers (Prague)** Can subjectivist reductions of objective probabilities be objective?
- **19.30 DINNER Friday 10 September**
- 9.30-10.20 **Stephan Hartmann (Tilberg)** Confirmation and Reduction: A Bayesian Account.

- 10.20-11.10 **Jan-Willem Romeijn (Groningen)** One Size Does Not Fit All: Proposal for a Prior-adapted BIC.
- **COFFEE**
- 11.40-12.30 **Jeanne Peijnenburg & David Atkinson (Groningen)** Pluralism in probabilistic justification
- **LUNCH**
- 14.00-14.50 **Ilkka Niiniluoto (Helsinki)** Foundations of Statistics: Inference vs. Decision.
- 14.50-15.40 **Roberto Festa (Trieste)** Verisimilitude and tendency hypotheses. Approaching the statistical truth about cross classified populations
- **COFFEE**
- 16.10-17.00 **Ulrike Hahn (Cardiff)** Experiential statistics: Taking the limitations of our experience into account
- **19.30 DINNER**

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