More About *Theory of Probability*

Theory of Probability gives extensive and illuminating philosophical discussion of scientific inference, the nature of induction, objectivity, realism, and the role of probability in these concepts; it provides an axiomatic development of probability based on the primitive notion of reasonable degree of belief; and it contains much material on comparative inference, including a cogent discussion of randomization and nuggets such as the demonstration that for any prescribed weighting of the relative importance of Type I and Type II errors, Jeffreys' (Bayesian) hypothesis tests are optimal. Beyond these matters of general principle, it treats a remarkable variety of problems in estimation and testing, emphasizing practical application throughout. Those who have not read Jeffreys might be surprised to learn, for example, that he

- emphasized maximum likelihood and minimum chi-squared estimation
- used Pearson's chi-squared as a rough guide in many standard testing problems
- discussed inefficient estimators, noting in particular the virtues of the sample median

Some examples of the interesting problems for which Jeffreys gave solutions in *Theory of Probability* are the following:

- errors-in-variables, with a correction for attenuation of the correlation
- computation of the posterior distribution of the location parameter in a normal hierarchical model, for which he provided an approximation
- the effect of coarse and fine grouping of data in linear and harmonic regression
- smoothing of data, for which he proposed quadratic splines fit to points interpolated from grouped-data running lines
- testing equality of several means when the variances are unequal
- multiple comparisons, for which he provided a correction to his testing procedure
- serial dependence, for which he gave a residual sign test and also a test for AR(1) dependence
- possible non-normality of the error distribution, for which he devised a computationally easy approximate method
- possible extra-Poisson variability, for which he provided a test
- variable selection in polynomial and other regression models
- combining evidence from many experiments (what is now called meta-analysis), for which he gave a simple procedure

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