



# The BUGS Book: A Practical Introduction to Bayesian Analysis (Chapman & Hall/CRC Texts in Statistical Science)

By David Lunn, Chris Jackson, Nicky Best, Andrew Thomas, David Spiegelhalter

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Bayesian statistical methods have become widely used for data analysis and modelling in recent years, and the BUGS software has become the most popular software for Bayesian analysis worldwide. Authored by the team that originally developed this software, **The BUGS Book** provides a practical introduction to this program and its use. The text presents complete coverage of all the functionalities of BUGS, including prediction, missing data, model criticism, and prior sensitivity. It also features a large number of worked examples and a wide range of applications from various disciplines.

The book introduces regression models, techniques for criticism and comparison, and a wide range of modelling issues before going into the vital area of hierarchical models, one of the most common applications of Bayesian methods. It deals with essentials of modelling without getting bogged down in complexity. The book emphasises model criticism, model comparison, sensitivity analysis to alternative priors, and thoughtful choice of prior distributions?all those aspects of the "art" of modelling that are easily overlooked in more theoretical expositions.

More pragmatic than ideological, the authors systematically work through the large range of "tricks" that reveal the real power of the BUGS software, for example, dealing with missing data, censoring, grouped data, prediction, ranking, parameter constraints, and so on. Many of the examples are biostatistical, but they do not require domain knowledge and are generalisable to a wide range of other application areas.

Full code and data for examples, exercises, and some solutions can be found on

the book's website.

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## Editorial Review

### Review

"This is a beautiful book?it was a pleasure, and indeed great fun to read. ... The authors succeeded in writing a very nicely readable yet concise and carefully balanced text. ... It contains a lot of motivation, detailed explanations, necessary pieces of underlying theory, references to useful book-length treatments of various topics, and examples of the code illustrating how to implement concrete models in the BUGS language efficiently. ... this book also has a substantial pedagogical value. By reading this book carefully, redoing the examples, and thinking about them, one can learn a lot not only about BUGS, but also about Bayesian methods and statistics in general. ... highly recommended to a wide audience, from students of statistics [to] practicing statisticians to researchers from various fields."

?ISCB News, 57, June 2014

"... truly demonstrates the power and flexibility of the BUGS software and its broad range of applications, and that makes this book highly relevant not only for beginners but for advanced users as well. ... a notable addition to the growing range of introductory Bayesian textbooks that have been published within the last decade. It is unique in its focus on explicating state-of-the-art computational Bayesian strategies in the WinBUGS software. Thus, practitioners may use it as an excellent, didactically enhanced BUGS manual that, unlike ordinary software manuals, presents detailed explanations of the underlying models with references to relevant literature [and] worked examples, including excerpts of WinBUGS code, as well as graphical illustrations of results and critical discussions. No doubt, **The BUGS Book** will become a classic Bayesian textbook and provide invaluable guidance to practicing statisticians, academics, and students alike."

?Renate Meyer, *Journal of Biopharmaceutical Statistics*, 2014

"In this book the developers of BUGS reveal the power of the BUGS software and how it can be used in Bayesian statistical modeling and inference. Many people will find it very useful for self-learning or as a supplement for a Bayesian inference course."

?William M. Bolstad, *Australian & New Zealand Journal of Statistics*, 2013

"If a book has ever been so much desired in the world of statistics, it is for sure this one. ... the tens of thousands of users of WinBUGS are indebted to the leading team of the BUGS project for having eventually succeeded in finalizing the writing of this book and for making sure that the long-held expectations are not dashed. ... it reflects very well the aims and spirit of the BUGS project and is meant to be a manual 'for anyone who would like to apply Bayesian methods to real-world problems.' ... strikes the right distance between advanced theory and pure practice. I especially like the numerous examples given in the successive chapters which always help readers to figure out what is going on and give them new ideas to improve their BUGS skills. ... **The BUGS Book** is not only a major textbook on a topical subject, but it is also a mandatory one for all statisticians willing to learn and analyze data with Bayesian statistics at any level. It will be the companion and reference book for all users (beginners or advanced) of the BUGS software. I have no doubt it will meet the same success as BUGS and become very soon a classic in the literature of computational Bayesian statistics."

?Jean-Louis Fouley, *CHANCE*, 2013

"... a two-in-one product that provides the reader with both a BUGS manual and a Bayesian analysis textbook, a combination that will likely appeal to many potential readers. ... The strength of **The BUGS Book** is its rich collection of ambitiously constructed and thematically arranged examples, which often come with snippets of code and printouts, as well as illustrative plots and diagrams. ... great value to many readers seeking to familiarize themselves with BUGS and its capabilities."

?Joakim Ekström, *Journal of Statistical Software*, January 2013

"MCMC freed Bayes from the shackles of conjugate priors and the curse of dimensionality; BUGS then brought MCMC-Bayes to the masses, yielding an astonishing explosion in the number, quality, and complexity of Bayesian inference over a vast array of application areas, from finance to medicine to data mining. The most anticipated applied Bayesian text of the last 20 years, **The BUGS Book** is like a wonderful album by an established rock supergroup: the pressure to deliver a high-quality product was enormous, but the authors have created a masterpiece well worth the wait. The book offers the perfect mix of basic probability calculus, Bayes and MCMC basics, an incredibly broad array of useful statistical models, and a BUGS tutorial and user manual complete with all the 'tricks' one would expect from the team that invented the language. BUGS is the dominant Bayesian software package of the post-MCMC era, and this book ensures it will remain so for years to come by providing accessible yet comprehensive instruction in its proper use. A must-own for any working applied statistical modeler."

?Bradley P. Carlin, Professor and Head of Division of Biostatistics, University of Minnesota, Minneapolis, USA

#### About the Author

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