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[Review of: P. Mair (2018) Modern Psychometrics with R]

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BOOK REVIEW

PATRICK MAIR: *MODERN PSYCHOMETRICS WITH R*

Cham, Switzerland, SS: Springer, 464 pp., 2018, € 51,16. ISBN: 978-3-319-93175-3

Well-informed psychometrics textbooks do not appear with clockwork regularity. Despite the importance of psychometric techniques to a wide variety of scientific disciplines and societal applications, many existing treatments are either too difficult for an introductory purpose or too superficial to support a full course on psychometrics. In addition, although there are textbooks on techniques related to psychometrics (e.g., factor analysis, structural equation modeling, hidden Markov models) that are supported with practical examples and analysis code, psychometrics so far lacked a systematic introductory treatment that provided such tools.

Given this situation, the appearance of Patrick Mair's Psychometrics with R is a breath of fresh air in the landscape of psychometrics teaching. The book provides a mostly accessible treatment of a wide variety of techniques that are relevant to psychometrics and illustrates these by means of analytic examples that are supported by freely downloadable R-code. This allows a course developer to easily construct an introductory course in which lectures on psychometric techniques alternate with practicals that apply these techniques.

The book covers an impressive amount of methods and techniques that range over several topics. As is to be expected in any psychometrics textbook, the initial topics that are discussed contain the essential ingredients for any aspiring psychometrician. From the treatment of classical test theory, including reliability and generalizability, in Chapter 1, to a detailed expose on latent variable modeling, covering factor analysis, structural equation modeling, and item response theory in Chapters 2 through 4. An unexpected, but very welcome, surprise is the discussion of preference modeling in Chapter 5, in which the seminal Bradley–Terry(–Luce) model gets the spotlight it deserves, yet (in the experience of the reviewers) seldom receives. The next part of the book, spanning Chapters 6 through 10, is dedicated to the practice of dimension reduction, covering topics such as principal component analysis, correspondence analysis, Gifi methods, multidimensional scaling, and biplots. The remaining chapters in the book each stand on their own. The chapter on networks not only discusses statistically proven methods for undirected graphs, but also dares to venture into the more esoteric realm of causal inferences, courtesy of Bayesian networks. This is followed by a chapter on cluster analysis where both mixture models and latent class analysis are discussed. In the chapter on trajectories and time series, other unexpected riches are found as, instead of diving straight into time-series analysis, we are first treated to an extensive demonstration on Markov models. The last chapter covers the analysis of fMRI data, while perhaps relevant to a more niche group at this time, with the increasing desire to connect psychological phenomena to activation patterns in the brain, a potentially indispensable tool, to separate fact from fiction, in the future.

The sections in the book follow a characteristic pattern of a short introduction into the theory and the appropriate method/technique, each accompanied by a reference to a more detailed explanation, and an example of the methodology in a concrete R implementation. The organization of

the material around snippets of R code helps to make the discussion of the techniques concrete and works well in teaching, because important concepts can be systematically explained though the running examples.

Although this approach works very well on the whole, it is important to note that the author has explicitly valued breadth over depth, and as a result, the book is occasionally very concise in its explanations. As an example, techniques that utilize variants of the lasso are discussed in no less than four different chapters, but only the last chapter offers a partial explanation of the way the technique actually works. While the book does typically help the reader by referring to introductory papers, most readers would expect a short description of the logic of the technique in question in the book itself. Relatedly, although the book is filled with an impressive number of succinctly explained techniques, typically it only explains one particular application of the technique in R, without giving a broader introduction into the R-functions used (e.g., which arguments are available for the function and what they do). As such, readers should not only be familiar with R, but also prepared to study help pages of R-functions extensively, if they want to get the most out of studying this book. However, for most of the target audience of this manuscript (graduate students and postdocs in psychology) this should not be a problem.

We used this book in as a template for the organization of our most recent iteration of the Psychometrics course in our Behavioural Data Science Masters program, where each class was structured around a chapter and was followed by a practical session in which students applied the techniques explained to a new data set. The book itself is freely available as a PDF or EPUB, within any university environment with a Springer subscription, and all packages and code used in the book are freely available from their respective CRAN and GitHub repositories. This makes it relatively easy to set up a course by letting students work through the code. This worked very well, as was evidenced by the positive evaluations of students. However, students also were quite clear that they thought the explanation of methods in the book could be improved, especially when it comes to the basic components of the models covered. Specifically, the book would have benefited from describing these basic ingredients in greater detail and sufficing with a general theoretical description and a few pointers to R-functions for more advanced variants of the models explained. In addition, one of the pitfalls of any book that deals with the fast paced world of R-package development is that when packages are updated, functions can change and dependencies no longer work-indeed, not all examples ran properly when we executed the code.

In conclusion, Modern Psychometrics with R provides the reader with an impressive amount of topics, methods, models, and applications for anything psychometrics. It lends itself very well to structuring a course by treating one chapter and associated R-code per week. The availability of R-code and data examples makes the material far more practical and accessible than is usual for a psychometrics text. In addition, the wide choice of topics represents a broad and eclectic perspective of psychometrics as a discipline that should be prepared to deal with any data arising from behavioral data science, rather than limiting its view to specific examples resulting from typical examples predicated on the standard testing situation in educational assessment. Despite its shortcomings, the accessibility and focus on practical data analytic examples, as well as the diversity of topics covered, in our view make Psychometrics with R the contemporary choice for introductory courses on psychometrics.

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