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Models for Intensive Longitudinal Data. Theodore A. Walls & Joseph L. Schafer (Eds.). Oxford, UK: Oxford University Press, 2006, 288 pages, $65.00 (hardcover).

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Intensive longitudinal data are defined as repeated observations that cover more than the usual three or four observation points in time (in chapter 3 of this book, *intensive* data also include "massively multivariate" data; p. 63). Most methods of statistics with which the average user is familiar have no problems handling short series of observations. These methods include, for example, analysis of variance (ANOVA), log-linear modeling (LLM), and structural equation modeling (SEM). Consider, however, a series of 20 measures. Here, ANOVA, LLM, and SEM methods can become unwieldy, and models for intensive longitudinal data are needed.

The book edited by Walls and Schafer covers two broad topics. First, it presents methods for the statistical analysis of such data. Based on this alone, the book is useful and can be recommended. Second, the book also contains a good number of examples of topics that can only be addressed when intensive longitudinal data are available. An example of such a topic concerns the "complexity and variety of individual trajectories and the need to move beyond simple time-graded effects" (p. xiv). Just imagine the number of observation points and respondents needed for the comparison of five developmental groups that differ in the point in time in which they change acceleration in a growth curve. Using the typical design with just three or four data waves, the trajectories of these groups can be compared in only a rudimentary fashion. The compilation of sample cases makes this book even more valuable.

BOOK OVERVIEW

This book contains an introduction, 11 chapters, and a subject index. The introduction motivates the topic of models for intense longitudinal data, indicates research questions typically addressed using such models, and introduces each chapter. This introduction is extremely helpful. The chapters are, as in most edited volumes, self-contained. Therefore, the introduction makes it easy to determine which chapters to read first. In this volume, almost every chapter is worth reading. Therefore, this exercise only affects the reading order.

The first chapter (by Walls, Yung, & Schwartz) gives a gentle introduction to the use of multilevel models for intensive data. This chapter is closely linked to the second chapter (by Schafer) in which generalized estimating equations are covered. These two chapters intensively reference each other, and the authors show where the two methods yield the same and discrepant results. This is illustrated using the same data.

The first two chapters do not present new material. Instead, they show how established methods can be applied to intensive data. In contrast, the third chapter (by Li, Root, & Shiffman) proposes an estimation procedure for functional multilevel modeling that uses a local linear regression technique. The method is presented both at the conceptual and the algorithmical levels. It is applied to a multivariate data example.

In chapter 4 (by Hedeker, Mermelstein, & Flay), item response theory (IRT) models are applied to intensive longitudinal data. Here again, a very reader-friendly introduction to IRT methodology makes it easy to follow and to appreciate the example.

Chapter 5 (by Fok & Ramsay) shows how curves with periodic (trigonometric functions) and nonperiodic (spline functions) trends can be combined in the analysis of intense longitudinal data.

In chapter 6 (by Rovine & Walls), multilevel autoregressive process models are proposed. The models are applied to consumption patterns of alcoholics, and it is shown how to implement the models in the SAS PROC MIXED module.

Chapter 7 (by Ho, Shumway, & Ombao) describes the state-space approach to modeling dynamic processes. This chapter is interesting because it covers a more general approach than most of the other chapters, and it shows the relations of some of the more specialized methods to state-space modeling. The authors illustrate that, for instance, regression with time-varying covariates, ARIMA models, linear mixed models, and dynamic factor analytic models are special cases. Data examples illustrate the methods.

Chapter 8 (by Ramsay) discusses methods of control of behavioral input–output systems. This chapter is interesting, but it remains somewhat abstract because it contains no complete data example.

Dynamical systems modeling is discussed in chapter 9 (by Boker & Laurenceau). Readers are introduced to coupled differential equations models of self-regulating dynamical systems. A data example illustrates applicability.

Chapter 10 (by Rathbun, Shiffman, & Gwaltney) finally covers models for the analysis of repeated events such as smoking a cigarette. Various process models are discussed, and smoking patterns are analyzed.

Chapter 11 (by Nusser, Intille, & Maitra) summarizes emerging technologies for intensive longitudinal data collection. The chapter begins with the unnecessary comment that "the social science community is largely unfamiliar with this new class of longitudinal data" (p. 254). This comment comes as a surprise, as (a) these

data are not all that new, as illustrated in the fMRI application that is presented by social scientists and statisticians in chapter 7; (b) social scientists routinely use fMRI, EEG, and GPS-provided data in their analyses; and (c) the book was edited with readers from many disciplines, not just the social sciences in mind (see p. xii). The remainder of this chapter summarizes current developments of instrumentation for data collection. Perhaps a social science methodologist could have helped with the section on data reduction techniques.

THE AUDIENCE

This collection of chapters will appeal to readers in many disciplines, including the social and behavioral sciences, health sciences, engineering, and even applied mathematics. The level of exposition is such that most readers with intermediate-level training in probability, statistics, algebra, and differential equations will have an easy time following the text. There are two aspects of this book that will increase the number of individuals who can benefit from it. First, many chapters include technical appendixes in which estimation procedures are presented or equations are summarized. For many readers, this structure will make it easier to follow the gist. Second, the publishers host a Web site where program code is presented for many of the chapters.[1] The codes should help the data analyst to cast their runs in analogy to the runs that the authors used as examples. Some authors also point to their personal Web sites in the texts of their chapters.

Also, I was unable to open all the files. Again, this may be a problem with my computers.

In addition to quantitative types from all these fields, students in these fields will benefit greatly. Practically all chapters are written so they are easy to read. With a little preparation on the instructor's side, this book should be usable as the main source for a course on methods of analysis of intensive longitudinal data. Alternatively, the book could be used for a section of a course on longitudinal data analysis. I have a hard time imagining a quantitatively oriented scholar in these disciplines who would not benefit enormously from this book.

Clearly, the doors to an exciting line of research and application have been opened. The editors did an excellent job, making sure the number of errors is minimal, the level of exposition is comparable over the chapters, and chapters cross-reference each other where meaningful. It is not very often that researchers detect a niche and go successfully about establishing and filling it. Walls and Schafer have accomplished this task.

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[1]In the introductory chapter, the URL for this Web site is provided. On my computers, this address did not work. However, the following address was successful: http://www.us.oup.com/us/companion.websites/0195173449/?view=usa