nothing at all or present something they can package as a theorem, most often some kind of large-sample result. That seemed unproductive. In my opinion, it is usually better to produce relevant theorems. I’ve never been able to produce relevant theorems. I have instead followed a style used by my scientific (as well as statistical) colleagues. They work by posing hypotheses and proving or disproving them. I prefer to do this indirectly, so that their hypotheses are either refuted or accumulate credibility while becoming more refined. Obviously accumulated credibility can’t replace the iron-clad certainty of a theorem when a relevant theorem can be proven, but the new methods of the last three decades are so complex that it may never be possible to prove relevant theorems. We can, however, make progress by approaching our black-box methods in the same way our colleagues approach nature’s black boxes, by plying them open gradually and indirectly if necessary. Chapters 11, 12, and 17 are examples of this style, with Chapter 11 refuting a hypothesis and Chapters 12 and 17 developing some hypotheses and producing a first inference of credibility for each.

Along with the sometimes non-rigorous style of inquiry, I’ve written in a relatively informal narrative style. I’ve done so because it’s friendlier in two senses: It’s easier to understand on a first reading and it doesn’t hide my opinions and ignorance behind the passive voice and calculated elisions. Students and other readers should find fault with the current state of this field, including the things I’ve contributed to it, and I want them to see those faults and decide they can do better. I will be delighted if this book attracts the interest of young people with better math and computing skills than I have, who can change this area of study from the backwater it is into the thriving area it can and should be.

Some Guidance about Using This Book

The object of Part I is to present a survey of essentials and a particular point of view about them. The object of Parts II, III, and IV is to present the beginnings of a theory of richly parameterized linear models. This book is not intended to be a magisterial overview of everything known about mixed linear models. It is rather intended to present a point of view about what we do and do not understand about mixed linear models and to identify research opportunities. Overviews of mixed linear models include Searle et al. (1992); Ruppert et al. (2003), which focuses on penalized splines represented as mixed linear models; Verbeke & Molenberghs (1997), which focuses on SASS’s MIXED procedure; Diggie et al. (1994), which focuses on longitudinal models; Snijders & Bosker (2012), a thorough treatment of hierarchical (multi-level) models obviously based on a lot of experience fitting them and explaining the fits; and Fahrmeir & Tutz (2001), which catalogs models with exponential-family error distributions and linearity in the mean structure.

The hazard of writing a book like this is that I have to write short chapters about subfields of statistics with huge literatures. Even D.R. Cox might not be able to master all those subfields today. Academics tend to be territorial and to view the world through a microscope, so whatever I write is guaranteed to offend specialists in each subfield even if I say nothing that is factually incorrect. Also, the literature and folklore of mixed linear models are gigantic and I know less than