Preface

This is the first book on model-based cognitive neuroscience, a nascent field that is defined by a reciprocal relationship between cognitive neuroscience and behavioral mathematical modeling. Traditionally, cognitive neuroscience and behavioral modeling are separate disciplines with little crosstalk. In recent years, however, neuroscientists have discovered the advantages of mathematical models of cognition and performance, whereas mathematical psychologists are increasingly aware of the fact that brain data can constrain mathematical models in ways that are useful and unique.

To stimulate the further integration between behavioral modeling and cognitive neuroscience, this book brings together 17 invited contributions from leading researchers in the field of model-based cognitive neuroscience. The main challenge in coordinating these contributions was to make the book accessible to both mathematical modelers and neuroscientists, a challenge we met in two ways. Firstly, the book starts with seven tutorial chapters: three of these chapters outline and illustrate the principles of mathematical modeling of behavior, another three chapters describe basic principles of brain function and structure, and the final tutorial chapter concerns the interaction between modeling and neuroscience. Secondly, in order to highlight the reciprocal relationship between the two fields, the five chapers in Part 2 feature applications that emphasize the value of modeling for neuroscience, whereas the five chapters in Part 3 deal with applications that center on the value of neuroscience for modeling.

The authors of each chapter have tried hard to make their work accessible. As a result of this book can be used as the core material for an advanced undergraduate or graduate course on model-based cognitive neuroscience. To facilitate the use of the book for teaching, each chapter ends with a list of recommended readings and a series of questions. The readings can be used to expand the course materials, and the questions can be used to deepen the learning process. Teachers can obtain the answers to the questions upon request. The 17 chapters vary in scope and in difficulty, and we suggest that teachers cherry-pick the chapters they expect to be particularly relevant and appropriate for the student's background level of knowledge.

Just as the chapter authors, we are excited about the advantages and challenges that come with the integration of two disciplines, disciplines that share the same goal—to unravel the mysteries of the human mind—but so far have pursued that common goal in disparate ways. We hope that the enthusiasm with which the book was written is noticable for the reader, whether undergraduate student, graduate student, or academic staff member.

Finally, should you note any typographical errors, conceptual mistakes, glaring omissions, overgeneralizations, or anything else you feel requires correction: please do not hesitate to contact us so we can address these issues in an erratum that we will post on our websites.

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