## Contents

### Part I  Introduction  1

**Chapter 1  Usability of Interactive Systems  3**
1.1  Introduction  4  
1.2  Usability Requirements  12  
1.3  Usability Measures  15  
1.4  Usability Motivations  17  
1.5  Universal Usability  24  
1.6  Goals for Our Profession  39  
  Practitioner’s Summary  44  
  Researcher’s Agenda  44

**Chapter 2  Guidelines, Principles, and Theories  59**
2.1  Introduction  60  
2.2  Guidelines  61  
2.3  Principles  66  
2.4  Theories  82  
2.5  Object-Action Interface Model  95  
  Practitioner’s Summary  101  
  Researcher’s Agenda  102

### Part II  Development Processes  107

**Chapter 3  Managing Design Processes  109**
3.1  Introduction  110  
3.2  Organizational Design to Support Usability  111  
3.3  The Three Pillars of Design  114  
3.4  Development Methodologies  118  
3.5  Ethnographic Observation  122  
3.6  Participatory Design  125  
3.7  Scenario Development  127  
3.8  Social Impact Statement for Early Design Review  129  
3.9  Legal Issues  131  
  Practitioner’s Summary  133  
  Researcher’s Agenda  134

**Chapter 4  Evaluating Interface Designs  139**
4.1  Introduction  140  
4.2  Expert Reviews  141  
4.3  Usability Testing and Laboratories  144  
4.4  Survey Instruments  150
Chapter 5 Software Tools 173
5.1 Introduction 174
5.2 Specification Methods 175
5.3 Interface-Building Tools 183
5.4 Evaluation and Critiquing Tools 203
Practitioner’s Summary 205
Researcher’s Agenda 206

Part III Interaction Styles 211
Chapter 6 Direct Manipulation and Virtual Environments 213
6.1 Introduction 214
6.2 Examples of Direct Manipulation 215
6.3 Discussion of Direct Manipulation 231
6.4 3D Interfaces 241
6.5 Teleoperation 246
6.6 Virtual and Augmented Reality 249
Practitioner’s Summary 258
Researcher’s Agenda 258

Chapter 7 Menu Selection, Form Fillin, and Dialog Boxes 267
7.1 Introduction 268
7.2 Task-Related Menu Organization 269
7.3 Single Menus 270
7.4 Combinations of Multiple Menus 280
7.5 Content Organization 286
7.6 Fast Movement Through Menus 294
7.7 Data Entry with Menus: Form Fillin, Dialog Boxes, and Alternatives 295
7.8 Audio Menus and Menus for Small Displays 304
Practitioner’s Summary 309
Researcher’s Agenda 309

Chapter 8 Command and Natural Languages 315
8.1 Introduction 316
8.2 Functionality to Support Users’ Tasks 319
8.3 Command-Organization Strategies 321
8.4 The Benefits of Structure 325
8.5 Naming and Abbreviations 328
8.6 Natural Language in Computing 331
Practitioner’s Summary 340
Researcher’s Agenda 341
### Chapter 9 Interaction Devices 345

9.1 Introduction 346  
9.2 Keyboards and Keypads 348  
9.3 Pointing Devices 358  
9.4 Speech and Auditory Interfaces 374  
9.5 Displays—Small and Large 385  
9.6 Printers 397  
Practitioner’s Summary 399  
Researcher’s Agenda 400

### Chapter 10 Collaboration 409

10.1 Introduction 410  
10.2 Goals of Collaboration 412  
10.3 Asynchronous Distributed Interfaces: Different Time, Different Place 416  
10.4 Synchronous Distributed Interfaces: Different Place, Same Time 429  
10.5 Face-to-Face Interfaces: Same Place, Same Time 437  
Practitioner’s Summary 445  
Researcher’s Agenda 445

### Part IV Design Issues 451

#### Chapter 11 Quality of Service 453

11.1 Introduction 454  
11.2 Models of Response-Time Impacts 455  
11.3 Expectations and Attitudes 462  
11.4 User Productivity 466  
11.5 Variability in Response Time 468  
11.6 Frustrating Experiences 470  
Practitioner’s Summary 472  
Researcher’s Agenda 474

#### Chapter 12 Balancing Function and Fashion 477

12.1 Introduction 478  
12.2 Error Messages 479  
12.3 Nonanthropomorphic Design 484  
12.4 Display Design 490  
12.5 Window Design 501  
12.6 Color 510  
Practitioner’s Summary 514  
Researcher’s Agenda 515

#### Chapter 13 User Manuals, Online Help, and Tutorials 521

13.1 Introduction 522  
13.2 Paper Versus Online Manuals 525  
13.3 Reading from Paper Versus from Displays 529  
13.4 Shaping the Content of the Manuals 531  
13.5 Online Manuals and Help 539