

Contents

Preface to the Third Edition	ix
Using This Book	xi
Introducing Ergonomics and Human Factors Engineering	xiii

Section I The Ergonomic Knowledge Base

Chapter 1 Size and Mobility of the Human Body

1.1 Humans Spreading Over the Earth	4
1.2 Anthropology and Anthropometry	5
1.3 Available Anthropometric Information	11
1.4 Anthropometric Statistics	18
1.5 Using Anthropometric Data	23
1.6 Body Proportions	25
1.7 Dealing With Statistics	27
1.8 How to Obtain Missing Data	31
1.9 “Fitting” Design Procedures	34
1.10 Design Steps	39
1.11 Chapter Summary	42
1.12 Challenges	42

Chapter 2 Bones, Muscles, and Strength of the Human Body

2.1 Understanding the Human Body	46
2.2 The Skeletal System	47
2.3 Muscle	64
2.4 Voluntary Strength	75
2.5 Designing for Body Strength	84
2.6 Chapter Summary	86
2.7 Challenges	86

Chapter 3 How the Body Does Its Work

3.1 Introduction	90
3.2 The Respiratory System	90
3.3 The Circulatory System	92
3.4 The Metabolic System	97
3.5 Energy Requirements at Rest and at Work	106

3.6 Chapter Summary.....	123
3.7 Challenges	124
Chapter 4	How the Mind Works
4.1 Introduction.....	128
4.2 The “Traditional” and the “Ecological” Concepts	128
4.3 Organization of the Nervous System.....	129
4.4 Stress.....	147
4.5 Enhancing Performance	159
4.6 When Our Mind Plays Tricks on Us.....	163
4.7 Chapter Summary.....	166
4.8 Challenges	166
Chapter 5	Human Senses
5.1 Introduction.....	173
5.2 Body Sensors.....	173
5.3 Seeing—The Vision Sense	176
5.4 Hearing—The Auditory Sense	205
5.5 Smelling—The Olfactory Sense	227
5.6 Tasting—The Gustation Sense	230
5.7 Touching—The Cutaneous Senses	232
5.8 Maintaining Balance—The Vestibular Sense.....	239
5.9 Engineering Use of Sensory Capabilities	240
5.10 Chapter Summary.....	248
5.11 Challenges	248
Chapter 6	How the Body Interacts with the Environment
6.1 Climate	254
6.2 Polluted Air.....	275
6.3 High Altitude	277
6.4 Vibrations and Impacts.....	279
6.5 Space.....	302
6.6 Under Water.....	314
6.7 Chapter Summary.....	318
6.8 Challenges	319
Chapter 7	Effects of Rhythms, Schedules, Substances
7.1 Biological Rhythms	324
7.2 Sleep	328
7.3 Shift Work	335
7.4 Compressed Work-Weeks, Extended Work-Days	340
7.5 Flextime	341
7.6 Body Rhythms and Alternate Work Schedules: Summary.....	342
7.7 Effects of Alcohol, Marijuana, and Other Drugs on Performance.....	343
7.8 Chapter Summary.....	359
7.9 Challenges	360

Section II Design Applications

Chapter 8 Ergonomic Models, Methods, Measurements

8.1 Introduction.....	366
8.2 Models	366
8.3 Methods.....	372
8.4 Measurements.....	374
8.5 Examples of Models, Methods, Measurements	375
8.6 Chapter Summary.....	376
8.7 Challenges	377

Chapter 9 Designing to Fit the Moving Body

9.1 Moving, Not Staying Still	380
9.2 Recording and Evaluating Postures at Work.....	386
9.3 Designing for the Standing Operator	390
9.4 Designing for the Sitting Operator	393
9.5 Designing for Working Positions other than Sitting or Standing	395
9.6 Designing for Foot Operation.....	396
9.7 Designing for Hand Use	406
9.8 Designing for Human Strength	418
9.9 Designing for Vision	421
9.10 Designing to Avoid Overuse Disorders in Shop and Office.....	421
9.11 Chapter Summary.....	437
9.12 Challenges	438

Chapter 10 The Computer Workplace

10.1 Introduction.....	444
10.2 Theories of Posture and Comfort	445
10.3 Designing for Vision, Manipulation, and Body Support.....	450
10.4 The Office Environment	466
10.5 Chapter Summary.....	470
10.6 Challenges	471

Chapter 11 The Individual Within an Organization

11.1 Introduction.....	474
11.2 Elements of an Organization	475
11.3 The Individual.....	477
11.4 Job Satisfaction.....	482
11.5 Job Design.....	483
11.6 Power at Work	484
11.7 Communicating at Work.....	485
11.8 Stress within Organizations.....	489
11.9 Work–Life Balance	491
11.10 Chapter Summary.....	495
11.11 Challenges	496

Chapter 12	Selection, Design, and Arrangement of Controls and Displays	
12.1	Controls	500
12.2	Keyboards and Computer Input Devices.....	526
12.3	Displays	536
12.4	Labels and Warnings	545
12.5	Autonomous Systems	550
12.6	Chapter Summary.....	555
12.7	Challenges	556
Chapter 13	Handling Loads	
13.1	Strains Associated with Load Handling.....	560
13.2	Assessing Body Capabilities for Material Handling.....	561
13.3	Current Guidelines for Material Handling	554
13.4	Training Individuals	567
13.5	Selecting Workers by Physical Testing.....	575
13.6	Ergonomic Design for Load Handling.....	578
13.7	Carrying Techniques.....	592
13.8	Moving Patients	595
13.9	Chapter Summary.....	597
13.10	Challenges	598
Chapter 14	Designing for Special Populations	
14.1	Background.....	602
14.2	Designing for Women or Men.....	603
14.3	Designing for Pregnant Women	606
14.4	Designing for Children.....	610
14.5	Designing for the Aging	614
14.6	Designing for Disabled Individuals.....	627
14.7	Designing for Overweight/Obese Workers.....	631
14.8	Designing for Patients and Healthcare Providers	633
14.9	Chapter Summary.....	640
14.10	Challenges	642
Chapter 15	Why and How to Do Ergonomics	
15.1	Evolution of the Quest for Ease and Efficiency.....	648
15.2	Reasons to Apply Ergonomics	648
15.3	Micro- and Macro-Ergonomics	649
15.4	How to Do Ergonomics	649
15.5	Judging the Efficacy of Ergonomic Interventions.....	653
15.6	Improving Human and System Performance, Health, Safety, Comfort, and Quality of Life.....	656
Section III Further Information		
References		661
Glossary		705
Index		725