

ADAPTIVE LEARNING AND THE HUMAN CONDITION

Jeffrey C. Levy
Seton Hall University

PEARSON

Boston Columbus Indianapolis New York San Francisco Upper Saddle River Amsterdam
Cape Town Dubai London Madrid Milan Munich Paris Montreal Toronto Delhi
Mexico City São Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo

Editorial Director: Craig Campanella
Editor in Chief: Jessica Mosher
Executive Editor: Susan Hartman
Editorial Assistant: Shivangi Ramachandran
Director of Marketing: Brandy Dawson
Senior Marketing Manager: Nicole Kunzmann
Managing Editor: Denise Forlow
Production Project Manager: Annemarie Franklin
Operations Specialist: Diane Peirano
Art Director: Jayne Conte

Cover Designer: Suzanne Behnke
Cover Art: fotolia
Media Editor: Peter Sabatini
Media Project Manager: Pam Weldin
Full-Service Project Management: Hema Latha
Composition: Integra Software Services, Ltd.
Printer/Binder: Courier/Westford
Cover Printer: Lehigh-Phoenix Color/Hagerstown
Text Font: 10/12, Times LT Std

Credits and acknowledgments borrowed from other sources and reproduced, with permission, in this textbook appear on page 261.

Copyright © 2013 Pearson Education, Inc. All rights reserved. Manufactured in the United States of America. This publication is protected by Copyright, and permission should be obtained from the publisher prior to any prohibited reproduction, storage in a retrieval system, or transmission in any form or by any means, electronic, mechanical, photocopying, recording, or likewise.

To obtain permission(s) to use material from this work, please submit a written request to Pearson Education, Inc., Permissions Department, One Lake Street, Upper Saddle River, New Jersey 07458, or you may fax your request to 201-236-3290.

Library of Congress Cataloging-in-Publication Data

Levy, Jeffrey C.

Adaptive learning and the human condition / Jeffrey C. Levy.

p. cm.

Includes bibliographical references and index.

ISBN-13: 978-0-205-20547-9

ISBN-10: 0-205-20547-X

1. Learning, Psychology of. I. Title.

BF318.L48 2013

153.1'526—dc23

2012023577

10 9 8 7 6 5 4 3 2 1

PEARSON

ISBN 10: 0-205-20547-X
ISBN 13: 978-0-205-20547-9

To my mother, Hilda, who first taught me to love learning
To my wife, Fran, for lovingly enriching my human condition

CONTENTS

Preface xiii

Acknowledgments xvii

About the Author xviii

PART 1 A Science of Adaptive Learning 1

Chapter 1 SCIENCE, PSYCHOLOGY, AND ADAPTIVE LEARNING 1

The Human Condition 1

Explanation and Empiricism 3

The Scientific Method 4

Early History of Psychology 4

Psychology Today 6

Scientific Explanation in Psychology 7

Where Does Psychology Look for Explanations? 9

Human Genetic Potential 10

The Importance of Learning 11

Definitions of Learning 11

Operational 11

Structural/Functional 14

Adaptive 15

Direct and Indirect Learning 15

Summary 16 • *References* 17

Chapter 2 ADAPTIVE LEARNING RESEARCH METHODS 18

Internal and External Validity 18

Nonexperimental Research Methods 19

Experimental Research Methods 19

Studies Comparing Groups 20

Small-*N* Designs 21

ESTABLISHING THE BASELINE 21

REVERSAL DESIGNS 22

MULTIPLE BASELINE DESIGNS 23

*Adaptive Learning Research Methods
and External Validity* 24

Nonhumans as Subjects 24

EXPERIMENTAL APPARATUS 25

Summary 28 • *References* 28

PART 2 Predictive Learning 29

Chapter 3 PREDICTIVE LEARNING: BASIC PRINCIPLES AND PHENOMENA 29

Pavlov's Classical Conditioning Paradigm 30

Measurement Procedures 32

Anticipation 32

Blank Trials 33

Sign Tracking 33

Conditioned Suppression 35

Basic Predictive Learning Phenomena 36

Acquisition 37

Extinction 37

Spontaneous Recovery 37

External Inhibition and Disinhibition 38

Renewal 39

Stimulus Generalization and Discrimination 40

Higher-Order Conditioning and Sensory Preconditioning 40

Excitatory and Inhibitory Learning 43

THE SUMMATION PROCEDURE 43

THE RETARDATION-OF-ACQUISITION PROCEDURE 44

Latent Extinction 44

Occasion Setting 45

Summary 46 • References 47

Chapter 4 PREDICTIVE LEARNING: BASIC VARIABLES AND THEORETICAL ISSUES 48

Variables Influencing Predictive Learning 48

Sequencing of Events 49

Timing of Events—The Law of Temporal Contiguity 51

EYEBLINK AND HEART RATE CONDITIONING 51

AN EXCEPTION—ACQUIRED TASTE AVERSION 52

Intensity of Events 53

Scheduling of Events 54

Theoretical Issues 55

Is Extinction Unlearning or Inhibitory Learning? 55

Pavlov's Stimulus Substitution Model 56

IS TEMPORAL CONTIGUITY SUFFICIENT? 57

MUST THE CR RESEMBLE THE UR? 61

The Rescorla-Wagner Model 62

Summary 66 • References 66

Chapter 5 PREDICTIVE LEARNING: APPLICATIONS 69

- Basic and Applied Science* 69
- Direct Classical Conditioning of Emotions* 70
- Indirect Classical Conditioning of Emotions* 72
- Desensitization and Sensitization Procedures* 73
- Classical Conditioning of Word Meaning* 74
- Classical Conditioning of Attitudes* 75
- Evaluative Conditioning* 77
- Classical Conditioning of Drug Tolerance* 78
- Summary* 78 • *References* 78

PART 3 Control Learning 81**Chapter 6 CONTROL LEARNING: BASIC PRINCIPLES AND PHENOMENA 81**

- Thorndike and Skinner* 81
- Apparatuses Used to Study Control Learning* 82
- Skinner's Contingency Schema* 84
- Adaptive Learning Overview* 86
- Learned and Unlearned Appetitive and Aversive Stimuli* 87
- Discriminative Stimuli and Warning Stimuli* 89
- Stimulus-Response Chains* 89
- Basic Control Learning Phenomena* 90
 - Acquisition—Appetitive Control* 90
 - Acquisition—Aversive Control* 93
- Species-Specific Characteristics and Adaptive Learning* 94
- Other Basic Control Learning Phenomena* 95
- Summary* 95 • *References* 96

Chapter 7 CONTROL LEARNING: BASIC VARIABLES AND THEORETICAL ISSUES 98

- Variables Influencing Control Learning* 99
 - Deprivation* 99
 - Timing of Consequence* 102
 - POSITIVE REINFORCEMENT 102
 - NEGATIVE REINFORCEMENT—ESCAPE 102
 - PUNISHMENT 103
 - Intensity of Consequence* 104
 - POSITIVE REINFORCEMENT 104
 - POSITIVE PUNISHMENT 104

Scheduling of Consequences	105
Contingency Between Response and Consequence	106
POSITIVE REINFORCEMENT	106
NEGATIVE REINFORCEMENT—LEARNED HELPLESSNESS	107
<i>Theoretical Issues</i>	108
What Maintains Avoidance Responding?	108
TWO-FACTOR THEORY	109
COGNITIVE THEORY OF CONTROL LEARNING	112
Theoretical Explanations of the PREE	113
DISCRIMINATION	113
FRUSTRATION THEORY	113
SEQUENTIAL THEORY	115
Is Punishment Effective?	115
PROBLEMS OF IMPLEMENTATION	115
PUNISHMENT SIDE EFFECTS	116
DESIRABILITY OF REINFORCING AN ALTERNATIVE RESPONSE	118
Summary	119
References	120

Chapter 8 CONTROL LEARNING: APPLICATIONS 122

<i>Speech and Language (Verbal Symbolic Behavior)</i>	123
<i>Parenting</i>	124
Parenting Styles and Control Learning	124
Parenting Styles and Moral Development	126
Preparing for Adulthood	127
PREPARING CHILDREN TO BE HUNTER/GATHERERS	127
PREPARING CHILDREN FOR SCHOOL AND WORK	128
<i>Treating Behavioral Problems with Nonverbal Individuals</i>	130
Applied Behavior Analysis with Autistic Children	130
BEHAVIORAL EXCESSES—REDUCING SELF-INJURIOUS BEHAVIOR	131
BEHAVIORAL DEFICITS—ESTABLISHING IMITATION AND SPEECH	132
<i>Treating Behavioral Problems with Verbal Individuals</i>	133
Cognitive-Behavioral Treatment of Depression	133
Contingency Management of Substance Abuse	134
<i>Empirically Validated Therapeutic Techniques</i>	134
<i>Using Technology to Treat Behavioral Excesses</i>	135
<i>Relapse Prevention</i>	137
Summary	138
References	138

Chapter 9 SCHEDULES OF REWARD AND MAINTENANCE OF LEARNED BEHAVIOR 142

Skinnerian Methodology 143

The Operant Chamber (Skinner-Box) 143

Cumulative Records 143

Skinner's Schema of Intermittent Schedules of Reinforcement 146

Why Do Ratio Schedules Produce Higher Response Rates Than Interval Schedules? 149

Maintenance of Learned Behavior 150

Differential Reinforcement Schedules as Alternatives to Punishment 151

Extinction as an Alternative to Punishment 152

Noncontingent Reinforcement as an Alternative to Punishment 153

Summary 153 • *References* 154

PART 4 The Human Condition 155

Chapter 10 PERSONALITY, SOCIALIZATION, AND CULTURE 155

Multiple Schedules, Personality, and Culture 155

Stimulus Control, Baseball, and the Human Condition 157

Measuring Stimulus Control in the Laboratory 160

Determinants of Stimulus Control Test Patterns 162

The Peak Shift and Spence's Model of Discrimination Learning 163

Attention Theory and Discrimination Learning 165

Summary 168 • *References* 169

Chapter 11 BECOMING HUMAN AND TRANSFORMING THE HUMAN CONDITION 170

Concept Learning 170

Qualitative and Quantitative Concepts 171

Natural Concepts 172

Learning to Learn 174

Basic Research in Problem Solving 175

Facilitative Effects of Prior Experience 176

Interference Effects of Prior Experience 177

<i>The General Problem-Solving Process</i>	179
<i>Tools, Technology, and the Human Condition</i>	180
The Law of Accelerating Returns	180
THE STONE AGE, BRONZE AGE, AND IRON AGE	180
THE INDUSTRIAL REVOLUTION AND THE MODERN ERA	181
<i>The Phonetic Alphabet and Arabic Numbering System</i>	186
Summary	187 • References 188

Chapter 12 BECOMING HUMAN THROUGH INDIRECT SOCIAL LEARNING 189

<i>Bandura's Four-Stage Model of Observational Learning</i>	190
Attention	190
Retention	191
Response Capability	192
Motivation	192
<i>Speech and Language</i>	194
Hockett's Features of Language	194
Language Acquisition	195
<i>Preparing for School and the 3 Rs</i>	196
Summary	198 • References 199

Chapter 13 ADAPTIVE LEARNING AND SELF-ACTUALIZATION 201

<i>The Nukak's Physiological Needs</i>	202
Hunting and Gathering	202
<i>The Nukak's Shelter and Safety Needs</i>	206
Building a Campsite	206
<i>The Nukak's Love and Interpersonal Needs</i>	208
<i>The Nukak's Esteem Needs</i>	209
<i>The Nukak's Self-Actualization Needs</i>	210
<i>Our Physiological Needs in Comparison to the Nukak's</i>	211
<i>Our Shelter and Safety Needs in Comparison to the Nukak's</i>	211
<i>Our Love and Interpersonal Needs in Comparison to the Nukak's</i>	212
<i>Developmental Tasks and Stages for the Nukak and Us</i>	213
<i>Our Esteem Needs in Comparison to the Nukak's</i>	214
<i>Our Self-Actualization Needs in Comparison to the Nukak's</i>	215
<i>Bridges, Globalization, and the Human Condition</i>	215
Summary	216 • References 217

**Chapter 14 SELF-ACTUALIZATION THROUGH
SELF-CONTROL 218**

Concurrent Schedules and the Matching Law 219

Self-Control—Magnitude and Delay of Reinforcement 221

Commitment 221

The Marshmallow Test 222

Matching, Impulsiveness, and Adaptive Learning 223

Determinism and Freedom 225

Lightning, Sharks, and Human Predators 226

Will Power and Self-Control 227

Self-Control as Problem Solving 228

Defining and Measuring the Problem 228

Collecting Baseline and Intervention Data 229

Manipulating As and Cs to Affect Bs 230

*Improving the Human Condition Through Humanistic
Ecology* 231

Summary 232 • *References* 232

Glossary 235

References 245

Credits 261

Index 262

PREFACE

The systematic study of adaptive learning has a long and storied history dating back to the beginning of the 20th century. At that time, Ivan Pavlov and Edward Thorndike introduced the two major experimental paradigms of classical and instrumental conditioning that have since defined this research area and stood the test of time. In the 1930s, B. F. Skinner made significant contributions to the study of instrumental conditioning. The methods and technical vocabularies he and Pavlov developed still serve as the basis of organizing the content covered in chapters and textbooks of learning.

Historically, there have been two major categories of learning textbooks: those emphasizing theories, exemplified by Hilgard and Bauer's *Theories of Learning* (1975), and those emphasizing principles, exemplified by Kimble's revision of Hilgard and Marquis's *Conditioning and Learning* (1961). The present book is in the tradition of the latter and similar in coverage to recent texts in learning and behavior (e.g., Domjan, 2009; Mazur, 2006; Powell, Symbaluk, & Macdonald, 2009; Schwartz, Wasserman, & Robbins, 2002).

Similar to other learning textbooks, *Adaptive Learning and the Human Condition* emphasizes the experimental research literatures related to classical and instrumental conditioning. Defining learning as an adaptive process through which individuals acquire the ability to predict and control the environment enables the student to appreciate why these two research paradigms, and only these two, are addressed. Adaptation requires acquiring the ability to predict, and when possible, control environmental events. Pavlov studied animals under circumstances that made it possible to predict, but not control, events. Thorndike and Skinner studied animals under circumstances in which their behavior reliably impacted (i.e., controlled) the environment. Observational learning and language are treated as indirect processes for acquiring the same abilities. This enables students to appreciate the relevance of the animal learning literature to human beings as well as the ubiquity and importance of learning principles in our everyday lives.

The first and last chapters of *Adaptive Learning and the Human Condition* begin with the same sentence. A recurring message of this book is that learning principles constitute very powerful explanations for human behavior and help us understand the way we live and why we, more than any other animal, dominate this planet. The two most fundamental ways in which this book differs from other learning textbooks are reflected in the title and this sentence. Learning is defined as an adaptive process that when combined with the human capacities for speech and creation of tools has enabled us to transform the world and thus the human condition. In addition to the usual extension of learning principles to clinical applications, they are related to such nontraditional topics as parenting, moral development, schooling, the effects of technology, and human self-actualization.

THE "BIG MAP"

A textbook, like a course, may be described as a long journey (Levy, 1991). When writing a textbook or teaching a course, it is essential to be an effective guide and to provide useful maps. Before starting, it is often helpful to look at the "big map" portraying the

entire length of the journey. This provides a sense of the scope, as well as an appreciation for where separate trips fit within the overall travel plan. Here and there we may find it necessary and/or enjoyable to take a short side trip. I hope you enjoy the ride!

The textbook (journey) is divided into four major sections (trips): Introduction to the Science of Adaptive Learning (Chapters 1–2), Predictive Learning (Chapters 3–5), Control Learning (Chapters 6–9), and The Human Condition (Chapters 10–14).

Chapter 1 considers how the assumptions, strengths, and limitations of the scientific method apply to the discipline of psychology. The goals and methods of the early schools are described as we examine how current approaches to the discipline evolved. Psychology studies how hereditary (nature) and environmental (nurture) variables affect the thoughts, feelings, and actions of individuals. Learning is seen as a ubiquitous process throughout the animal kingdom, whereby individuals change as the result of experience. It is adaptive, enabling individuals to predict and control their circumstances. The traditional classical and instrumental (or operant) conditioning paradigms, introduced by Pavlov, Thorndike, and Skinner, relate to these two components of adaptation. Classical conditioning procedures study individuals under conditions that enable them to predict, but not control, their environment. Instrumental conditioning procedures study individuals under conditions that enable them to affect the environment. Observational learning and symbolic communication (i.e., language) are treated as indirect procedures for acquiring the ability to predict and control.

The title of the book implies that a science of adaptive learning can result in principles helpful to understanding and influencing the human condition. Chapter 2 addresses the needs of a science to determine cause and effect (internal validity) under naturalistic conditions (external validity). Issues concerning the implementation of these strategies to the study of psychology are considered. The strengths of large- N and small- N experimental designs in addressing internal validity concerns are described. Issues related to the extension of findings obtained with other animals studied in specialized apparatuses to the human condition are considered.

Chapters 3 through 5 consider the scientific research findings related to predictive learning. Basic principles, phenomena, theoretical issues, and applications are reviewed. Chapters 6 through 8 cover the same topics for control learning. Chapter 9 describes issues related to the maintenance of learned behavior. Alternatives to punishment as a procedure to reduce problematic behaviors are considered. A unifying schema for adaptive learning is presented, consisting of the ability to predict and control the occurrence or nonoccurrence of appetitive and aversive events. In subsequent chapters, this schema is used to describe and explain the changing human condition and to generate solutions to individual and social problems.

Chapter 10 describes how adaptive learning principles may be applied to understand human personality and culture. Chapter 11 extends adaptive learning principles to concept learning, problem solving, and tool making. The abilities to learn, communicate symbolically, and use the precision grip have enabled humans to create transformational technologies. Chapter 12 describes how reading and writing enable the permanent recording of human advancement, further accelerating the transformational process. In Chapter 13, Maslow's hierarchy of human needs is used to compare the human conditions for contemporary Stone Age hunter/gatherers and technology-enhanced cultures. Chapter 14 addresses the implications of a science of adaptive learning to issues of freedom and

determinism. Self-control strategies are described as alternatives to relying upon will-power to achieve personal goals and to self-actualize.

The topic of learning poses many challenges for a textbook author. The material is difficult to “chunk” into meaningful units telling a story. One must define what constitutes “the forest and the trees” in selecting articles to cite from the extensive classic and current research literature. The title of the book implies the strategies used to address each of these challenges.

The four book sections constitute the major chunks:

1. The study of learning is placed within the context of the scientific revolution originating around the time of Galileo; learning is defined as an adaptive process through which individuals acquire the ability to predict and control the environment.
2. Predictive learning (classical conditioning) methods, principles, theoretical issues, and applications are treated in depth.
3. Control learning (instrumental conditioning) methods, principles, theoretical issues, and applications are treated in depth.
4. Adaptive learning principles are applied to the understanding of the human condition.

Throughout the book, research is selected from the voluminous nonhuman literature with an eye toward application to understanding and addressing human concerns. Often, the lives of members of a Stone Age nomadic tribe (the Nukak) are contrasted with those of humans in technologically enhanced societies so that the student can appreciate the remarkable transformation that has taken place over the eons, centuries, and even within their lifetimes. Toward the end of the book, the principles are applied to help us understand the accelerating transformation of our planet and the human condition. In the final chapter, the student is asked to consider the implications and applications of learning principles to governing their own lives. The topics of freedom and self-control are considered in both theoretical and practical terms.

LITTLE MAPS AND STUDENT LEARNING AIDS

I have tried to write *Adaptive Learning and the Human Condition* in a clear, engaging style for the undergraduate student. A few learning aids have been integrated into the text in order to help students acquire an often unfamiliar and technical vocabulary and to understand the material in a more cohesive and integrative way than is assessed through objective examination questions (i.e., multiple choice and true-false).

The four major sections constitute the big map, charting the entire journey. Chapter outlines at the beginning constitute small maps, providing the detail necessary to consider and negotiate current journeys. Even though summaries occur at the end of chapters, it would be an effective strategy to read them and consider how they relate to the outlines before actually beginning the content. The summaries are partially written in a cumulative manner. Rereading them after completing the chapters should enable the student to integrate the current material with that covered previously as the story line progresses.

Key terms are highlighted and defined in the margins near where they first appear as well as in a comprehensive glossary at the end of the book. Students often believe that studying simply consists of reading and rereading the material. I encourage

a more active approach in which students ask themselves and try to answer questions requiring mastery of the factual and conceptual material. I try to assist them in becoming objective and accurate assessors of their own learning. Comprehensive essay questions are provided at the end of major sections. I suggest that students assess their mastery of the material by either standing in front of a mirror and stating the answers out loud or writing them down. The questions are difficult, and it is unlikely that the student will be able to adequately answer them by attempting to memorize the material. A thorough understanding of the rationale and details regarding the procedures, findings, and implications of the research literature is required.

I have attempted to present the material in a sufficiently interesting way so that the student recognizes its relevance and importance and becomes willing to dedicate the time and effort required to achieve a high level of mastery. From the time I was an undergraduate and fell in love with psychology, I have believed and hoped that application of the scientific method to the study of behavior could help us frame human existential issues as testable questions and develop effective technologies to address individual and social concerns. By writing this book, I have attempted to share this belief and hope with others.

ACKNOWLEDGMENTS

My interest in learning principles dates back to my memorable experience in Edward Gavurin's undergraduate course at Hunter College, City University of New York. This interest was nurtured in the stimulating and inspirational classes and office conversations held during my graduate studies with Jeffrey Landau and Coleman Paul at Adelphi University.

My Seton Hall departmental colleague Michael Vigorito provided valuable feedback on sections of this book and was enormously helpful in the creation of many of the graphs and tables. I owe thanks to Provost Gabriel Esteban and Vice Provost Larry Robinson for making me an offer I couldn't refuse and granting me a sabbatical year to work on the book. In addition to providing her usual encouragement and support as my wife and soul mate, Fran added muse and editor to her lengthy job description. This book is dedicated to Fran and my mother, Hilda Levy, who first taught me to love learning.

Finally, I would like to thank all those at Pearson who made the editing and production process so constructive, efficient, and enjoyable.

I would also like to extend my thanks to the following individuals who reviewed my manuscript and provided many thoughtful and helpful comments and suggestions: David Rentler—University of the Rockies, Margherita Rossi—Broome Community College, Jeffrey Lamoureux—Boston College, Yosh Kawahara—San Diego Mesa College, Xiongyi Liu—Cleveland State University, Robert Boughner—Rogers State University, W. David Stahlman—UCLA, Kimberly Hall-Chambers—Cleveland State University, James Crosby—Sam Houston State University, Jonathan Kahane—Springfield College, and Peter Spiegel—California State University, San Bernardino.

Jeffrey C. Levy

South Orange, New Jersey

ABOUT THE AUTHOR



Jeffrey C. Levy's professional career at Seton Hall University may be divided into three stages, BC, DC, and AC (before, during, and after his 24-year term as chair of the Department of Psychology). Frequently recognized for teaching excellence, he received the Deans Advisory Council's Outstanding Teacher Award for the College of Arts & Sciences and the Sears-Roebuck Award for College Teaching and Campus Leadership, and he was twice nominated by Seton Hall for National CASE Professor of the Year recognition. Trained as an experimental psychologist with interests in behavior modification, Levy regularly taught the undergraduate Learning course with and without a related animal laboratory and a graduate course in Behavior Modification. A sabbatical opportunity subsequent to his service as chair enabled him to dedicate a year to elaborating upon this teaching experience and drafting *Adaptive Learning and the Human Condition*.