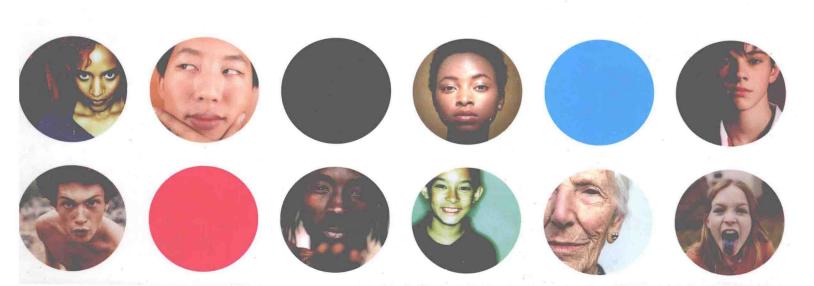


third edition

psychologicalscience

michael gazzaniga / todd heatherton / diane halpern



Psychological Science Third Edition

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Psychological Science

Third Edition

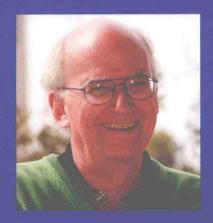
We dedicate this book to

Lilly, Emmy, and Garth Tretheway

Sarah Heatherton and James Heatherton

Sheldon, Evan, Karen, Amanda, and Jason Halpern
and Jaye, Danny, and Belle Halpern-Duncan.

ABOUT THE AUTHORS



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Diane F. Halpern (PhD, University of Cincinnati) is Professor of Psychology at Claremont McKenna College. She has won many awards for her teaching and research, including the 2002 Outstanding Professor Award from the Western Psychological Association, the 1999 American Psychological Foundation Award for Distinguished Teaching, the 1996 Distinguished Career Award for Contributions to Education from the American Psychological Association, and the California State University's State-Wide Outstanding Professor Award. Halpern was president of the American Psychological Association in 2004 and is a past president of the Society for the Teaching of Psychology. She is author of *Thought and Knowledge: An Introduction to Critical Thinking* and *Sex Differences in Cognitive Abilities*. She is currently chairing an APS task force on redesigning undergraduate education in psychology. Her edited book, *Undergraduate Education in Psychology: A Blueprint for the Future of the Discipline* (APA Books), will be published in 2009.

PREFACE

When we, Mike and Todd, began the First Edition of this book, more than a decade ago, our primary motivation was to create a textbook that captured ongoing revolutionary changes in the field by focusing on cutting-edge psychological and brain sciences. Instead of an encyclopedic and homogenized textbook that dutifully covered worn themes and tired topics, we tried to create a readable book that captured the excitement of contemporary research and yet was respectful to the rich tradition of scientific research accumulated by the field. We sought and received excellent advice from countless colleagues about what was most important to them in introductory psychology courses and what they believed was of greatest value to students. It became clear that most instructors wanted a textbook that focused on material that students really needed to know at the introductory level rather than being bloated with unnecessary details. As we noted in the preface to the Second Edition, it was clear that there was an audience eager for a current and scientific treatment of psychology that was accessible for the majority of students.

We made a number of important revisions in the Second Edition, with students first and foremost in our minds. The Second Edition was more balanced in terms of level of detail, and it included many more vivid examples and case histories. Moreover, we expanded our coverage of critical thinking because it was clear that students needed more explicit instruction in how to think about and judge empirical research. However, we retained the features that appealed most to students and instructors, such as the declarative style that focused on answers to current scientific questions and the ask-and-answer approach that captured students' interest and kept the material engaging. We also continued to focus on research that crossed levels of analysis, from cultural and social context to genes and neurons. In the first half of the book, we included more social and cultural examples.

A New Coauthor for the Third Edition

Although we were enormously gratified by the response from instructors and students to our Second Edition, we also knew that there was room for improvement. One of the most important advantages we had was our editor extraordinaire, Jon Durbin, who was as personally invested in the project as we were and who worked tirelessly with us to improve the book. Given how favorably people responded to our enhanced discussion of critical thinking in the Second Edition, Jon sought out one of the world's leading experts on critical thinking to help us do even more with this important construct. Fortunately for us, the expert he sought was Diane Halpern, past president of the American Psychological Association; leader in the study of the science of learning; author of many critically acclaimed articles and

books on cognition, culture, and gender; organizer of many important committees for examining learning objectives and training of students in psychology; and the acknowledged guru of critical thinking. Moreover, Diane had won many awards for her teaching, including the 2002 Outstanding Professor Award from the Western Psychological Association, the 1999 American Psychological Foundation Award for Distinguished Teaching, and the 1996 Distinguished Career Award for Contributions to Education given by the American Psychological Association. So when Diane spoke, we listened.

As it became clear that Diane could contribute to our book in many ways, Jon Durbin raised the idea of Diane joining us as a coauthor. Indeed, it was an intriguing idea, particularly with Mike recently being the President of the Association for Psychological Science and Diane recently being the President of the American Psychological Association. Although the two societies differ somewhat in their primary focuses, both are committed to educating students on the science of psychology, so Diane's joining our textbook would be symbolic of the core mission of APS and APA. Fortunately, Diane shared our interest and vision in creating a highly accessible, scientifically rigorous textbook and agreed to join us. What she also added, and we very much desired, was her expertise on the science of learning. Although we had both spent considerable time in the classroom and received awards for our teaching, Diane's empirical approach to the science of learning resonated for us. That, after all, is the point of our book: We learn how things work through careful scientific study.

The Third Edition Emphasizes the Science of Learning

Over the past few decades, by conducting empirical studies, researchers have discovered the best practices for learning. Researchers have studied the way people think, learn, and remember, yet this knowledge is not often applied to student learning. Diane's expertise in these areas brought many new science-based learning features to the Third Edition, such as an enhanced ask-and-answer approach and Critical Thinking modules that show students how to put critical thinking into action. Using scientific evidence about the cognitive, individual, and environmental factors that influence learning, the Third Edition brings this science into the classroom. Learning Objectives focus students on the central questions they should be able to answer after reading the chapter. The Learning Objectives are explicitly tied to the corresponding Summing Up/Measuring Up features at the end of each main section, which give students take-home messages as well as questions with which they can test their understanding. Practice Tests at the end of the chapters help students consolidate their knowledge. Thus we used knowledge from scientific research to design the pedagogical elements of the book.

The Visual Program

We followed a similar approach to improving the quality of the visual art program. The artwork in the First and Second Editions, like that in most introductory psychology textbooks, mainly consisted of static drawings, graphs of findings, pictures of researchers, and so forth—nothing really inspiring. We wanted to do better with this new edition. Because we value the scientific approach, we sought out one of the world's leading educational psychologists, Richard Mayer, whose research focuses on how people can learn more effectively using visual materials. Indeed, for his pioneering research in science education, Rich won the 2008 Distinguished Contribution of Applications of Psychology to Education and Training Award from

the American Psychological Association. Fortunately, Rich was just down the hall from Mike's new office in Santa Barbara, so Diane and Todd flew to Santa Barbara to seek Rich's advice and counsel. This was an enormously productive meeting, as Rich helped us conceptualize new presentations of visual information in ways that will help students learn.

Active learning is not stimulated by text alone. The Third Edition supports visual learners with clear, attractive graphics that stimulate students' thinking skills and drive home their understanding of key concepts. Throughout this edition, new figures bring abstract concepts to life for students. "Try for Yourself" features encourage students to engage in demonstrations on their own, and "Scientific Method" illustrations carefully and consistently lead students through the steps of some of the most interesting experiments and studies. We are especially pleased with the new "How We" figures, in Chapter 5, which take students step by step through complex processes such as how we hear and how we see. We also carefully considered each piece of visual material in the book, making sure that captions were informative rather than descriptive, and we eliminated many figures that were simply uninspired, replacing them with art that is more meaningful for students.

The Third Edition Comes to Life

After considerable time, thought, and effort, we are pleased to present our new edition. We believe that our book gives students a thorough and interesting overview of contemporary psychological research using the best practices from the science-of-learning research. It develops psychological literacy by presenting the material in a way that is directly related to their lives. The Third Edition also invites students to consider the difficult new ethical dilemmas stemming from advances in psychological research. Mike's book *The Ethical Brain* raised many fundamental questions about how society needs to consider the implications of research in psychological and brain sciences. For each chapter of *Psychological Science*, Mike wrote a feature describing an ethical issue central to the theme of the chapter. Given the success of *The Ethical Brain*, we expect that students will find these features engaging and thought provoking.

The three of us feel that the revisions we have made to our textbook will have great appeal for students and instructors. We conducted focus sessions and conducted a large survey of users and potential users to canvas their thoughts, and we took these ideas into careful consideration as we crafted this new edition. There have been major changes to nearly every chapter; in particular, we have added more material related to gender, culture, and international issues. We also followed the advice of many faithful users by moving the social chapter up in the order, merging the motivation and emotions chapter, expanding the health coverage, adding a large section on positive psychology, increasing the coverage of consciousness, moving the brain anatomy material back to the "Biological Foundations" chapter, and combining attention and memory in one chapter. There are many good solutions for ordering and presenting material in introductory psychology, and we look forward to hearing from users about the solutions we arrived at in this edition.

At the same time, we stayed true to our primary goal—of creating an accessible book that focuses on contemporary research approaches within psychological science. This is an exciting time to work in psychological science, and we hope that our excitement is contagious to our students and readers. We are energized and inspired by the many undergraduate and graduate students we have the pleasure to interact with each day. This book is written for them, with our respect for their intelligence and our admiration for their inquisitiveness.

Acknowledgments

We begin by acknowledging the unwavering support we have received from our families. Writing a textbook is a time-consuming endeavor, and our family members have been generous in allowing us the time to focus on writing. We are also extremely grateful to the many colleagues who gave us constructive feedback and advice. Some individuals deserve special recognition. First and foremost is our good friend Margaret Lynch, who has shared marvelous advice across all three editions as well as helping out in numerous other ways. Margaret is an amazing advocate for students and reminds us never to take them for granted or underestimate them. (She has also remained steadfast in discouraging contractions.) We are also particularly indebted to Debra Mashek for creating the Practice Tests and Psychology and Society questions and contributing richly to the learning system, including advising us on Learning Objectives and other pedagogical features. Wendy Domjan took the time to provide detailed reviews across most of the book, and she really pushed us to make the material accessible.

We also benefited from the astute guidance of many reviewers and consultants over the past three editions, particularly Elizabeth Phelps, Howard Hughes, Peter Tse, Steven Heine, Richard Mayer, Jamie Pennebaker, Wendi Gardner, Tara Callaghan, Jim Enns, David Barlow, Lisa Best, Erin Hardin, Katherine Gibbs, Dana Dunn, Dawn Strongin, and numerous others who took the time to share with us their views about what works in teaching introductory psychology. We have been very pleased with the warm reception our book has received internationally and would like to recognize the thoughtful guidance and advice of our UK advisor, Jamie Ward, University of Sussex.

Producing a textbook requires a small army of people who are crucial at each step of the way. For instance, our ancillary team was instrumental in producing first-rate materials that will assist students and instructors in having a rich experience with the material. Gary Lewandowski joined our long-time friends and colleagues from Bloomsburg University Brett Beck and Eileen Astor-Stetson as the author of the Third Edition's Study Guide. Brett and Eileen also authored superb new content for the student StudySpace Web site. Pat Carroll once again assembled wonderful video offerings that contribute so much to classroom instruction. Likewise, Caton Roberts created brilliant PowerPoint lectures to accompany the text. Sue Franz, Robin Morgan, and Patrick Dyer wrote a truly spectacular Instructor's Manual, which also benefited from design ideas by Katherine Gibbs. We are so grateful to all these individuals, who lent their talent and time to create a strong support package for the Third Edition.

A special mention needs to be made of the Test Bank, which, as every instructor knows, is crucial to a successful course. Inadequate test banks with uneven or ambiguous items can frustrate students and instructors alike. For the Third Edition, we used a science-of-learning approach to assessment. First, we convened a focus group in July 2007 in La Jolla, California, composed of leading assessment researchers to discuss best practices for test item construction and assessment. Valerie Shute and Deigo Zapata-Rivera then wrote guidelines for assessment that were useful for all print and media support materials to ensure quality and consistency throughout. Subsequently, the highly accomplished team of Wendy Domjan, Bernard Beins, Valeri Farmer-Dugan, and Jessica Shryack did an amazing job of assembling the items. We cannot express the depth of our appreciation for their efforts.

Focus Group Participants

Throughout the planning process, we sought expert advice on many aspects of the textbook and the ancillary package. Two focus group sessions were particularly helpful. The first, as mentioned, was for test assessment. This group of academics and researchers included Dave Daniel (James Madison University), Peter Ewell (Vice President, National Center for Higher Education Management Systems), Kurt F. Geisinger (University of Nebraska, Lincoln; Center Director, Buros Center on Testing), Arthur Graesser (University of Memphis), Milt Hakel (Bowling Green State University), Mark McDaniel (Washington University, St. Louis), and Valerie Shute (Florida State University; Principal Research Scientist at Educational Testing Service, Research & Development Division).

We would also like to thank a group of first-rate introductory psychology instructors who met with us at APS in Washington, D.C., in May 2007: Thomas Capo (University of Maryland), Stephen Forssell (George Washington University), Cynthia S. Koenig (St. Mary's College of Maryland), Molly Lynch (Northern Virginia Community College), Beth Morling (University of Delaware), and Benjamin Walker (Georgetown University). This talented group of individuals gave us tough-minded, thoughtful critiques of our revision plan for the main text and teaching support materials. There is no doubt that they helped significantly tighten and improve our plans for this exciting new edition. We are ever grateful for their contributions.

The Norton Team

In the modern publishing world, where most books are produced by large multinational corporations, W. W. Norton stands out as a beacon to academics and authors. Its employees own the company, and therefore every individual who worked on our book has a vested personal interest in its success; it shows in the great enthusiasm they bring to their work. Jon Durbin, a born motivational speaker, was our first editor. Jon absorbed so much psychological knowledge and came to know some many people in the field that at times it was easy to forget he wasn't a psychologist. Unfortunately for psychology, his first love is history, and Jon decided to shift his full-time attention to editing books in that field. However, he needs to be recognized as the person responsible for bringing Diane onto the team. We missed Jon's exuberant enthusiasm as we completed the Third Edition, and we wish him well as he toils away with all those dreary historians.

We are indebted to Roby Harrington for his unwavering support of our book, but we are especially grateful to him for hiring Sheri Snavely to head the psychology list and to serve as our new editor. Sheri is a highly experienced science editor, and she brought many excellent ideas to the book, particularly in terms of reconsidering the entire art program. We are grateful for her dedication to the project and for her unflagging commitment to its success. She has a way of bringing out our best work, and her care and passion show throughout this Third Edition. Sheri is one of a kind, and we are honored to have worked with her this past year.

Beth Ammerman served admirably in her role as developmental editor, pushing us to be crystal clear in how we describe concepts and ideas and making sure that the reader cannot distinguish the three authorial voices. Senior developmental editor Kurt Wildermuth, who served as lead manuscript editor and project editor, is a wordsmith of the highest order and one of the most organized people we have met. He possesses the rare talent to stay completely focused, even when

dealing with the potential vagaries of jury duty. As senior production editor, Christopher Granville managed to keep us all on track in meeting critical timelines and did so without complaining about the authors' erratic and never-ending travel schedules. Sarah England did an amazing job creating the visual art program for the Third Edition. She worked with Rich Mayer to develop new interactive figures that encourage student involvement, and she created wonderful new illustrations throughout the book. Students will be forever grateful for her visual art that helps them understand some of the more complex and technical aspects of psychological science. We also thank Rachel Comerford for taking charge of the ancillaries to make sure we have the strongest possible support package and Dan Jost for working his usual magic with emedia. Peter Lesser played an especially important role on the assessment initiative, and we appreciate the efforts he made on our behalf.

If there were an award for the most disciplined, organized, efficient, and all-round master editorial assistant, Wamiq Jawaid would run away with the prize. Words cannot convey how grateful we are to Wamiq for working long hours to make sure we had all the materials we needed right when we needed them.

Special thanks go to our marketing manager, Ken Barton, who has racked up enough frequent flier points traveling for our book that he could probably fly to the moon and back. He is ever cheerful and ever thoughtful, which is truly a winning combination. Indeed, the entire sales management and marketing team at Norton, led by director of sales and marketing Stephen Dunn, have put together wonderful materials to demonstrate key features of the book. Sales managers Nicole Albas, Lib Triplett, Allen Clawson, Katie Incorvia, Annie Stewart, and Scott Berzon have inspired the Norton travelers. Of course, we are especially grateful to the travelers for taking the time to learn about our book in order to introduce it to our fellow instructors. We have enjoyed talking to so many of the travelers about the book, particularly Peter Ruscitti, John Darger, John Kelly, and Greg Leiman. Finally, we acknowledge Norton president Drake McFeely for inspiring a workforce that cares so deeply about publishing and for having continuing faith in us.

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MEDIA & PRINT RESOURCES FOR INSTRUCTORS AND STUDENTS

For Instructors

Instructor's Resource Manual

by Sue Franz (Highline Community College), Robin Morgan (Indiana University Southeast), and Patrick Dyer (Kennesaw State University)

The Instructor's Resource Manual has been comprehensively integrated with the new edition of the text. The manual equips you with new Concept Maps for each chapter that are completely integrated with emedia features.

Test-Item File

by Wendy Domjan (University of Texas at Austin), Barney Beins (Ithaca College), Valeri Farmer-Dougan (Illinois State University), and Jessica Shryack (University of Minnesota)

This file has been completely revised, using an evidence-centered approach designed by Valerie Shute of Florida State University and Diego Zapata-Rivera of the Educational Testing Service. It includes over 3,000 questions structured around a Concept Map that is consistent with the Study Guide and Instructor's Resource Manual. Use it to evaluate student knowledge on factual, applied, and conceptual levels. The Test-Item File is available in print, ExamView® Assessment Suite, and Word formats.

The Norton Psychology DVD

This diverse collection of over 60 minutes of video clips, ranging from 3 to 7 minutes each, shows the science of psychology in action. The updated DVD includes a host of new clips that incorporate the Learning Objectives of the text with Critical Thinking questions—creating a truly effective teaching tool. Free to qualified adopters.

Instructor's Resource DVD

The Instructor's Resource DVD provides an array of resources for instructors to create easy and effective lecture presentations:

- Lecture PowerPoints with Clicker Questions
- · Art PowerPoints
- · Image Gallery of art from the text

Instructor's Resource Site

The Instructor's Resource Site is an online source of instructional content for use in lectures, modified classrooms, and distance education courses. The site includes:

- Lecture PowerPoints
- Clicker Questions in PowerPoint format
- Art PowerPoints
- Image Gallery of art from the text

- BlackBoard/WebCT Coursepack
- BlackBoard/WebCT Web Quizzes and Test Bank
- Computerized Test Bank and ExamView® Assessment Suite Software

For Students



StudySpace

wwnorton.com/studyspace

This free student Web site provides a rich array of multimedia resources and review materials within a proven, task-oriented study plan. Each chapter is arranged in an effective Organize, Learn, and Connect structure, with review materials such as chapter summaries, flashcards, and quizzes. The Norton Quiz+ Assessment Program gives students customized chapter-by-chapter study plans that target specific content areas for review. The StudySpace offers:

- Chapter Audio Podcasts that serve as chapter overviews and discussions of key concepts. The content is chapter-specific and is organized around the key Learning Objectives.
- Scientific Method Tours with Review Questions that help students understand the basic processes of psychological phenomena such as vision and hearing. Each process tour incorporates the new Scientific Method features in the text and is accompanied by review questions.
- New Animations that cover more topics and psychological processes in the text. They appear on StudySpace and can be accessed and launched from the ebook.
- Drag-and-Drop Labeling Exercises that use the line art from the text to help students understand key diagrams and complex structures.
- Visual Quizzes that integrate the revised art program from the text to help students review the details of important figures and diagrams.



Ebook

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Same great content, half the price!

The ebook links to StudySpace and offers many useful electronic tools, such as highlighting and sticky notes.

Study Guide

by Gary Lewandowski (Monmouth University)

The thoroughly revised Study Guide is based on new assessment principles. A Concept Map gives students a tour of each chapter; Learning Objectives and self-tests are also included. Exercises include quizzes in various question formats (with answer key), graphical concept models, key terms, and Critical Thinking questions based on the Critical Thinking Skills in the text.

ZAPS

wwnorton.com/zaps

The Norton Psychology Labs are online labs that allow students to participate in classic studies in psychology. ZAPS online gives students the theoretical background for each psychological experiment within an interactive, data-driven format.

STUDENT PREFACE

How Psychology Can Help You Learn

In this increasingly fast-paced world, we are constantly bombarded with information: News stories reach us in minutes from around the globe, new technologies replace old ones, and groundbreaking scientific studies alter long-held beliefs about the physical world. To succeed in college and in your career, you will need to develop powerful learning strategies that produce durable and flexible learninglearning that lasts well into the future and that you can transfer to new situations. The following study skills, based on psychological research, will help you work more productively, learn more efficiently, and apply what you have learned in a variety of settings. (You will find more about learning in several chapters in this book, especially in Chapter 7, "Attention and Memory," and Chapter 8, "Intelligence.")

The Right Goals Lead to Success

Throughout your life, you will set countless short-term and long-term goals for yourself: to get that enormous pile of laundry done, to run an eight-minute mile, to have a family, to succeed in your career. It's important to choose goals that are challenging yet attainable. If your goals are unrealistically high, you set yourself up for failure and discouragement, but if they are too low, you won't achieve your greatest potential. Divide each goal into specific, achievable steps, or subgoals, and reward yourself when you reach a milestone. Even a small achievement is worth celebrating!

2. A Little Stress Management Goes a Long Way

Let's face it: Stress is a fact of life. A moderate amount of stress can improve your performance by keeping you alert, challenged, and focused. However, too much stress has the opposite effect and can diminish your productivity, interfere with your sleep, and even take a toll on your health. When the pressure is on, seek healthy ways to manage your stress, such as exercising, writing in a journal, spending time with friends, practicing yoga, or meditating.

3. Cramming Is a Crummy Way to Learn

You have a busy life, and it is always tempting to postpone studying until the night or two before an exam. But in all of your classes there is too much to learn to cram your learning into a few days or late nights. You might be able to remember enough information to get a passing grade on an exam the following day, but plenty of research has shown that cramming does not produce learning that lasts. To make

learning stick, you need to space out your study sessions over the semester and build in plenty of time for active reviews.

4. Learning Is Not a Spectator Sport

The more effort you put into your studying, the more benefit you will receive. Merely rereading a chapter or your class notes is not as effective as actively trying to remember what you have learned. Every time you learn something, you create "memory traces" in your brain. By retrieving the information that was learned, you strengthen the memory traces so that you will be more likely to recall the memory in the future. In this book, to encourage active studying, every major section heading is in the form of a question. When you go back to study each section, begin by writing out an answer to the question in the heading without looking at the book. Then check the accuracy and completeness of what you wrote.

5. Explaining Enhances Understanding and Memory

As you learn, focus on trying to explain and describe complicated topics in your own words, as opposed to just memorizing terms and definitions. For example, simply using flashcards to learn about visual perception may help you memorize individual parts of the eye and their functions, but doing so will not help you put the pieces together to understand the incredible process of how we see and recognize objects in the world. Memorizing isolated bits of information is also likely to result in shallow learning that is easily forgotten. A deeper level of learning based on explanation and description would give you a more holistic understanding and a greater ability to generalize the information.

6. There Is More Than One Way to Learn

As you will read in Chapter 7, people process information in two channels—visual and verbal. Another strategy for creating durable learning is to use both of these information formats. Try to supplement the notes you take with visual and spatial displays such as concept maps, graphs, flowcharts, and other types of diagrams. Doing so not only makes you more likely to remember the information but also helps you gain a better understanding of the big picture by emphasizing the connections among important ideas.

A knowledge of psychology can be useful to you in many ways, even if you do not pursue a career in the field. For this reason, we have tried to make all the material in *Psychological Science* accessible and interesting for you as well as directly applicable to your life. As you gain an integrated grounding in traditional and new approaches within psychological science, we hope that this book spurs your curiosity about psychological phenomena. We hope that, by thinking critically about issues and themes in psychological science and in aspects of your life, you will develop a greater understanding of yourself and others.

Mike, Todd, and Diane