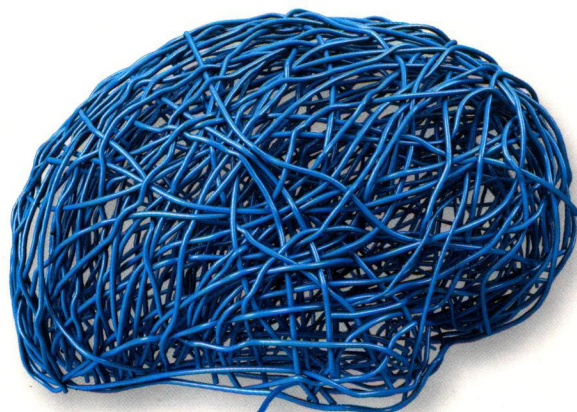


Algorithms to Live By



The COMPUTER SCIENCE of HUMAN DECISIONS

Brian Christian and Tom Griffiths

"Fascinating...Entertaining and educational."

—*The New York Times Book Review*

PICADOR

"By the end of the book, I was convinced. Not because I endorse the idea of living like some hyperrational Vulcan, but because computing algorithms could be a surprisingly useful way to embrace the messy compromises of real, non-Vulcan life."

—The Guardian (London)

What should we do, or leave undone, in a day or a lifetime? How much messiness should we accept? What balance of the new and familiar is the most fulfilling? These may seem like uniquely human quandaries, but they are not. Computers, like us, confront limited space and time, so computer scientists have been grappling with similar problems for decades. And the solutions they've found have much to teach us.

In a dazzlingly interdisciplinary work, Brian Christian and Tom Griffiths show how algorithms developed for computers also untangle very human questions. They explain how to have better hunches and when to leave things to chance, how to deal with overwhelming choices and how best to connect with others. From finding a spouse to finding a parking spot, from organizing one's inbox to managing one's time, *Algorithms to Live By* transforms the wisdom of computer science into strategies for human living.

"Compelling and entertaining...Packed with practical advice about how to use time, space, and effort more efficiently. And it's a fascinating exploration of the workings of computer science and the human mind. Whether you want to optimize your to-do list, organize your closet, or understand human memory, this is a great read."

—CHARLES DUHIGG, author of *The Power of Habit*

"Remarkable...A solid, research-based book that's applicable to real life. The algorithms the authors discuss are, in fact, more applicable to real-life problems than I'd have ever predicted....It's well worth the time to dig deeper into." **—Forbes**

COVER DESIGN BY LUCY KIM

COVER PHOTOGRAPHS: BRAIN MADE OF CABLES
© MIGUEL NAVARRO / GETTY IMAGES; USB TYPE C
CONNECTOR © CHRIS WILLSON / ALAMY STOCK PHOTO

PICADOR // PICADORUSA.COM

175 FIFTH AVENUE, NEW YORK, N.Y. 10010

PRINTED IN THE UNITED STATES OF AMERICA

US \$18.00 / Science

ISBN 978-1-250-11836-3



9 781250 118363

Brian Christian
and Tom Griffiths

ALGORITHMS TO LIVE BY

The
COMPUTER
SCIENCE
of
HUMAN
DECISIONS



PICADOR

Algorithms to Live By

The Computer Science of Human Decisions

Brian Christian and
Tom Griffiths

Picador

Henry Holt and Company
New York

ALGORITHMS TO LIVE BY. Copyright © 2016 by Brian Christian and Tom Griffiths. All rights reserved. Printed in the United States of America. For information, address Picador, 175 Fifth Avenue, New York, N.Y. 10010.

picadorusa.com • picadorbookroom.tumblr.com
twitter.com/picadorusa • facebook.com/picadorusa

Picador® is a U.S. registered trademark and is used by Macmillan Publishing Group, LLC, under license from Pan Books Limited.

For book club information, please visit facebook.com/picadorbookclub or e-mail marketing@picadorusa.com.

Designed by Meryl Sussman Levavi

The Library of Congress has cataloged the Henry Holt edition as follows:

Names: Christian, Brian, 1984– author. | Griffiths, Tom, 1978–

Title: Algorithms to live by : The computer science of human decisions / Brian Christian and Tom Griffiths.

Description: New York : Henry Holt and Company, [2016] | Includes bibliographical references and index.

Identifiers: LCCN 2015032177 | ISBN 9781627790369 (hardcover) | ISBN 9781627790376 (e-book)

Subjects: LCSH: Human behavior—Mathematical models. | Problem solving—Mathematics. | Computer simulation. | Computer algorithms.

Classification: LCC BF39.C4885 2016 | DDC 153.4'3—dc23

LC record available at <http://lcn.loc.gov/2015032177>

Picador Paperback ISBN 978-1-250-11836-3

Our books may be purchased for educational, business, or promotional use. For information on bulk purchases, please contact the Macmillan Corporate and Premium Sales Department at 1-800-221-7945, extension 5442, or write specialmarkets@macmillan.com.

First published by Henry Holt and Company, LLC

First Picador Edition: April 2017

10 9 8 7 6

© Henry Young



BRIAN CHRISTIAN (*left*) is the author of *The Most Human Human*, which was a *Wall Street Journal* bestseller, *New York Times* editors' choice, and a *New Yorker* favorite book of the year. His writing has appeared in *The New Yorker*, *The Atlantic*, *Wired*, *The Wall Street Journal*, *The Guardian*, and *The Paris Review*, as well as in scientific journals such as *Cognitive Science*, and has been translated into eleven languages. He lives in San Francisco.

TOM GRIFFITHS (*right*) is a professor of psychology and cognitive science at UC Berkeley, where he directs the Computational Cognitive Science Lab. He has published more than two hundred scientific papers on topics ranging from cognitive psychology to machine learning, and has received awards from the National Science Foundation, the Sloan Foundation, the American Psychological Association, and the Psychonomic Society, among others. He lives in Berkeley.

Additional Praise for *Algorithms to Live By*

"In this remarkably lucid, fascinating, and compulsively readable book, Christian and Griffiths show how much we can learn from computers. We've all heard about the power of algorithms—but *Algorithms to Live By* actually explains, brilliantly, how they work, and how we can take advantage of them to make better decisions in our own lives."

—Alison Gopnik, coauthor of *The Scientist in the Crib*

"I've been waiting for a book to come along that merges computational models with human psychology—and Christian and Griffiths have succeeded beyond all expectations. This is a wonderful book, written so that anyone can understand the computer science that runs our world—and more importantly, what it means to our lives."

—David Eagleman, author of *Incognito: The Secret Lives of the Brain*

"Excellent . . . While much of the computer science Christian and Griffiths explain is useful in personal and management contexts, the book is also a beautifully accessible primer on algorithms and computer science themselves, and a kind of philosophical treatise."

—Cory Doctorow, *BoingBoing*

"Can computer scientists help us to solve human problems such as having too many things to do, and not enough time in which to do them? It's an appealing idea to any economist. . . . Computer scientists have devoted decades to problems such as sorting information, setting priorities, and networking. Many of the algorithms they have developed for computers can also work for human beings."

—Tim Harford, *Financial Times*

"I absolutely reveled in this book. . . . It's the perfect antidote to the argument you often hear from young math students—'What's the point? I'll never use this in real life!' . . . The whole business, whether it's the relative simplicity of the 37% rule or the mind-twisting possibilities of game theory, is both potentially practical and highly enjoyable as presented here. Recommended."

—Brian Clegg, *Popular Science* (London)

"An entertaining, intelligently presented book . . . Craftily programmed to build from one good idea to the next . . . The value of being aware of

algorithmic thinking—of the thornier details of ‘human algorithm design,’ as Christian and Griffiths put it—is not just better problem solving, but also greater insight into the human mind. And who doesn’t want to know how we tick?”
—*Kirkus Reviews*

“Astonishingly useful advice . . . Geeks will adore it. Don’t let the math frighten you, though, because the concepts are explained well and should be equally accessible and applicable for non-geeks. . . . This is definitely one of those books that will make you smarter.”
—*New Atlas*

“In addition to learning how computers perform their magic, you’ll also discover strategies to optimize your to-do list and organize your bedroom closet. All of this information is presented in an interesting, humorous, and thought-provoking way. . . . This book is a keeper that I would heartily recommend to anyone.”
—*EE Times*

“Challenges you and expands your mind all at once . . . A marvelously accessible way to look at the incredible complexity of the brain, taking ideas like buffering and optimization and applying them to everyday life.”
—*San Francisco Book Review*

Algorithms to Live By

The Computer Science of Human Decisions

Brian Christian

Tom Griffiths

Westerly

How to think and act wisely

1999

Contents

For our families

Introduction

Robert A. Johnson, Jr.

Chapter 1: The Family

Robert A. Johnson, Jr.

Chapter 2: The Family

Robert A. Johnson, Jr.

Chapter 3

Robert A. Johnson, Jr.

Chapter 4

Robert A. Johnson, Jr.

Chapter 5

Robert A. Johnson, Jr.

Chapter 6

Robert A. Johnson, Jr.

Chapter 7

Robert A. Johnson, Jr.

Algorithms to Live By

Contents

	Introduction	1
	<i>Algorithms to Live By</i>	
1	Optimal Stopping	9
	<i>When to Stop Looking</i>	
2	Explore/Exploit	31
	<i>The Latest vs. the Greatest</i>	
3	Sorting	59
	<i>Making Order</i>	
4	Caching	84
	<i>Forget About It</i>	
5	Scheduling	105
	<i>First Things First</i>	
6	Bayes's Rule	128
	<i>Predicting the Future</i>	
7	Overfitting	149
	<i>When to Think Less</i>	

8	Relaxation <i>Let It Slide</i>	169
9	Randomness <i>When to Leave It to Chance</i>	182
10	Networking <i>How We Connect</i>	205
11	Game Theory <i>The Minds of Others</i>	229
	Conclusion <i>Computational Kindness</i>	256
	Notes	263
	Bibliography	315
	Acknowledgments	335
	Index	339