

5TH EDITION

Light | Science & Magic

AN INTRODUCTION TO PHOTOGRAPHIC LIGHTING

Fil Hunter • Steven Biver • Paul Fuqua



Light: Science & Magic

Photographic lighting is a topic that will never go out of style, no matter how sophisticated cameras and other technology get. Even with the most high-tech gear, photographers still need to put a lot of thought and vision into lighting their photographs in order to get great results. This key skill has the power to dramatically and quickly improve photographs.

Light: Science & Magic provides you with a comprehensive theory of the nature and principles of light, with examples and instructions for practical application. Featuring photographs, diagrams, and step-by-step instructions, this book speaks to photographers of varying levels. It provides invaluable information on how to light the most difficult subjects, such as surfaces, metal, glass, liquids, extremes (black-on-black and white-on-white), and portraits.

This new edition includes:

- All new chapter entitled “Setting Up Your First Studio”
- A re-vamped and expanded [chapter 8](#), “Making Portraits”
- New [appendix](#) of reliable photo gear sources
- Over 100 new photographs and informational sidebars
- Updated information about advances in flash equipment, LED panels, and fluorescent lights

Styles of lighting continue to change, but the nature of light will always remain the same. Once photographers understand the basic physics of lighting, they can apply that knowledge to a broad range of photographic styles.

Fil Hunter was a highly respected commercial photographer specializing in still life and special effects photographs for advertising and editorial illustration. During a career spanning over three decades, he worked for such clients as America Online (AOL), US News, Time-Life Books, *Life Magazine* (27 covers), the National Science Foundation, and *National Geographic*. He taught photography at university level and served as technical consultant on a number of photographic publications. Mr. Hunter won the Virginia Professional Photographer's Grand Photographic Award three times.

Steven Biver has over twenty years of experience as a commercial photographer specializing in portraits, still life, photomontage, and digital manipulation. His client list includes Johnson & Johnson, USDA, William & Mary College, Condé Nast, and IBM. He has been honored with awards from Communication Arts, *Graphis*, *HOW Magazine*, and Adobe, who have also included his work on a Photoshop 'extras' disc to inspire other photographers. He is also the co-author of *FACES: Photography and the Art of Portraiture*, another Focal Press publication.

Paul Fuqua has worked as an editorial and wildlife photographer for more than thirty-five years. He started his own production company in 1970 and is dedicated to teaching through the use of visuals. Paul has written and produced educational and training material in a variety of fields including law, public safety, history, science, and the environment. For the last ten years he has produced educational material dealing with the natural sciences and the need for global habitat stewardship. Paul is also a co-author of *FACES: Photography and the Art of Portraiture* for Focal Press.

Light: Science & Magic

An Introduction to Photographic Lighting

Fifth Edition

**Fil Hunter
Steven Biver
Paul Fuqua**

 **Focal Press**
Taylor & Francis Group
NEW YORK AND LONDON

First published 2015
by Focal Press
70 Blanchard Road, Suite 402, Burlington, MA 01803

and by Focal Press
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

*Focal Press is an imprint of the Taylor & Francis Group, an informa
business*

© 2015 Fil Hunter, Steven Biver, and Paul Fuqua

The right of Fil Hunter, Steven Biver, and Paul Fuqua to be identified as authors of this work has been asserted by them in accordance with sections 77 and 78 of the Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this book may be reprinted or reproduced or utilised in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying and recording, or in any information storage or retrieval system, without permission in writing from the publishers.

Notices

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our understanding, changes in research methods, professional practices, or medical treatment may become necessary.

Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds, or experiments described herein. In using such information or methods they should be mindful of their own safety and the safety of others, including parties for whom they have a professional responsibility.

Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Library of Congress Cataloging in Publication Data
CIP data has been applied for

ISBN: 978-0-415-71940-7 (pbk)
ISBN: 978-0-415-71941-4 (hbk)
ISBN: 978-1-315-86739-7 (ebk)

Typeset in New Caledonia
By Keystroke, Station Road, Codsall, Wolverhampton

Dedication

We dedicate this book to our friend and co-author, Fil Hunter. It is his pioneering vision that this book so largely reflects.

Sadly, Fil died while this edition was in preparation after a long and tortuous battle against a terrible disease. We shall miss him, as will many others in the photography community.

Steven Biver and Paul Fuqua

Bound to Create

You are a creator.

Whatever your form of expression — photography, filmmaking, animation, games, audio, media communication, web design, or theatre — you simply want to create without limitation. Bound by nothing except your own creativity and determination.

Focal Press can help.

For over 75 years Focal has published books that support your creative goals. Our founder, Andor Kraszna-Krausz, established Focal in 1938 so you could have access to leading-edge expert knowledge, techniques, and tools that allow you to create without constraint. We strive to create exceptional, engaging, and practical content that helps you master your passion.

Focal Press and you.

Bound to create.

We'd love to hear how we've helped
you create. Share your experience:
www.focalpress.com/boundtcreate

Table of Contents

Dedication	v
Special Thanks	xvii
Introduction	1

Chapter 1

Light: the Beginning	5
Lighting Is the Language of Photography	6
What Are the “Principles”?	6
Why Are the Principles Important?	8
How Did We Choose the Examples for This Book?	9
To Do or Not to Do?	10
What Kind of Camera Do I Need?	12
A Word of Caution	13
What Lighting Equipment Do I Need?	16
What Else Do I Need to Know to Use This Book?	17
What Is the “Magic” Part of This Book?	18

Chapter 2

Light: the Raw Material of Photography	21
What is Light?	22
How Photographers Describe Light	26
<i>Brightness</i>	27
<i>Color</i>	27
<i>Contrast</i>	29
“Light” Versus “Lighting”	33
How the Subject Affects Lighting	36
<i>Transmission</i>	36

TABLE OF CONTENTS

<i>“Direct” Versus “Diffuse” Transmission</i>	39
<i>Absorption</i>	40
<i>Reflection</i>	41
Chapter 3	
The Management of Reflection and the Family of Angles	43
Types of Reflections	44
<i>Diffuse Reflections</i>	45
<i>The Inverse Square Law</i>	49
<i>Direct Reflections</i>	50
<i>The Family of Angles</i>	54
<i>Polarized Direct Reflection</i>	55
<i>Is It Polarized Reflection or Ordinary Direct Reflection?</i>	60
<i>Turning Ordinary Direct Reflection into Polarized Reflection</i>	62
Applying the Theory	63
Chapter 4	
Surface Appearances	65
Photographer as an Editor	66
Capitalizing on Diffuse Reflections	67
The Angle of Light	68
The Success and Failure of the General Rule	73
The Distance of Light	75
Doing the Impossible	78
Using Diffuse Reflection and Shadow to Reveal Texture	83
Capitalizing on Direct Reflections	85
Complex Surfaces	89

TABLE OF CONTENTS

Chapter 5

Revealing Shape and Contour	95
Depth Clues	97
Perspective Distortion	98
<i>Distortion as a Clue to Depth</i>	99
<i>Manipulating Distortion</i>	100
Tonal Variation	102
The Size of the Light	103
<i>Large Lights Versus Small Lights</i>	104
<i>Distance from the Subject</i>	105
The Direction of the Light	107
<i>Light on the Side</i>	108
<i>Light above the Subject</i>	110
<i>Fill Light</i>	112
<i>Adding Depth to the Background</i>	116
How Much Tonal Variation is Ideal?	120
<i>Photographing Cylinders: Increasing Tonal Variation</i>	120
The Glossy Box	123
<i>Use a Dark- to Medium-toned Background</i>	124
<i>Eliminate Direct Reflection from the Box Top</i>	125
<i>Move the Light Source toward the Camera</i>	126
<i>Raise or Lower the Camera</i>	126
<i>Use Falloff</i>	127
<i>Eliminate Direct Reflection from the Box's Sides</i>	128
<i>Put a Black Card on the Tabletop</i>	128
<i>Tip the Box</i>	129
<i>Use a Longer Lens</i>	129
<i>Finish with Other Resources</i>	129
<i>Try a Polarizer</i>	130

TABLE OF CONTENTS

<i>Use Dulling Spray</i>	131
<i>Use Direct Reflection</i>	131
Chapter 6	
Metal	133
Flat Metal	134
<i>Bright or Dark?</i>	136
<i>Finding the Family of Angles</i>	136
<i>Position a White Target Where You Think the Family of Angles Will Be</i>	137
<i>Place a Test Light at the Camera Lens</i>	137
<i>Aim the Test Light</i>	138
<i>Study the Position and Shape of the Area Marked on the Test Surface</i>	139
<i>Lighting the Metal</i>	140
<i>Keeping the Metal Bright</i>	140
<i>What Is a “Normal” Exposure for Metal?</i>	144
<i>Keeping the Metal Dark</i>	145
<i>The Elegant Compromise</i>	149
<i>Controlling the Effective Size of the Light</i>	152
<i>Keeping the Metal Square</i>	157
<i>Use a View Camera or Perspective Control Lens</i>	157
<i>Aim the Camera through a Hole in the Light Source</i>	158
<i>Photograph the Metal at an Angle</i>	160
<i>Retouch the Reflection</i>	160
Metal Boxes	160
<i>A Light Background</i>	163
<i>A Transparent Background</i>	164
<i>A Glossy Background</i>	167
Round Metal	169

TABLE OF CONTENTS

<i>Camouflage</i>	171
<i>Keeping the Light Off the Camera</i>	171
<i>Using a Tent</i>	172
Other Resources	174
<i>Polarizing Filters</i>	175
<i>Black Magic</i>	175
<i>Dulling Spray</i>	176
Where Else Do These Techniques Apply?	176
Chapter 7	
The Case of the Disappearing Glass	179
Principles	179
Problems	180
Solutions	180
Two Attractive Opposites	182
<i>Bright-field Lighting</i>	182
<i>Choose the Background</i>	184
<i>Position the Light</i>	184
<i>Position the Camera</i>	185
<i>Position the Subject and Focus the Camera</i>	186
<i>Shoot the Picture</i>	186
<i>Dark-field Lighting</i>	188
<i>Set Up a Large Light Source</i>	189
<i>Set Up a Dark Background Smaller Than the Light Source</i>	190
<i>Position the Camera</i>	191
<i>Position the Subject and Focus the Camera</i>	192
<i>Shoot the Picture</i>	192
The Best of Both Worlds	193
Some Finishing Touches	194
<i>Defining the Surface of Glassware</i>	195

TABLE OF CONTENTS

<i>Illuminating the Background</i>	199
<i>Minimizing the Horizon</i>	200
<i>Stopping Flare</i>	203
<i>Eliminating Extraneous Reflections</i>	204
Complications from Nonglass Subjects	205
<i>Liquids in Glass</i>	205
<i>Liquid as a Lens</i>	206
<i>Keeping True Color</i>	208
<i>Secondary Opaque Subjects</i>	211
Recognizing the Principal Subject	212
Chapter 8	
Making Portraits	215
The Single-light Portrait Set-up	216
<i>The Basic Set-up</i>	216
<i>Light Size</i>	218
<i>Skin Texture</i>	219
<i>Where to Put the Main Light</i>	220
<i>The Key Triangle</i>	221
<i>Key Triangle Too Large: Main Light Too Near the Camera</i>	222
<i>Key Triangle Too Low: Main Light Too High</i>	223
<i>Key Triangle Too Narrow: Main Light Too Far to Side</i>	224
<i>Left Side? Right Side?</i>	225
<i>Broad Lighting or Short Lighting?</i>	225
<i>Eyeglasses</i>	227
Additional Lights	228
<i>Fill Lights</i>	229
<i>Reflector Cards as Fill Lights</i>	232
<i>Background Lights</i>	234

TABLE OF CONTENTS

<i>Hair Lights</i>	236
<i>Kickers</i>	238
<i>Rim Lights</i>	241
Mood and Key	242
<i>Low-key Lighting</i>	243
<i>High-key Lighting</i>	244
<i>Staying in Key</i>	247
Dark Skin	247
The Unfocused Spot	249
Using Colored Gels	254
Chapter 9	
The Extremes	257
The Characteristic Curve	258
<i>The Perfect “Curve”</i>	258
<i>A “Bad” Camera</i>	261
<i>Overexposure</i>	263
<i>Underexposure</i>	265
Using Every Resource	270
White-on-White	270
<i>Exposing White-on-White Scenes</i>	271
<i>Lighting White-on-White Scenes</i>	274
<i>Subject and Background</i>	275
<i>Using an Opaque White Background</i>	276
<i>Light the Subject from Above</i>	277
<i>Use a Gobo Above the Subject</i>	278
<i>Add Dimension</i>	281
<i>Using a Translucent White Background</i>	282
<i>Using a Mirror Background</i>	286
<i>In Any Case, Keep the Background Small</i>	287
Black-on-Black	288

TABLE OF CONTENTS

<i>Exposing Black-on-Black Scenes</i>	289
<i>Lighting Black-on-Black Scenes</i>	290
<i>Subject and Background</i>	291
<i>Using an Opaque Black Background</i>	293
<i>Using a Glossy Black Surface</i>	296
<i>Keeping the Subject Away from the Background</i>	297
Histograms	299
<i>Preventing Problems</i>	301
<i>Overmanipulation</i>	303
Curves	305
New Principles	306
Chapter 10	
Traveling Light	309
The Lights We Use	310
<i>Heavy-duty Portable Strobes</i>	310
<i>“Hot-shoe” Flashes</i>	311
<i>LED Panels</i>	312
Getting the Exposure Right	313
<i>Letting Your Flash Do the Figuring</i>	314
<i>Using a Meter</i>	314
<i>Meters and LEDs</i>	315
Getting More Light	315
<i>Multiple, or “Ganged”, Flashes</i>	316
<i>Battery Packs</i>	318
<i>Flash Extenders</i>	318
Getting Better-quality Light	319
<i>The Problems</i>	319
<i>Take It Off</i>	320
Bouncing From Hard To Soft	321

TABLE OF CONTENTS

<i>The Omni-Bounce—A Big Help For a Little Money</i>	323
<i>“Raccoon Eyes”</i>	324
Feathering Your Light	326
Forcing the Shadow	328
Lights of Different Colors	329
<i>Why Is the Color of the Light Important?</i>	330
<i>Tungsten</i>	330
<i>Daylight</i>	331
<i>Nonstandard Light Sources</i>	331
<i>Do the Colors Mix?</i>	334
<i>The Remedies</i>	337
<i>Correcting Mixed Colors</i>	337
<i>Correcting Unmixed Colors</i>	338
<i>Filtering Daylight</i>	339
<i>Correcting Errors in Reproduction</i>	340
Lights of Different Duration	340
Different Approaches	342
Other Useful Gear	348
Chapter 11	
Setting Up Your First Studio	353
Lights: An Early Issue	354
Getting Your Lights Right	356
<i>What Kind of Lights?</i>	356
<i>Flash</i>	357
<i>Continuous Lights</i>	358
<i>How Many Lights?</i>	359
Light Stands	359
<i>Booms</i>	361
Light Modifiers—Which Do I Need?	361

TABLE OF CONTENTS

<i>Diffusers</i>	362
<i>Reflectors</i>	363
<i>Snoots and Grids</i>	364
<i>Gobos and Flags</i>	364
Backgrounds	365
Computers and Associated Gear	366
Miscellaneous Equipment	367
What Sort of Space?	368
Appendix: Reliable Suppliers	372
Index	374

Special Thanks

I would like to thank, Leah Bassett (Hair & Make-up), Nicolette Steele, Brynn Tucker, Mike Jones, Tessa Biver, Mark Romanoff, Mike Harvey, Jade Biver, Nigel Biver, Union 206 Studio, the late Vance Bockis, Adonis, Quiterio, and the folks at Focal Press. I would also like to thank my wonderful family for all their support.

Steven Biver

With gratitude and undying admiration for Robert Yarbrough—a teacher who taught.

Paul Fuqua

This page intentionally left blank

Introduction

Lighting is at the very heart of photography. Unlike some of our picture-making colleagues, we will not go quite so far as to claim that “Without great lighting, there can be no great photographs.” However, we do believe that comes close to being the truth.

And that is exactly why we wrote the first edition of this book. In it we wanted to present a number of key lighting concepts in a clear, readily understandable way. Our aim remains exactly the same for this—the fifth edition.

It is important to understand that this is *not* a “how to” book in the sense that the term is generally used. In it we rarely, if ever, suggest appropriate lens apertures, shutter speeds, flash settings, or other such information—information that is often an important part of the currently popular “recipe” approach to teaching lighting. If that is what you are looking for, you must look elsewhere. (Personally, we would recommend the brilliantly done “Digital Photography Book” series by Scott Kelby.)

If, on the other hand, you want to understand something about the underlying nature of light and learn how to employ its key characteristics to the lighting of any sort of subject in any location or circumstance, we suggest that this is the right book for you. In it we present an overarching approach to photographic lighting. Applying it will enable you to *understand* why a subject looks the way it does when it is illuminated by any given “light,” and how to *use this understanding* to make exactly the picture you are after.

INTRODUCTION

We also include chapters dealing with the peculiarities associated with using hot-shoe and similar flashes, and suggestions for those of you who may be considering setting up your first studio. Finally, in a brief [appendix](#), we list some of the photographic suppliers from whom we have received particularly good services over the years.

This page intentionally left blank

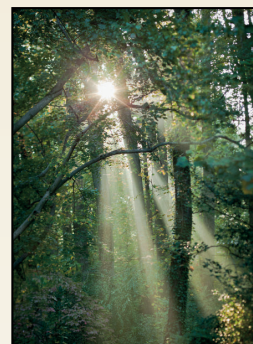


Light: the Beginning

Light: Science & Magic is a discussion, not a lecture. You bring to this discussion your own opinions about art, beauty, and aesthetics. We do not intend to change those opinions and may not even influence them very much. We will be more annoyed than flattered if reading this book causes you to make pictures that do nothing but mirror ours. For better or worse, you have to build your own pictures on your own vision.

What we *do* have to offer you is *a set of tools*. This book is about technology. Science. Brass tacks. It is information for you to use when you please, if you please, and how you please. This does not, however, mean that this book is not also about *ideas*, because it is.

The basic tools of lighting are principles, not hardware. Shakespeare's tool was the Elizabethan English language, not the quill pen he used. A photographer without mastery of lighting is like a Shakespeare who could speak only the language of the people in the Globe Theatre pit. Being Shakespeare, he still might have come up with a decent play, but it certainly would have taken a lot more work and, very likely, more blind luck than most people are entitled to expect.



LIGHTING IS THE LANGUAGE OF PHOTOGRAPHY

Patterns of light convey information just as surely as do spoken words. The information that light conveys is clear and specific. It includes definite statements, such as “The bark of this tree is rough” or “This utensil is made of stainless steel, but that one is sterling.”

Lighting, like any other language, has a grammar and a vocabulary. Good photographers need to learn both. Fortunately, photographic lighting is a lot easier to master than a foreign language. This is because physics, not social whim, dictates its rules.

The tools we have included in this book are the grammar and vocabulary of light. Whatever we say about specific technique is important only to the extent that it proves the principles. *Please, do not memorize the lighting diagrams in this book.*

It is entirely possible to put a light in exactly the same spot as shown in one of the diagrams and still make a bad picture—especially if the subject is not identical to that in the diagram. But if you learn the principles, you may well see several other good ways to light the same subject that we never mention, and which perhaps have never even occurred to us.

WHAT ARE THE “PRINCIPLES”?

To photographers, the important principles of light are those that predict *how it will behave*. Some of these principles are especially powerful. You will, however, probably be surprised to find how few they are, how simple they are to learn, and how much they explain.

We discuss these key principles in detail in [Chapters 2](#) and [3](#). They are the tools we use for everything else. Then in later

Working with Light

Figures 1.1 These four images—very different pictures—are a small sample of some of the many different ways photographers have worked with light, be it either in a studio or the outside world.



Credit: Steven Biver



Credit: Steven Biver



Credit: Mark Romanoff



Credit: Paul Fuqua

1.1 Some examples of the different photographers that have worked with light.

chapters we put them to work lighting a wide range of subjects. At this point we will simply list them:

1. The effective *size of the light source* is the single most important decision in lighting a photograph. It determines what types of shadows are produced and may also affect the type of reflection.

2. Three *types of reflections* are possible from any surface: direct reflection, diffuse reflection, and polarized direct reflection. They determine why any surface looks the way it does.
3. Some of these reflections occur only if light strikes the surface from within a limited *family of angles*. After we decide what type of reflection is important, the family of angles determines where the light should or should not be.

Just think about that for a minute. If you think lighting is an art, you're exactly right—but it's also a technology that even a bad artist can learn to do well. These are the most important concepts in this book. If you pay close attention to them whenever they come up, you will find they will usually account for any other details you may overlook or we forget to mention.

WHY ARE THE PRINCIPLES IMPORTANT?

The three principles we have just given are statements of physical laws that have not changed since the universe began. They have nothing to do with style, taste, or fad. The timelessness of these principles is exactly what makes them so useful.

Consider, for example, how they apply to portrait style. A representative 1952 portrait does not look like most portraits made in 1852 or 2014. However, and this is the important point, *a photographer who understands light could duplicate either of them.*

Chapter 8 presents a number of useful approaches to lighting a portrait. But some photographers will not want to adopt those approaches, and even fewer will do so in 20 years. We do not care whether or not you use the methods of portrait lighting we chose to demonstrate.

LIGHT: THE BEGINNING

We do, however, care very much that you understand exactly *how* and *why* we did what we did. It is the answers to those very “hows” and “whys” that will allow you to produce your own pictures your own way. Good tools do not limit creative freedom. They make it possible.

Good photographs take planning, and lighting is an essential part of that planning. For this reason, the most important part of good lighting happens *before* we turn on the first lights. This planning can take many days or it can happen a fraction of a second before pressing the shutter release. It does not matter when you plan or how long it takes, as long as you get the planning done. The more you accomplish with your head, the less work you have to do with your hands.

Understanding the principles we presented above enables us to decide what lights need to be where before we begin to place them. This is the important part. The rest is just fine-tuning.

HOW DID WE CHOOSE THE EXAMPLES FOR THIS BOOK?

The portrait is but one of the several basic photographic subjects we discuss. We chose each to prove something about the basic principles. We also lit the subject to show the principle, regardless of whether there might be other good ways to light the same thing. If you master the principles, you will discover the other ways without any help from us.

The above means that you should give at least some attention to every representative subject. Even if you have no interest in a particular subject, it probably relates to something you do want to photograph.