

Photo COURSE

An Interactive Multimedia eText

Dennis P. Curtin

Photo Course
An Interactive Multimedia eText™

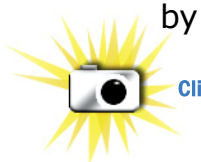
Photos – Drawings – Animations – Interaction – Movies – Audio

by Dennis Paul Curtin
with Steve Webster

PhotoCourse.com
Marblehead, Massachusetts USA
www.photocourse.com
publisher@photocourse.com

ISBN 1-928873-63-4 (eText) and ISBN 1-928873-64-2 (printed text)

© Copyright 2006 by Dennis P. Curtin. All rights reserved. Printed in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of the publisher.



Preface

As a student or teacher of digital photography, this multimedia eText™ may be what you're looking for. Its unique visual approach introduces the core concepts of digital photography using photos, drawings, and interactive animations instead of long pages of text.

In addition to this unique visual, animated design, you may also notice that the eText is titled simply "Photo Course" although it's a text on digital photography. Why is this? Because times have changed and almost all photography now is digital—or soon will be. Descriptive adjectives have to be added to photography books that cover the use of film, not books that cover digital. This is not to denigrate film photography. It is a wonderful media that has served artists, journalists and others well for over a century. As time passes and film leaves the core curriculum it will find a welcome home in courses on alternative and historical processes.

Although designed for use as the core text in a semester-length course, this eText is so inexpensive you may find it useful in other settings including:

• As a supplement, or projectible teaching aide in courses where you are using "*The Textbook of Digital Photography*" as the main text.

• As the textbook in a short course offered in adult education, community education, or other settings where only part of the material is covered in the course and the rest is read by students on their own or used as a reference during the course and after.

• As an individualized learning eText™ on your own computer.

• As a source of projects or assignments you can assign your students or yourself (see page 6).

In this eText you are introduced to two major aspects of photography; the underlying concepts and the creative applications.

Typical concepts include how the shutter speed controls the portrayal of motion in an image, how the aperture controls the depth of field, and how flash falls off with distance following the inverse square law. A typical creative application is using slow sync flash to combine all three of these concepts to create photos that are both sharp and blurred with a lighter background. As you'll see there are only a few concepts, but a countless number of creative applications that use these concepts in a variety of combinations.



Click to visit the companion Web site

This eText is published as an Adobe PDF file and works just like other PDFs. It's distributed in this eText format to dramatically lower costs.

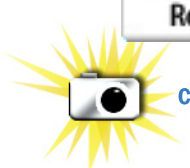
• **If you are a student**, just open the eText with the free Acrobat Reader and page through it. Most users print only selected pages when they need them (called *print on demand*) but others run off color copies of the entire work. You have the right to do either as long as it's for personal use and not for sale or distribution to others.

• **If you are an instructor** projecting the materials to support your lectures, you may want to pick and choose from the wealth of information presented here. To do so, just display the eText in Acrobat Reader with the *Bookmarks* or *Pages* tabs displayed (*View>Navigation Tabs*). Note down the pages you want to project and the order in which you want to present them. Once connected to a projector, use your notes and the contents or thumbnails to jump directly to the pages you want to show in the order you want to show them.

If you are unfamiliar with Acrobat Reader, click the *PDF Resource* button on the page title bar to display a printable PDF quick reference guide.



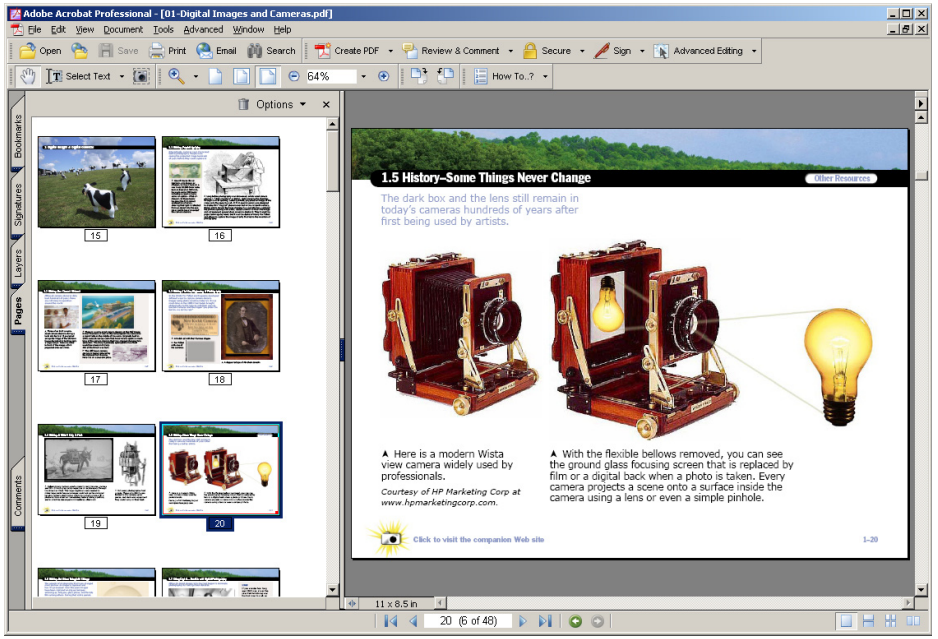
➤ If you don't have Adobe Reader, click here.



Click to visit the companion Web site

Animations and Other Resources

Throughout this eText, you will find over 80 buttons on page title bars. Clicking them displays an animation or other resource stored on the PhotoCourse.com Web site. To use them you need an Internet connection. If you are a teacher and this presents problems, please write us and we can supply an instructor's copy on a CD.



➤ Adobe's Reader displays tabs on the left side of the page. Clicking the "Bookmarks" tab displays a table of contents and clicking the "Pages" tab displays thumbnails of each page.

Ahoy, Matey! Beware of Pirates

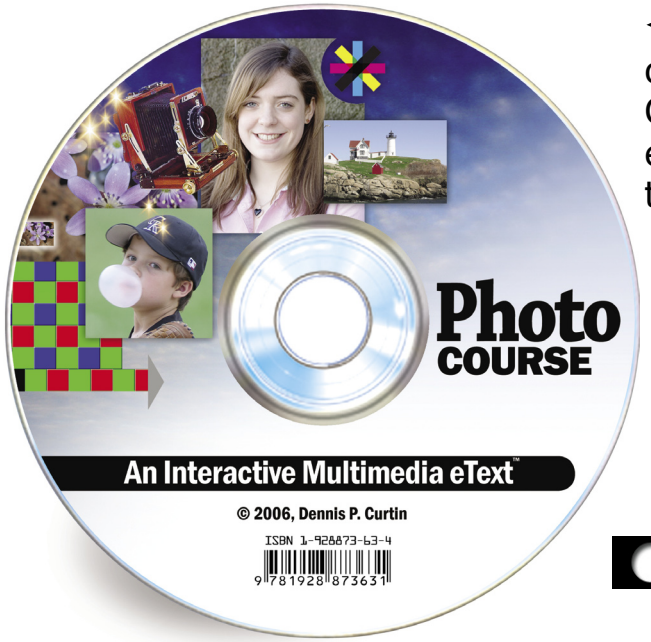
PDF Resource

As a member of the photographic community, one of your concerns should be intellectual property rights. Technology has made it easy to steal materials without compensation to the creator. This theft is happening on a grand scale.

As you take and share photos you may find your work appearing elsewhere without your permission. It's not a good feeling when you discover it happening to your own work. When it happens to us we usually find out when friends in the photo community alert us or from an analysis of the logs showing who is visiting the PhotoCourse.com Web site to play the animations. We hope you appreciate and share our goals of providing low-cost, high-quality materials and will help us continue this policy by notifying us if you suspect our materials are being pirated.

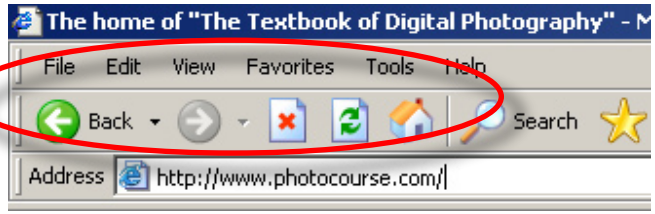
To determine if you are using a legal copy check the CD label and the URL when you click a button on a spread title bar as described to the right. If you suspect something is wrong e-mail me at *publisher@photocourse.com* and we will take it from there—without involving you in any way.

For an introduction to US copyright law, click the *PDF Resource* button on the title bar to open a PDF introduction from the Copyright Office.



➤ A legal copy of the eText CD should look exactly like this.

Click to E-mail Us



➤ When you click a button on a spread title bar, like the PDF Resource button above, be sure the Address line on your browser begins with http://www.photocourse.com.... If it doesn't, you are at an illegal site that may be trying to hijack or otherwise harm your system.

Click to visit the companion Web site

About the Photos

If you are a teacher or student, this eText isn't just to teach you about digital photography. It's also a great guide to structured assignments or projects you can shoot. Many photographers use photos to illustrate ideas or themes. The comparison and example photos throughout this eText were taken that way. The goal was to illustrate concepts such as the effect of shutter speed on motion, or aperture on depth of field. You can adopt these same goals as you put what you are learning about photography into practice. Take your own versions of these photos. Just as a pianist practices the musical scales, you can practice the scales of photography. Gradually you will assemble a number of tools on which to draw as you create your own personal style.

If you or your class want to submit photos for inclusion in this eText, you are invited to do so. Not only does it give you projects on which to work, if you are accepted you get published, with full credit and a link to your Web site, in a widely used textbook.

Dennis Curtin
Publisher
PhotoCourse.com
Marblehead, Massachusetts
publisher@photocourse.com
www.photocourse.com

SEND IN YOUR OWN PHOTOS

Our goal is to have this eText eventually illustrated with work from students and teachers who have taught or learned from it. If you think you have a photo that illustrates a photo concept and that's as good or better than one in this book, send a small version of it (100 or so pixels wide) by e-mail to photos@photocourse.com. Be sure to give the page number of the illustration you think it compares to. If the photo is selected for inclusion, you will be given full credit and a link to your Web site.



Click to visit the companion Web site

Taking Your First Pictures—It's All About Workflow

Before we launch off into the vast field of digital photography, keep in mind that digital cameras are so easy to use you almost don't need a manual. All you have to do is frame the image and push the shutter button. However, this is just one step in a multi-step process called a *workflow*. Creating and following the steps in your own workflow will save you much time and frustration later on. Typical steps in a workflow include the following

• **Getting ready**. Turn the camera on and set it to auto mode (or any other exposure mode once you understand them). To conserve your batteries, turn off the monitor and compose your image through the optical viewfinder. If the camera has a lens cap, remove it.

• **Check the Camera**. Check that your batteries are charged, there is room on the memory card, the lens is clean, and you have everything with you that you'll need.

• **Check Settings**. Be sure you check your settings so they are the ones you want to use. Be sure that a setting you made previously doesn't affect the current photo.

• **Holding the camera**. When taking pictures, hold the camera in your right hand while supporting the lens with your left. Be sure not to block the flash, lens or any of the sensors or lights on the front of the camera.

• **Framing the image**. The viewfinder shows you the scene you are going to capture. If your camera has a zoom lens, you can zoom in and out by pressing a button or lever or by turning a ring on the lens. Zooming out widens your angle of view and zooming in enlarges subjects. If the image in the viewfinder is fuzzy, see if the camera has a diopter adjustment dial you can use to adjust it.

• **Autofocus**. Compose the image so the subject that you want sharpest is covered by the focus area in the center of the viewfinder or monitor. Some cameras have more than one autofocus point indicated in the viewfinder or on the monitor and will focus on the closest part of the scene covered by one of the points. This makes it easier to focus on an off-center subject.

• **Autoexposure**. Autoexposure measures light reflecting from various parts of the scene and uses these readings to set the best possible exposure. This happens at the same time focus is locked—when you press the shutter button halfway down.



Click to visit the companion Web site

• **Autoflash**. If the light is too dim, the autoexposure system will usually fire the camera's built-in flash to illuminate the scene. If the flash is going to fire, it pops up or a flash lamp glows when you press the shutter button halfway down. If the flash lamp blinks when you press the shutter button halfway down, the flash is charging. Release the shutter button for a few seconds and try again.

• **White balance**. Because the color cast in a photograph is affected by the color of the light illuminating the scene, the camera automatically adjusts color balance to make white objects in the scene look white in the photo.

• **Taking the picture**. The shutter button has two stages. When you press it halfway down, the camera locks focus and exposure and the camera beeps or an indicator lights up when this happens. (If the indicator blinks, it means the camera is having trouble focusing.) After focus and exposure are locked, press the shutter button all the way down to take the picture. When you do so, the camera may beep.

• **Check your results**. Review your photos on the camera's monitor before leaving the scene. This way you can reshoot if necessary.

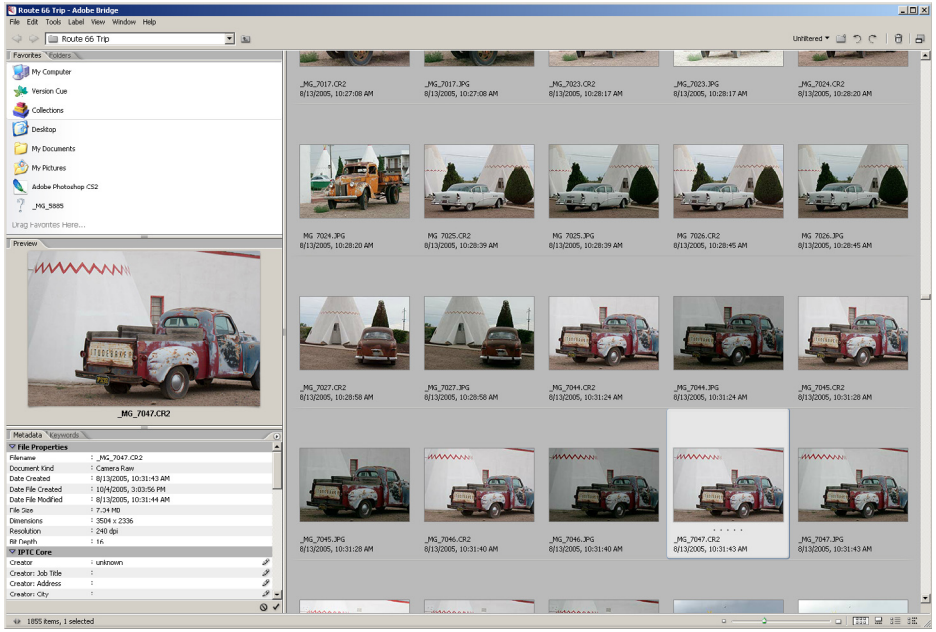
• **Quit**. When finished taking pictures, turn the camera off to conserve battery power.

• **Image Transfer**. Transfer your images to the computer in a logical and systematic way so you can find them later.

• **Image Management**. Review your images on the computer and attach keywords or rankings so you can more easily find images later.



Taking Your First Pictures—It's All About Workflow, con't.



➧ Take pictures from different angles and positions, vary the lens focal length, try everything you can think of. Digital images don't cost you anything to shoot and you may be surprised by what works and what doesn't.

As you immerse yourself in the seemingly endless details of photography, here are some thoughts about the journey you are on and what's really important.

Photography has not changed since its origin except in its technical aspects, which for me are not a major concern.

Henri Cartier-Bresson
The Mind's Eye

The mystery isn't in the technique, it's in each of us.

Harry Callahan
More Joy of Photography

Trust that little voice in your head that says 'Wouldn't it be interesting if...." And then do it.

Duane Michals
More Joy of Photography

The virtue of the camera is not the power it has to transform the photographer into an artist, but the impulse it gives him to keep on looking—and looking.

Brooks Atkinson
Once Around the Sun

Contents

Cover 1
Copyright 2
Preface 3
How to Use this eText™ 4
Ahoy, Matey! Beware of Pirates 5
About the Photos 6
Taking Your First Pictures—It's All About Workflow 7
Taking Your First Pictures—It's All About Workflow, con't. 8
Taking Your First Pictures—It's All About Workflow, con't. 9
Contents 10
Contents, con't. 11
Contents, con't. 12
Contents, con't. 13

Chapter 1 Digital Images & Digital Cameras 14

1.1 History–Prephotography 15
1.2 History–The Camera Obscura 16
1.3 History–The Very Beginning of Photography 17
1.4 History–It Wasn't Easy at First 18
1.5 History–Some Things Never Change 19
1.6 History–But Some Things do Change 20
1.7 Going Digital—The Dawn of Digital Photography 21
1.8 Going Digital—The First Images 22
1.9 Going Digital—The First Digital Cameras 23
1.10 Types of Digital Cameras–Point and Shoot Cameras 24
1.11 Types of Digital Cameras–Camera Phones 25
1.12 Types of Digital Cameras–Disposable Point and Shoot Cameras 26
1.13 Types of Digital Cameras–High-end Fixed Lens Cameras 27
1.14 Types of Digital Cameras—The Rangefinder 28
1.15 Types of Digital Cameras–The Single-Lens Reflex (SLR) 29
1.16 Types of Digital Cameras–SLR Cutaway View 30
1.17 Types of Digital Cameras–Professional/Studio Cameras 31
1.18 Composing Images–Introduction 32
1.19 Composing Images–Orientation 33
1.20 Composing Images–Optical Viewfinders 34
1.21 Composing Images–LCD Monitors 35
1.22 Composing Images–LCD Monitors, con't. 36
1.23 Composing Images–Electronic Viewfinders 37
1.24 Composing Images–Single-Lens Reflexes (SLRs) 38
1.25 Taking Pictures–The Shutter Button 39
1.26 Taking Pictures–Continuous Mode 40
1.27 Taking Pictures–Audio and Video Clips 41
1.28 What is a Digital Photo–Pixels 42
1.29 The Image Sensor—Replacing Film 43
1.30 The Image Sensor—Sizes 44
1.31 The Image Sensor—Types 45
1.32 The Image Sensor—Types, con't. 46
1.33 Digital Color—RGB 47
1.34 Digital Color—RGB 48
1.35 Digital Color—CMYK 49
1.36 Image Sizes 50
1.37 Image Sizes–Calculating 51
1.38 Image Sizes–Pixelization 52
1.39 Image Sizes—Cropping 53
1.40 Image Sizes—Sharpness & Detail 54
1.41 Image Sizes–The Other "Resolution" 55
1.42 Image Sizes—Standard Screen Sizes 56
1.43 Image Sizes—Calculating Screen Display 57
1.44 Image Sizes—Prints 58
1.45 Image Quality–Compression 59
1.46 File Formats 60
1.47 Image Quality–A Dirty Little Secret 61

Chapter 2 The Digital Darkroom..... 62

2.1 Storing Images in the Camera 63
2.2 Storing Images in the Camera, Con't. 64
2.3 Transferring Photos–Card Readers and Slots 65
2.4 Transferring Photos–Cable Connections 66
2.5 Transferring Photos–Cable Connections 67
2.6 Transferring Photos–Wireless Connections 68
2.7 How Photos are Stored in Your Camera and Computer 69
2.8 How Photos are Stored in Your Camera and Computer 70
2.9 Transferring Images to the Computer–Procedures 71
2.10 Organizing Your Photo Files 72
2.11 Storing Images—Hard Drives & Flash Drives 73
2.12 Storing Images—On the Road 74
2.13 Storing Images—CD Drives and Discs 75
2.14 Storing Images—DVD Drives and Discs 76
2.15 CD/DVD Burning Software 77
2.16 Labeling CD/DVD Discs 78
2.17 Image Management—Thumbnail Viewers 79
2.18 Image Management—Asset Managers 80
2.19 Image Management—Asset Managers, con't. 81
2.20 Photo-editing Tools—The Big Two 82
2.21 Photo-editing Tools—Editing to Improve 83
2.22 Photo-editing Tools—Editing to Change 84
2.23 Photo-editing Tools—Resizing, Cropping and Rotating 85
2.24 Photo-editing Tools—Adjusting the Tonal Range 86
2.25 Photo-editing Tools—Removing Color Casts 87
2.26 Photo-editing Tools—Removing Color Casts, A Word About Neutral 88
2.27 Photo-editing Tools—Sharpening 89
2.28 Photo-editing Tools—Brightness and Contrast 90
2.29 Photo-editing Tools—Hue and Saturation 91
2.30 Photo-editing Tools—Transforming 92
2.31 Photo-editing Tools—Touching Up 93



Contents, con't.

2.32 Photo-editing Tools—Selecting 94
2.33 Photo-editing Tools—Adding Text 95
2.34 Photo-editing Tools—Layers 96
2.35 Photo-editing Tools—Filters 97
2.36 Photo-editing Tools—Actions 98

Chapter 3 Controlling Exposure 99

3.1 Understanding Exposure 100
3.2 Understanding Exposure, con't. 101
3.3 Understanding Exposure–The Controls 102
3.4 Understanding Exposure–Why Choices? 103
3.5 Understanding Exposure–The Range of Choices 104
3.6 Understanding Exposure–Analogy #1 105
3.7 Understanding Exposure–Analogy #2 106
3.8 Exposure Modes—Selecting 107
3.9 Exposure Modes—Auto & Programmed 108
3.10 Exposure Modes—Scene Modes 109
3.11 Shutter-Priority–Introduction 110
3.12 Shutter-Priority–Types of Shutters 111
3.13 Shutter Priority—Freezing and Blurring Motion 112
3.14 Aperture-Priority—Introduction 113
3.15 Aperture-Priority—Depth of Field 114
3.16 Manual Mode 115
3.17 Manual Mode–Bulb 116
3.18 How Your Exposure System Works—Middle Gray 117
3.19 When Automatic Exposure Works Well 118
3.20 Why Autoexposure Doesn't Always Work 119
3.21 When to Increase Exposure—Light Scenes 120
3.22 When to Increase Exposure—Light Backgrounds 121
3.23 When to Increase Exposure—Foggy and Misty Scenes 122
3.24 When to Decrease Exposure—Dark Scenes 123
3.25 When to Decrease Exposure—Dark Backgrounds 124
3.26 Metering a Scene 125
3.27 Metering a Scene, con't. 126
3.28 Adjusting Exposure—Exposure Compensation 127
3.29 Adjusting Exposure—Exposure Lock 128
3.30 Adjusting Exposure—Exposure Lock, con't. 129
3.31 Adjusting Exposure—Auto Exposure Bracketing (AEB) 130
3.32 Expanding Your Exposure Range 131
3.33 Evaluating Your Exposures—Histograms 132
3.34 Evaluating Your Exposures—Histograms When Shooting 133
3.35 Histograms—Normal and Good 134
3.36 Histograms—Middle Gray 135
3.37 Histograms—High Key 136
3.38 Histograms—Night Scene 137
3.39 Histograms—Low Key 138
3.40 Histograms & Exposure 139

Chapter 4 Controlling Sharpness 140

4.1 Eliminating Camera Movement 141
4.2 Eliminating Camera Movement—Holding the Camera 142
4.3 Eliminating Camera Movement—Tripods and Monopods 143
4.4 Eliminating Camera Movement—Tripod Heads 144
4.5 Eliminating Camera Movement—Tripod Quick Release Systems 145
4.6 Eliminating Camera Movement—Shutter Release 146
4.7 Eliminating Camera Movement—Shutter Release, con't 147
4.8 Eliminating Camera Movement—The ISO Setting 148
4.9 Eliminating Camera Movement—ISO and Noise 149
4.10 How to Photograph Motion Sharply 150
4.11 Shutter Speed and Sharpness 151
4.12 Focus 152
4.13 Types of Focus 153
4.14 Autofocus Facts 154
4.15 Autofocus—Types Of 155
4.16 Autofocus—Focus Points 156
4.17 Focus—Focus Lock 157
4.18 Manual Focus—Ways it's Done 158
4.19 Depth of Field 159
4.20 Depth of Field—The Reasons Why 160
4.21 Controlling Depth of Field—The Influences 161
4.22 Controlling Depth of Field—Checking 162
4.23 Controlling Depth of Field—Shallow 163
4.24 Controlling Depth of Field—Shallow, con't. 164
4.25 Controlling Depth of Field—Shallow, con't. 165
4.26 Controlling Depth of Field—Deep 166
4.27 Controlling Depth of Field—Hyperfocal Distance 167
4.28 Sharpness Isn't Everything—Using the Shutter Speed 168
4.29 Sharpness Isn't Everything—Using the Aperture 169
4.30 Panning the Camera 170

Chapter 5 Capturing Light & Color 171

5.1 The Color of Subjects 172
5.2 The Color of Sources 173
5.3 White Balance 174
5.4 White Balance, con't. 175
5.5 White Balance, con't. 176
5.6 Color Management—Color Spaces 177
5.7 White Balance and Time of Day 178
5.8 Sunsets and Sunrises as the Subject 179
5.9 Sunsets and Sunrises—As the Subject 180
5.10 Sunsets and Sunrises—As the Light Source 181
5.11 Moonsets and Moonrises 182
5.12 Weather—Snow 183
5.13 Weather—Haze, Mist and Clouds 184



Click to visit the companion Web site

Contents, con't.

5.14 Weather—Rainbows 185
5.15 Weather—Rainbows 186
5.16 White Balance and Mixed Lighting 187
5.17 Photographing at Night 188
5.18 The Direction of Light—Backlighting 189
5.19 The Direction of Light—Backlighting, con't. 190
5.20 The Direction of Light—Backlighting, con't 191
5.21 Photographing Light Sources 192
5.22 The Quality of Light—Diffuse 193
5.23 The Quality of Light—Direct 194

Chapter 6 Using Lenses 195

6.1 Lenses—Pinholes 196
6.2 Lenses—Reading Lens Information 197
6.3 Lenses—Fixed or Interchangeable 198
6.4 Focal Length—Definition 199
6.5 Focal Length—And Aperture 200
6.6 Focal Length—Angle of View & Magnification 201
6.7 Focal Length—Image Stabilization 202
6.8 Focal Length–Effect of Sensor Sizes 203
6.9 Focal Length–Effect of Sensor Sizes, con't. 204
6.10 Lenses—OEM or 3rd Party 205
6.11 Zoom Lenses—Introduction 206
6.12 Zooming—Fixed Lens Cameras 207
6.13 Zooming—SLRs 208
6.14 Zoom Lenses—Optical and Digital 209
6.15 Normal Lenses 210
6.16 Wide Angle Lenses 211
6.17 Wide Angle Lenses, con't. 212
6.18 Wide Angle Lenses, con't. 213
6.19 Distortion with Wide-Angle Lenses 214
6.20 Distortion with Wide-Angle Lenses, con't. 215
6.21 Long or Telephoto Lenses 216
6.22 Long or Telephoto Lenses, con't. 217
6.23 Perspective 218
6.24 Macro Lenses and Macro Mode 219
6.25 Macro Lenses and Macro Mode, con't. 220
6.26 Macro Lenses and Macro Mode, con't. 221
6.27 Macro Lenses and Macro Mode, con't. 222
6.28 Tilt-Shift Lenses 223
6.29 Lens Accessories 224
6.30 Lens Accessories, con't. 225

Chapter 7 On-camera Flash Photography 226

7.1 Flash—The Beginnings 227
7.2 Built-in Flash 228
7.3 External Flash 229
7.4 External Flash, con't. 230
7.5 Ring and Twin Flash 231
7.6 Flash Accessories 232
7.7 Autoflash 233
7.8 Flash and Shutter Speeds 234
7.9 Flash and Distance 235
7.10 Red-eye Reduction 236
7.11 Fill Flash 237
7.12 Fill Flash, con't. 238
7.13 Flash Off 239
7.14 Slow Sync Flash—Automatic Modes 240
7.15 Slow Sync Flash—Manual Control 241
7.16 First and Second Curtain Sync 242
7.17 Controlling Flash Exposures—FE Lock 243
7.18 Controlling Flash Exposures—Flash Exposure Compensation 244
7.19 Controlling Flash Exposures—Flash Exposure Compensation 245
7.20 High-speed Sync 246
7.21 Stroboscopic Flash 247
7.22 Flash Guide Numbers 248

Chapter 8 Studio Photography 249

8.1 Professional Studios 250
8.2 Tabletop Studios 251
8.3 Using Studio Strobes 252
8.4 Using Continuous Lights 253
8.5 Using Multiple Flash Units 254
8.6 Understanding Hard and Soft Light 255
8.7 Creating Hard Light 256
8.8 Creating Soft Light—Reflecting and Diffusing 257
8.9 Creating Soft Light—Reflecting and Diffusing, con't. 258
8.10 Creating Soft Light—Reflecting and Diffusing, con't. 259
8.11 Creating Soft Light—Light Tents 260
8.12 Choosing a Background 261
8.13 Choosing a Background—Dropping it Out 262
8.14 Choosing a Background—Light Panels 263
8.15 Positioning the Camera 264
8.16 Positioning Lights—Introduction 265
8.17 The Main Light 266
8.18 The Fill Light 267
8.19 The Background Light 268
8.20 The Rim Light 269
8.21 Putting it All Together—Exposure and White Balance 270



Click to visit the companion Web site

Contents, con't.

Chapter 9 Displaying Photos 271

9.1 Displaying & Sharing Digital Photos—Introduction 272
9.2 Displaying & Sharing Digital Photos—Introduction, con't. 273
9.3 E-mailing Digital Photos 274
9.4 E-mailing Digital Photos, con't. 275
9.5 Instant Messaging 276
9.6 Slide Shows—Direct from the Camera 277
9.7 Slide Shows—Editing & Polishing 278
9.8 Slide Shows—Presenting & Sharing 279
9.9 Home Entertainment Networks 280
9.10 Digital Frames 281
9.11 eBooks—PDF Files 282
9.12 Creating a Photo Web Site 283
9.13 Photo Blogs 284
9.14 Peer-to-Peer Photo Sharing 285

Chapter 10 Printing Photographs 286

10.1 Printing—Introduction 287
10.2 Printing Colors—CMYK 288
10.3 Printers—How an Inkjet Printer Works 289
10.4 Printers—How a Dye Sub Printer Works 290
10.5 Printers—Drivers 291
10.6 Prints—On-line 292
10.7 Prints—Locally 293
10.8 Prints—Printing Paper 294
10.9 Prints—Inks 295
10.10 Prints—Matting and Mounting for Protection 296
10.11 Prints—Matting and Mounting for Protection, con't. 297
10.12 Prints—Framing for Presentation 298
10.13 Prints—Hanging for Display 299
10.14 Prints—Storing Archivally 300
10.15 Photo Albums—Sheet Protectors 301
10.16 Photo Albums—Album Kits 302
10.17 Photo Albums—Outside Printers 303
10.18 Photo Albums—Desktop Publishing 304
10.19 Printing Photos 305
10.20 Printing Photos—Exploring Print Sizes 306
10.21 Understanding Pixels per Inch 307
10.22 Exploring Pixels Per Inch 308





Photo COURSE

Digital Images & Digital Cameras

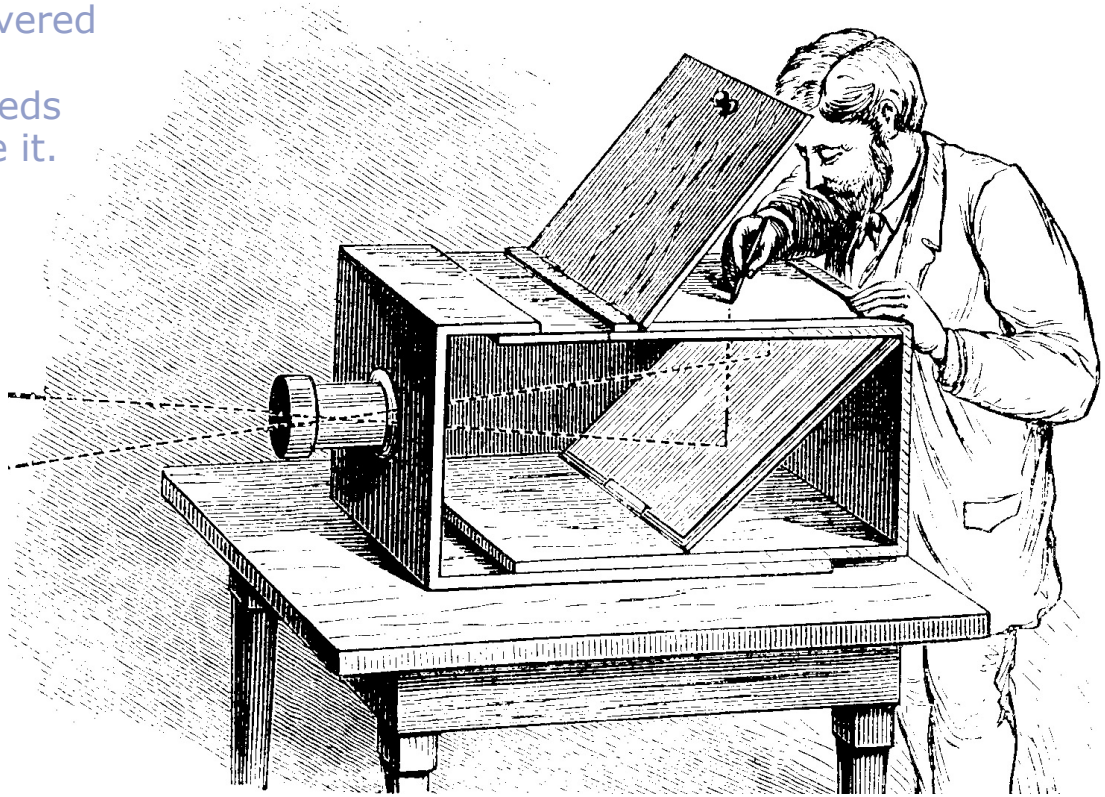
Chapter 1

1.1 History–Prephotography

Interestingly, cameras were discovered before photography. People were seeing the projected image hundreds of years before they could capture it.



▲ Abu Ali Hasan Ibn al-Haitham, also known as Alhazen, is shown here on a new Iraqi 10,000 Dinar note. Born in Basrah in 965 A.D., he wrote some 200 books including a seven volume series on optics—Kitab al-Manazir. In these books he gives the first correct explanation of vision, showing that light is reflected from an object into the eye. He is said to have 'invented' the camera obscura.



▲ Long before photography was discovered, artists used camera obscuras—"dark chambers" in Italian. Light entering the chamber through a small opening, called a pinhole, projected an image of the scene onto the opposite wall. At first special rooms were designed to display this "magical" phenomenon but in the sixteenth century, Italian artists shrunk the large chamber to a portable box, replaced the pinhole opening with a lens, added a mirror to invert the image and a translucent ground glass screen to display it. They traced the projected image by hand, and it was the desire of Henry Fox Talbot and others to capture the image directly that led to the invention of photography.



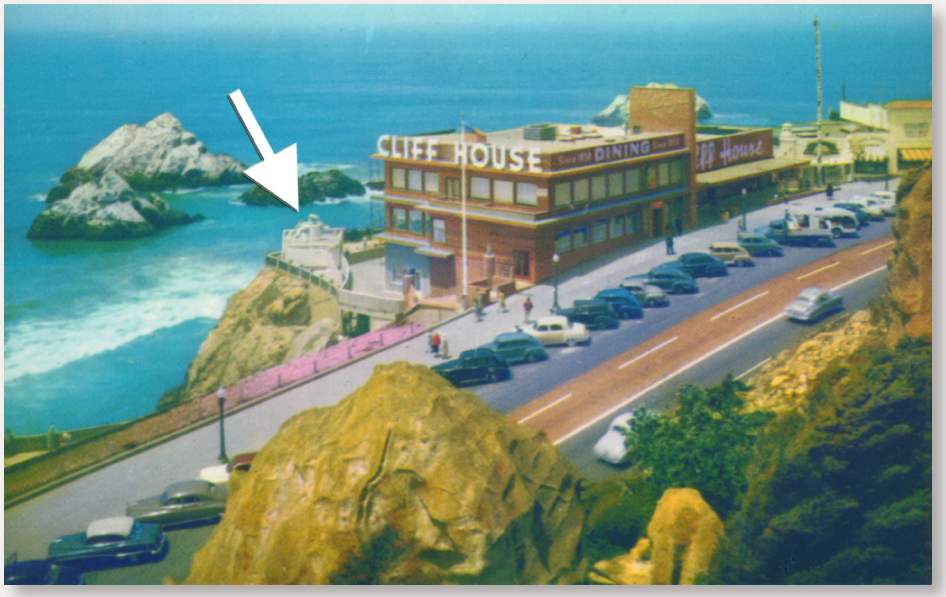
Click to visit the companion Web site

1.2 History–The Camera Obscura

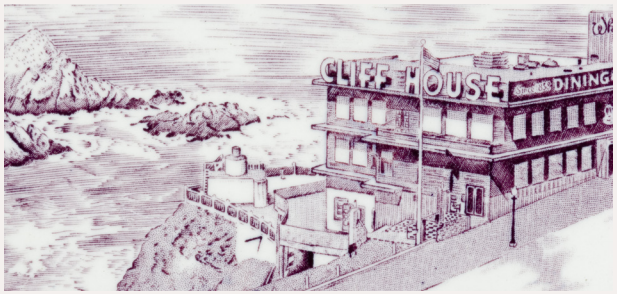
Although camera obscuras date back hundreds of years, there are still many in operation around the world.



▲ Three of us built a room-sized camera obscura during a local arts festival. It projected an upside image of the old town house decorated in bunting onto a large screen. Here we stand in front of the image with it projected onto our shirts.



▲ There is a room-sized camera obscura at the Cliff House in San Francisco. A lens on the roof projects the scene onto a round table in the middle of the room. Originally built in 1949, several sources claim that Ansel Adams spent so much time at the camera obscura that they stopped charging him admission. The story is probably apocryphal since Ansel would have been in his late 40s at the time it was built.



➤ The cliff house camera obscura is being restored by the National Park Service. Here it is on a souvenir plate.



Click to visit the companion Web site

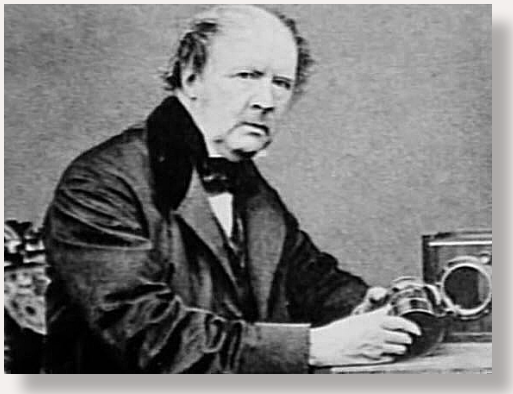
1.3 History–The Very Beginning of Photography

In the 1840s Fox Talbot and Daguerre developed different ways to capture camera obscura images using photo sensitive materials. It was much later, in the 1880s that Kodak brought photography to the masses with their easy-to-use box cameras and the slogan "you press the button, we do the rest."



▲ A Kodak ad with their famous slogan.

➤ Fox Talbot with one of his cameras.





▲ A daguerreotype of Abraham Lincoln.

1.4 History–It Wasn't Easy at First



▲ William Henry Jackson used a mule to carry his view camera and 20 x 24 inch glass plate negatives on explorations through the American West. The large negatives were needed to make large prints because images could not yet be enlarged. He also carried a dark tent in which he coated a plate with a photosensitive emulsion immediately before taking a picture, and in which he developed it immediately afterward.



▲ Not every photographer had a mule. Those who didn't were limited to the camera, glass plates, and darkroom equipment they could carry on their back.

1.5 History–Some Things Never Change

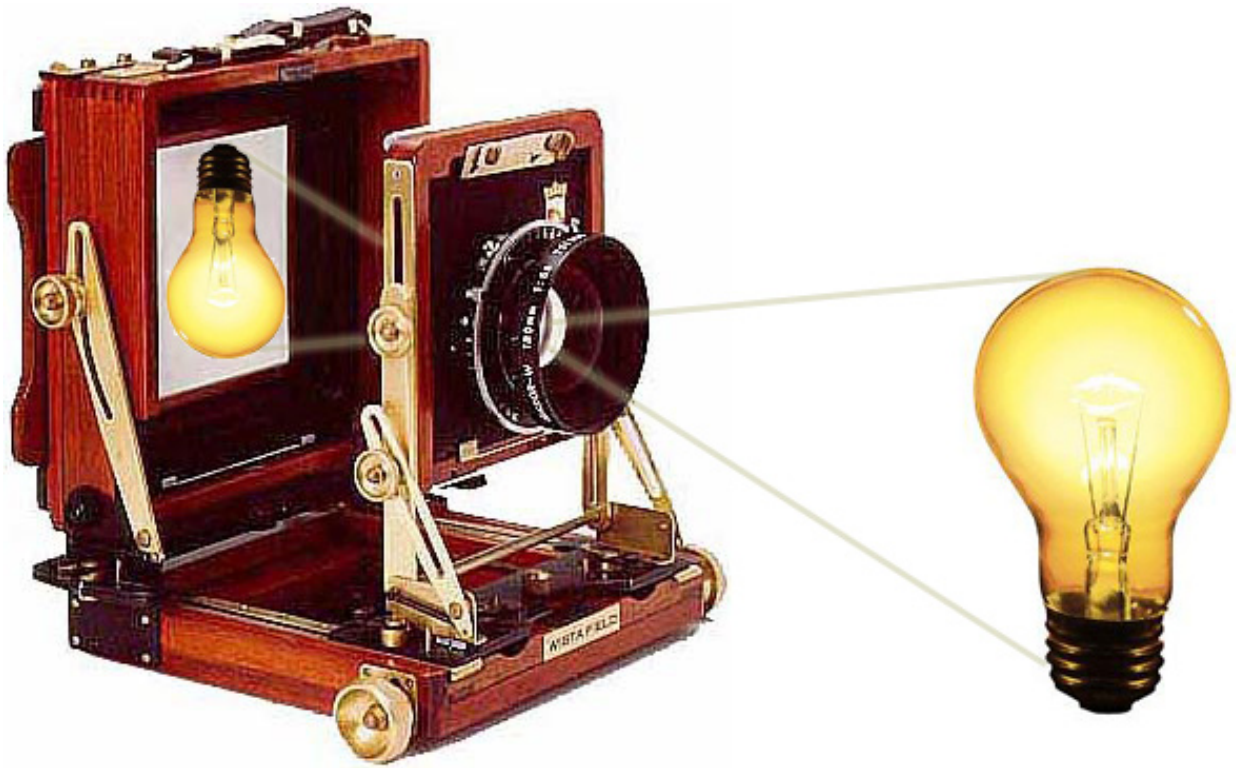
Animation

The dark box and the lens still remain in today's cameras hundreds of years after first being used by artists.



▲ Here is a modern Wista view camera widely used by professionals.

Courtesy of HP Marketing Corp at www.hpmarketingcorp.com.



▲ With the flexible bellows removed, you can see the ground glass focusing screen that is replaced by film or a digital back when a photo is taken. Every camera projects a scene onto a surface inside the camera using a lens or even a simple pinhole.

Click to visit the companion Web site

1.6 History–But Some Things do Change

The aspects of photography that have changed most are how an image is captured and how it's processed. Over the years images have been captured on daguerreotypes, ambrotypes, tintypes, glass plates, and flexible film among others. During that entire period, the images were processed with chemicals in a darkroom. Now images are captured on solid-state image sensors and processed with Photoshop with the lights on.



Film sales and processing are rapidly declining as digital photography becomes increasingly widespread.



The Kodak Brownie #1, introduced in 1888 came preloaded with film for 100 photos. When finished shooting, you returned it to Kodak for processing—the first one-time-use camera. Interestingly, the photos were round.

Click to visit the companion Web site

1.7 Going Digital—The Dawn of Digital Photography

Although digital photography has just begun to dominate photography, its roots go back decades.

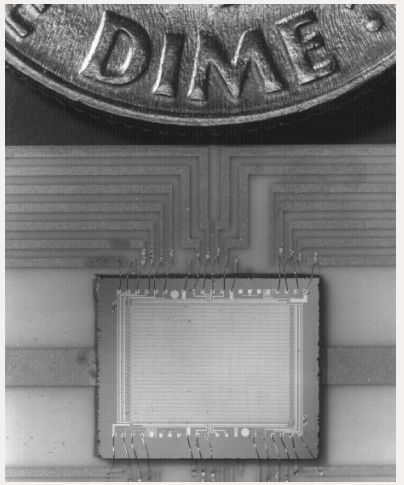


▲ The modern era started at Bell Labs in 1969 when Willard Boyle (left) and George Smith (right) invented the charge-coupled device (CCD). Their invention made possible digital photography, digital video, and scanning among other things.

Photo courtesy of Lucent Technologies Inc./Bell Labs at www.lucent.com.

1969

If you wonder how long ago 1969 was, it was the year Neil Armstrong was the first man to walk on moon and the Woodstock rock festival was held on a farm in upstate New York.



▲ One of the first uses of the new CCD image sensor was in a solid state video camera built by Bell Labs engineers.

Photo courtesy of Lucent Technologies Inc./Bell Labs at www.lucent.com.

Click to visit the companion Web site

1.8 Going Digital—The First Images

Digital photography quickly replaced film in astronomy and still serves that field well.

➤ Here is an amazing photo of gas pillars in the Eagle Nebula. The tallest pillar (left) is about 4 light-years long from base to tip. Forming inside are embryonic stars.



➤ The Cat's Eye Nebula was formed when a sun-like star gently ejected its outer gaseous layers to form bright nebulae with amazing twisted shapes.

Credits: ESA, NASA, HEIC and The Hubble Heritage Team (STScI/ AURA).

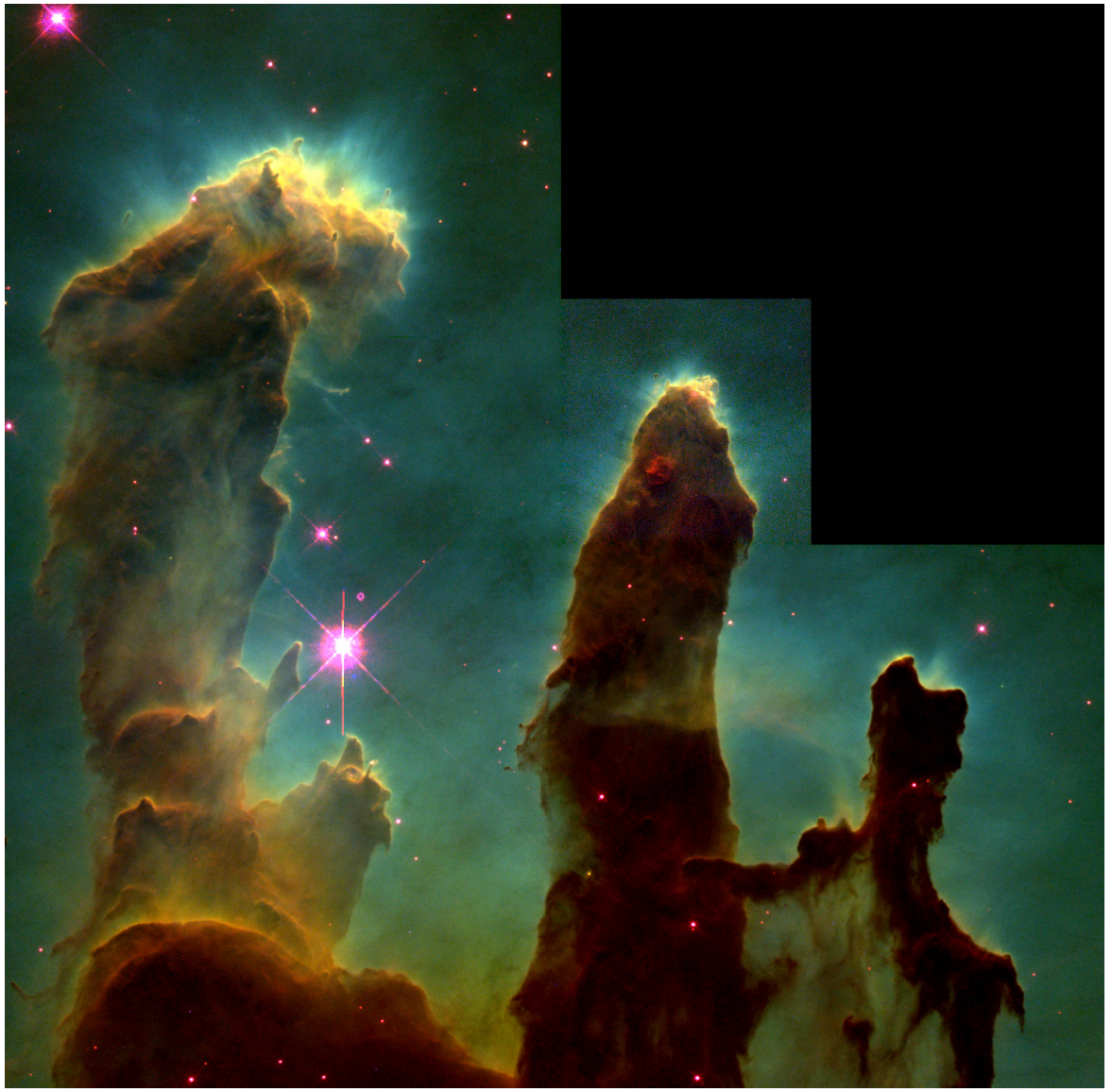


Photo courtesy of Jeff Hester and Paul Scowen (Arizona State University), and NASA (http://hubblesite.org).

Click to visit the companion Web site

1.9 Going Digital—The First Digital Cameras

PDF Resource

There were earlier digital cameras but 1995 was really a breakout year, especially for consumers.

▼ In March of 1995 Kodak introduced the DC40. It had a resolution of 756 x 504 and cost $995. The camera came with 4 Megabytes of flash memory, enough to hold 48 standard or 96 low-resolution images.



➤ The Canon EOS DCS 3 digital camera, introduced in July 1995, captured images with 1.3 million pixels. It cost about $17,000.





◄ 1995, Apple introduced the QuickTake 100 with a resolution of 640 x 480 and a price of $749.

Photo courtesy of Apple at www.mac.com.



▲ Here, the small image is typical of the image sizes captured by the first Kodak and Apple cameras using just over 300 thousand pixels. The larger image is from a new SLR that captures over 8 million pixels.

Click to visit the companion Web site

1.10 Types of Digital Cameras–Point and Shoot Cameras

PDF Resource

Point and shoot cameras usually have fewer controls than other digital cameras but many are also small, bordering on tiny. With a camera that fits into your pocket, you're more likely to have it when you need it.



➤ Many point and shoot cameras look much like their film counterparts.

Courtesy of Canon at www.powershot.com.



➤ Freed of the need to feed film through the camera, shapes are almost unlimited.

Courtesy of Olympus at www.olympus.com.



➤ Special edition cameras are used to entice the fashion conscious.

Courtesy of HP at www.hp.com.



➤ Pentax makes underwater cameras like the Optio WPi.

Photo courtesy of Pentax at www.pentax.com.



➤ There is even a camera you swallow so you can be photographed inside out.

Courtesy of Given Imaging at www.givenimaging .com.



➤ Digital cameras can be made so small they will fit into watches and even pens like the one shown here.

Click to visit the companion Web site

1.11 Types of Digital Cameras–Camera Phones

The fastest selling point and shoot digital cameras are those built into camera phones. Their biggest advantage it that your camera will be with you almost all the time.

➤ A cheap plastic lens and low resolution give a romantic painterly effect to some camera phone photos.

Courtesy of David Grady.



➤ Sony-Ericsson makes camera phones that look much like traditional point and shoot cameras.



➤ Samsung has a 7 megapixel camera phone. Soon, image quality will be as good as it is with dedicated point and shoot cameras.





➤ Leanne takes a camera phone photo in Rome.

Photo courtesy of Rick Ashley at www.rickashleyphotographer.com.



Click to visit the companion Web site

1.12 Types of Digital Cameras–Disposable Point and Shoot Cameras

Digital photography has already matured to the point where there are one-time-use point and shoot versions.



▲ One-time-use digital cameras take surprisingly good pictures as in this scene in Rome.

Courtesy of Emily Morin.





▲ Some one-time-use cameras have monitors on which you can review your results.

Courtesy of Pure Digital Technologies.



▲ Those who fault one-time-use cameras for poor quality probably aren't aware of the great work artists are creating with even more primitive vintage plastic cameras like the Diana as shown here.

Photo courtesy of Mel Curtis at www.melcurtis.com.

Click to visit the companion Web site

1.13 Types of Digital Cameras–High-end Fixed Lens Cameras

High-end fixed lens cameras usually have a zoom lens and many of the exposure and focus controls found on SLR cameras.



▲ The Canon S2 IS (IS stands for "Image Stabilization") has 8 megapixels and a 12x zoom lens.

Courtesy of Canon at www.powershot.com.



▲ The Sony DSC-H1 has 8 megapixels and a 12x zoom lens.

Courtesy of Sony at www.sony.com.



▲ The Sony DSC-R1 has 10.3 megapixels and a 5x zoom lens.

Courtesy of Sony at www.sony.com.



➤ The Coolpix 8800 has 8 megapixels and a 12x zoom lens.

Courtesy of Nikon at www.nikon.com.



Click to visit the companion Web site

1.14 Types of Digital Cameras—The Rangefinder

The first digital rangefinder camera is the Epson R-D1. It accepts all Leica lenses and even looks like a Leica. The term *rangefinder* comes from its focusing system. Two windows superimpose the image in the viewfinder so you can focus it very precisely.



▲ The R-D1 has 6.1 megapixels and accepts over 200 vintage and contemporary lenses.

Courtesy of Epson at www.epson.com.



▲ This is one of the Leica M series rangefinder 35mm cameras used by many journalists and fine art photographers. During its heyday in the 50s and 60s, photographers would become attached to their camera and use it for years, even decades.



▲ Minox makes a Leica M3 miniature camera with a 3.2 megapixel image sensor.

Courtesy of Minox at www.minox.com.



Click to visit the companion Web site

1.15 Types of Digital Cameras–The Single-Lens Reflex (SLR)

PDF Resource

One of the most popular camera types among professionals and serious amateurs is the single-lens reflex, better known as an SLR. These cameras are expensive but have certain advantages over other camera types:

- You can change lenses.
- You see through the lens so what you see is what you get.
- You can select from a large variety of accessories, including powerful flash units.



➤ *Digital SLR courtesy of Canon at www.canon.com.*



➤ *Lenses courtesy of Canon at www.canon.com.*



➤ *Digital SLR courtesy of Nikon at www.nikon.com.*

Click to visit the companion Web site

1.16 Types of Digital Cameras–SLR Cutaway View

The digital SLR, like other digital cameras, may look traditional but it's packed with electronics instead of mechanical moving parts.



▲ The front and back view of a modern digital SLR

Illustrations courtesy of Canon at www.canon.com.

Click to visit the companion Web site

1.17 Types of Digital Cameras—Professional/Studio Cameras

Professionals, just like the rest of us, use SLRs and even point-and shoot cameras. However, when they move into the studio or explore some speciality field, they often use other cameras. Many, such as the view camera and Hasselblad shown here, are converted to digital by the simple addition of a digital back that replaces the traditional film holder.



▲ Many digital backs for studio cameras are one-shot models that work just like your digital camera. When you press the shutter button the picture is taken immediately.

Courtesy of Hasselblad at www.hasselblad.se.



▲ Some digital camera backs work like scanners. When you press the shutter button, the digital back begins to scan the image. Some capture it in a single pass, others make three passes—one each for the red, blue, and green light reflecting from the subject. These cameras are slow so can't be used with moving subjects or with studio strobe lights.

Courtesy of Linhof at www.linhof.de/english/gallery/digital.html.



Click to visit the companion Web site

1.18 Composing Images–Introduction

Images can be composed in one of two ways—
using an optical viewfinder or viewing through the lens.



➤ Optical viewfinders found on most point and shoot cameras show the view through a separate window. These viewfinders often show as little as 90% of the image area. The missing area around the edges can be critical to your composition.



➤ Photographers love rangefinder cameras because their viewfinders show an area larger than the one that will be captured—the area indicated by the white lines. This lets you anticipate action because you can see things before they enter the frame.



➤ Many cameras offer both an optical viewfinder and an LCD monitor that shows the view through the lens.



➤ SLRs, LCD monitors, and electronic viewfinders show the view through the lens and usually show the entire image area. There are two ways this is done. The SLR uses a mirror and prism to project the image into the viewfinder. Other cameras take the signal right off the image sensor and display it on an LCD monitor or electronic viewfinder. If you connect your camera to a TV set or a TV tuner in your computer, the TV or computer screen actually becomes a very large monitor that shows the view through the lens.

Camera courtesy of Samsung at www.samsung.com.

Click to visit the companion Web site

1.19 Composing Images–Orientation

One of the creative choices you have to make is how to orient the camera—in portrait or landscape mode, or any angle in between.

Many cameras now have an orientation sensor that detects when you rotate the camera into portrait mode. During playback it then rotates any photos taken in that mode so they can be played back without rotating the camera. This is especially helpful if you connect the camera directly to a TV set for a slide show.



➤ Camera rotated during shooting.

➤ Camera held normally during playback.





➤ Sometimes tilting the camera lends a different feeling to a photo.



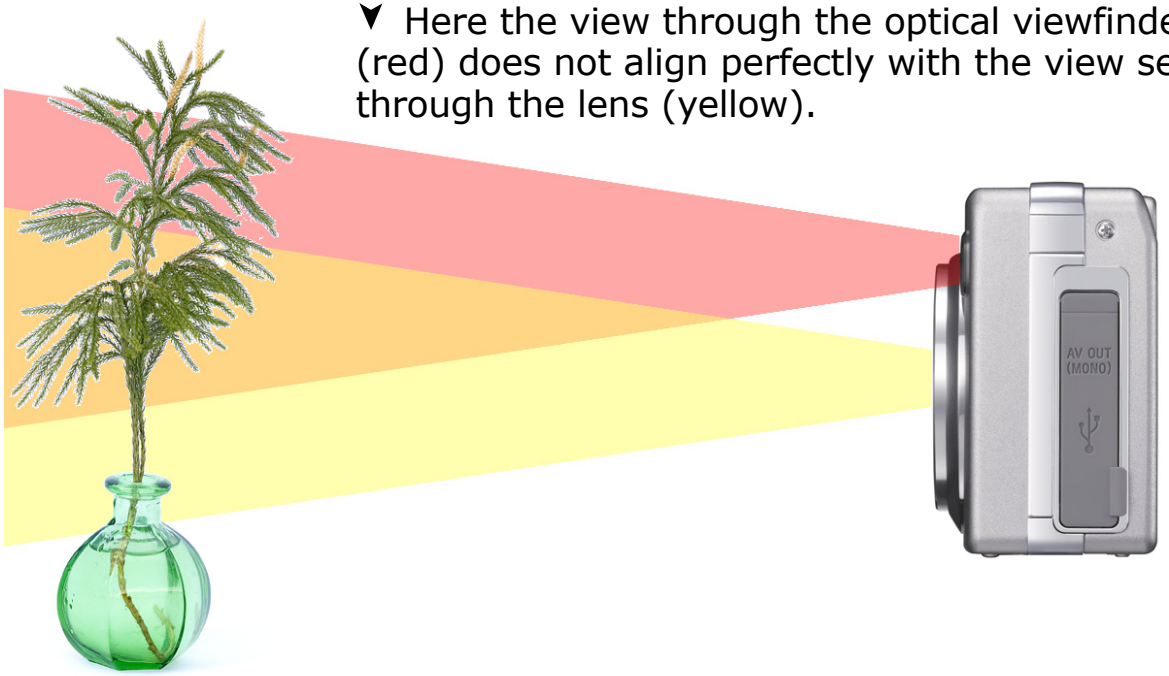
➤ Landscape mode (left) gives you an image that is wider than it is tall. Portrait mode (right) is the opposite.



1.20 Composing Images–Optical Viewfinders

Animation

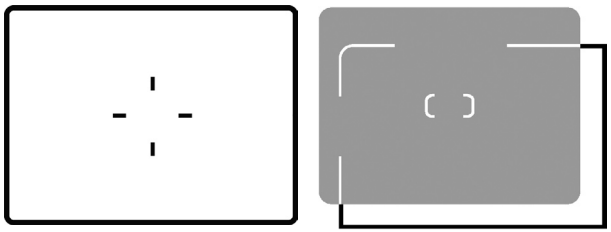
Because an optical viewfinder is offset somewhat from the lens, you don't see the same area that is captured. The difference is negligible when shooting landscapes or group shots but can become a problem when doing portraits or close-ups. To see this yourself, place your index finger in front of your nose and then alternately close each eye so one acts as the viewfinder and the other the lens.



▼ Here the view through the optical viewfinder (red) does not align perfectly with the view seen through the lens (yellow).



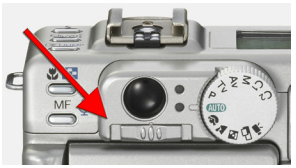
▲ When using any viewfinder, you should always be aware of the image area at the edges and not just the center of interest.



▲ Most optical viewfinders only indicate where the camera will focus (left). Some have parallax correction lines (right) that guide you when composing images close-up.



▲ Parallax is caused by the distance between the viewfinder windows and the lens.



▲ Many cameras have a diopter adjustment slider or dial that lets you adjust the viewfinder's sharpness.

Click to visit the companion Web site

1.21 Composing Images–LCD Monitors

Most cameras have both an optical viewfinder and LCD monitor. The monitor is used to display menus, compose pictures (except on SLR cameras), and play them back. A few cameras have no optical viewfinder so you have to use the monitor to compose your pictures—something that may be difficult in bright light.

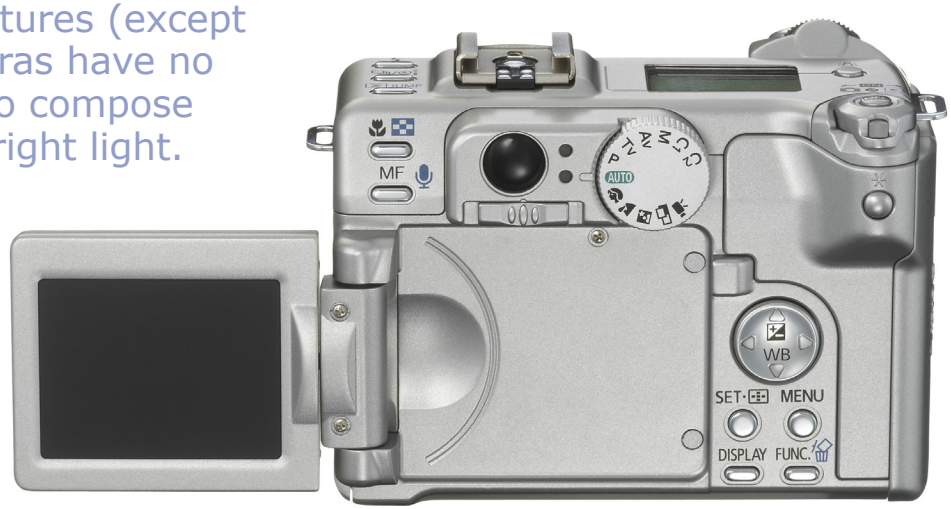


▲ Many cameras have connectors and cables for displaying your photos on a TV set or a computer with a TV tuner. You can also connect it when taking photos and it then displays what would otherwise be displayed on the much smaller camera monitor.

Photo courtesy of Rick Ashley at www.rickashleyphotographer.com.

▼ Most cameras let you adjust the brightness of the monitor. This is the standard icon for this feature.





▲ The best monitors swivel and tilt so you can shoot from ground level or over the heads of a crowd. Being able to change the monitor's angle also helps you find a position where glare doesn't make the screen unreadable.



◀ Display size matters when sharing photos, and the Kodak EasyShare One has a 3 inch monitor.

Photo courtesy of Kodak at www.kodak.com.

1.22 Composing Images–LCD Monitors, con't.



▲ Monitor sizes are measured diagonally and larger ones let you check your results more carefully and share them with others. Most range between about 1.5 and 2.5 inches but there are larger and smaller—currently topping out around 4 inches.



◄ Transparent monitor covers keep monitors from being scratched. They are cheap and easy to replace.



▲ Kodak's EasyShare One has a touch-sensitive monitor and stylus you use to change settings and add photos to albums and perform other functions.



▲ Monitors are easier to read when clean. Use only products designed to clean these fragile surfaces without scratching them.



▲ If glare is a problem for you, there are companies that make monitor hoods, shades or visors that shield the screen from direct light. Some even include a magnifier.

Courtesy of www.hoodman.com.

▼ Monitors usually have an on/off switch. This is the commonly used monitor on/off button icon.





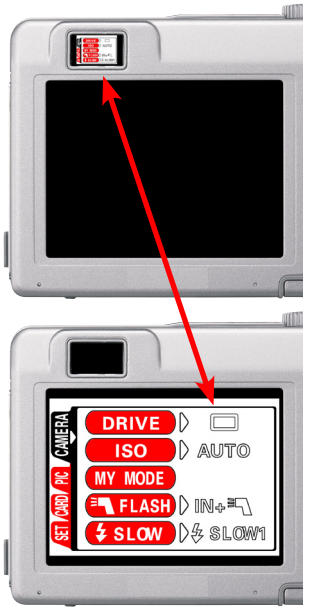
1.23 Composing Images–Electronic Viewfinders

Some cameras use an electronic viewfinder (EVF), basically a small *microdisplay* in the viewfinder. Although similar to the LCD monitor on the back of most cameras, these displays are smaller and viewed close to the eye instead of being viewed directly.

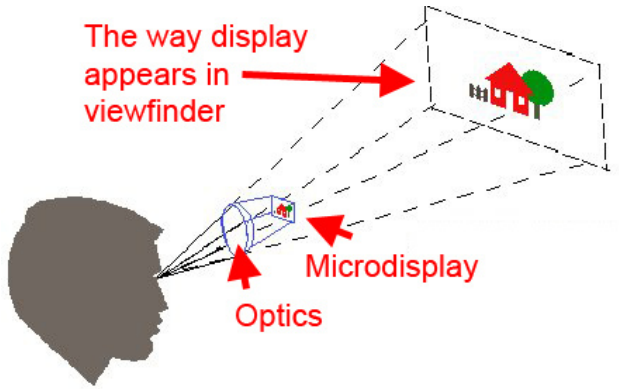


▲ The best thing about electronic viewfinders is that they can also display menus and let you review photos without being bothered by glare, and if the viewfinder also has a diopter adjustment you can read menus without putting on reading glasses as you may have to with a monitor. They also consume less battery power than the larger monitor.

The worst thing about them is that they often don't have enough pixels to give you a sharp, detailed view and their refresh or frame rate is so low they tend to lag behind the actual scene when you pan the camera to follow action.



◄ Cameras with an electronic viewfinder often let you switch between it and the monitor when composing images or using menu commands.



▲ An optical system makes the electronic viewfinder appear at a much greater viewing distance from the eye than it actual is.

Image courtesy of www.insightmedia.info/whatisamd.htm.



Click to visit the companion Web site

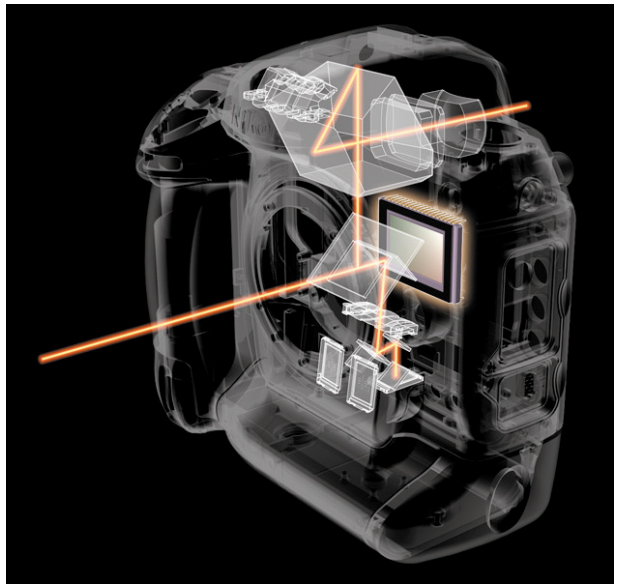
1.24 Composing Images–Single-Lens Reflexes (SLRs)

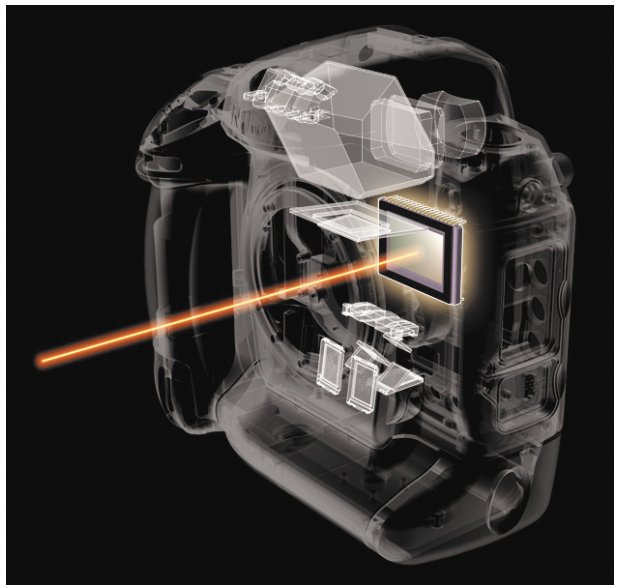
Animation

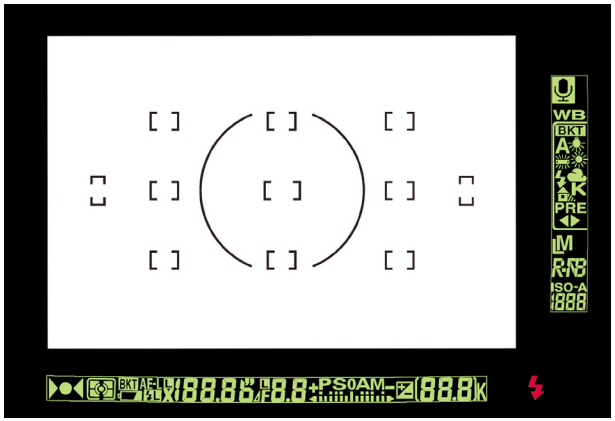
➤ You see through the lens of an SLR because light enters the camera through the lens, bounces off a mirror up into a prism which projects it out the viewfinder.

When you take a picture the mirror swings up out of the way so the light hits the image sensor.

Images courtesy of Nikon Imaging at www.nikon.com.





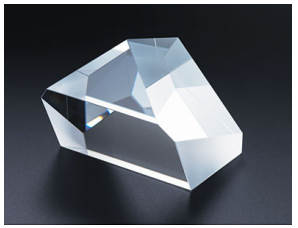


➤ SLR viewfinders display not only the image but a variety of information such as focus areas (the square brackets) shutter speeds and apertures. Here all of the information on a Nikon is shown although only a small portion is displayed at any time.



➤ Professional cameras often let you change the focusing screen in the viewfinder.

Courtesy of Olympus at www.olympus.com.



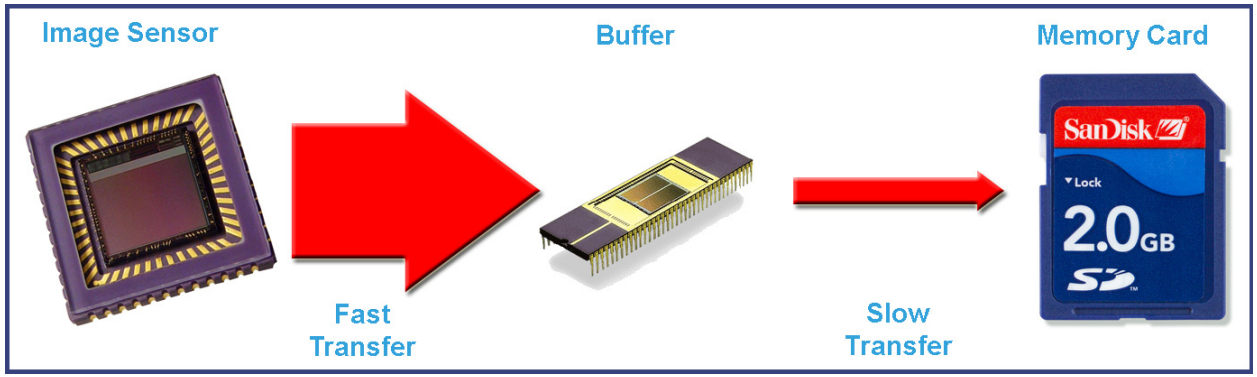
Prism photo courtesy of Konica/Minolta at konicaminolta.com.

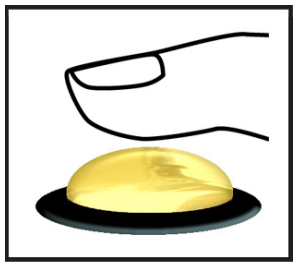


➤ SLRs have eyepiece covers that prevent light from entering the camera when you are not looking through the viewfinder. Light leaking in can affect the exposure.

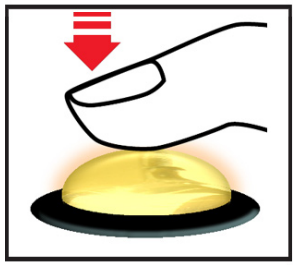
1.25 Taking Pictures–The Shutter Button

The primary cause of unsharp pictures is camera movement—usually caused by pressing the shutter button too hard. To avoid this blur, press the shutter button smoothly and gently, moving just your finger. The shutter button has two stages, except on fixed focus cameras.

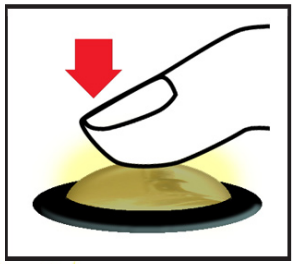




➤ When composing an image, you usually leave your finger resting on the shutter button so you are ready if action happens.



➤ When you press it halfway down, the camera sets focus and exposure. Usually indicators near or in the viewfinder tell you when these are locked.



➤ When you press it all the way down, you take the picture, and if the light is dim, the flash may fire.

➤ Many digital cameras make it difficult to capture "the decisive moment." There are two delays (called shutter lag) that cause this problem:

- *The first delay* occurs as the camera clears the image sensor, sets white balance to correct for color, sets the exposure, and focuses the image. Finally it fires the flash (if it's needed) and takes the picture.
- *The second delay* occurs as the image is processed and stored. This delay has been dramatically reduced by the addition of internal memory, called a "buffer." Images are temporarily stored in the buffer while awaiting processing because they can be stored there much more quickly then they can be stored on the memory card. You can continue shooting until the buffer fills and resume when some images have been transferred from it to the memory card.

1.26 Taking Pictures–Continuous Mode

Animations

To capture unfolding action, many cameras have a continuous or burst mode that captures pictures one after another as long as you hold down the shutter button. The number you can capture is usually limited by the size of the camera's buffer.



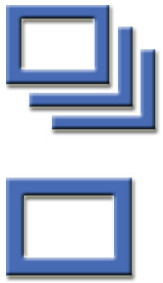


▲ Continuous mode can capture a series of images much like movie frames. You can select the best one for printing, use them all to created an animation, or use the series to analyze an action such as the swing of a golf club or baseball bat.



▲ The speed at which you can capture images in continuous mode is specified in frames per second (fps). This is usually between 3–5 fps.

➤ The icons normally used for continuous mode (top) and single image mode (bottom).



Click to visit the companion Web site

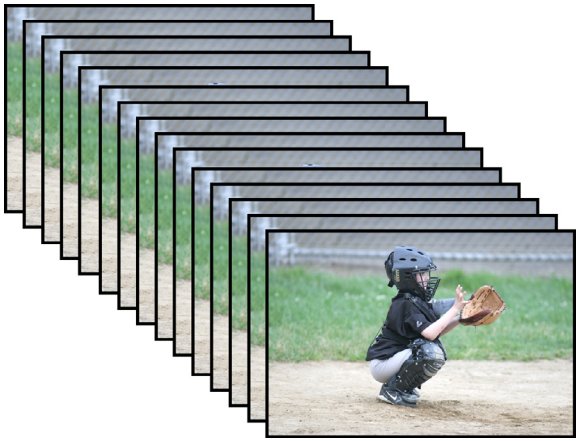
1.27 Taking Pictures–Audio and Video Clips

Animation

Digital cameras often have the ability to capture sounds and movies, some of them at surprisingly high quality. Although not yet a replacement for a camcorder, they will do in a pinch.



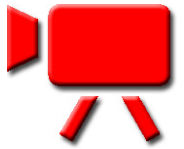
➧ Movies can always be played back on the camera or computer but need to be converted to play from a DVD disc.



➧ Professional quality video is 30 fps but many cameras capture fewer than that.



➧ Movie modes usually top out at a TV-quality 640 x 480 (VGA), 320 x 240 (QVGA), or even smaller.



➧ The almost universally recognized movie mode icon.



➧ Many digital cameras have a built in microphone that records sounds in movies or let's you attach sounds to images, perhaps to annotate them.



Click to visit the companion Web site

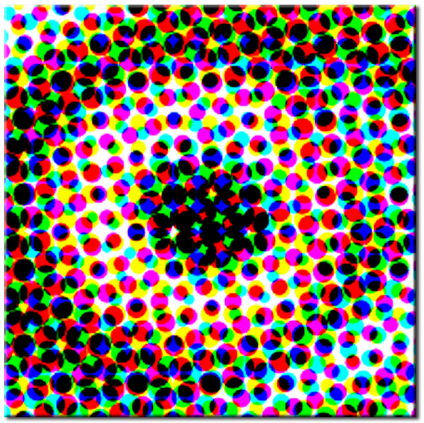
1.28 What is a Digital Photo–Pixels

Digital cameras create pictures from dot-like pixels. This isn't as unusual as it sounds. It's how newspaper and magazine photos have been printed for a very long time.

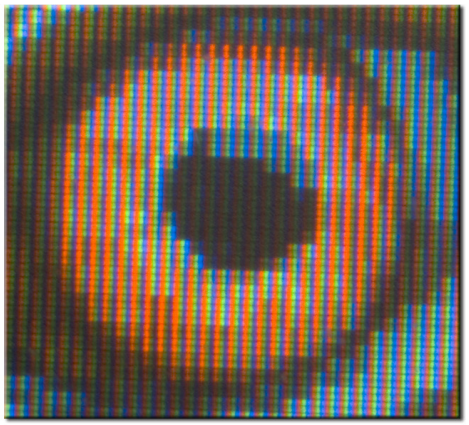


▲ This reproduction of the famous painting "The Spirit of '76" is done in jelly beans. Think of each jelly bean as a pixel and it's easy to see how dots or pixels can form images.

Jelly Bean Spirit of '76 courtesy of Herman Goelitz Candy Company, Inc. Makers of Jelly Belly jelly beans at http://jellybelly.com/.



Dots on the printed page



Dots on the monitor

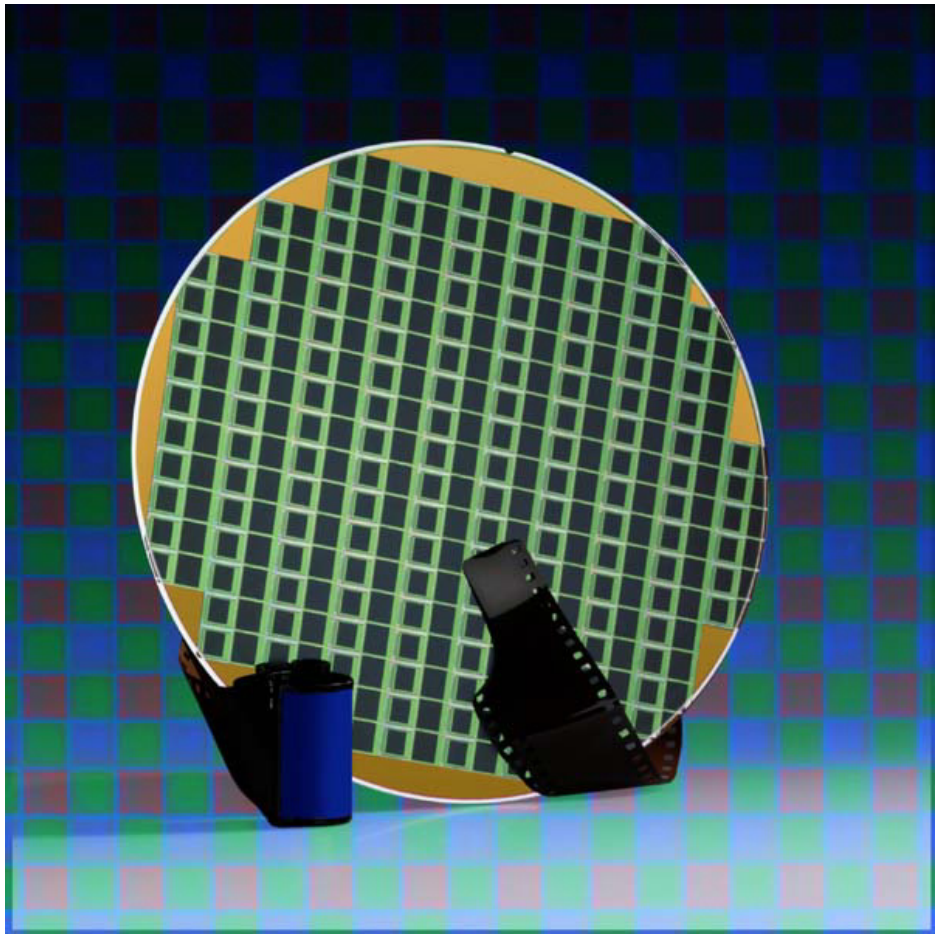


▲ Dot-like pixels on the monitor create photos using three smaller red, green, and blue dots called subpixels. Grab a magnifying glass and check out some color photos on screen and in print.

Click to visit the companion Web site

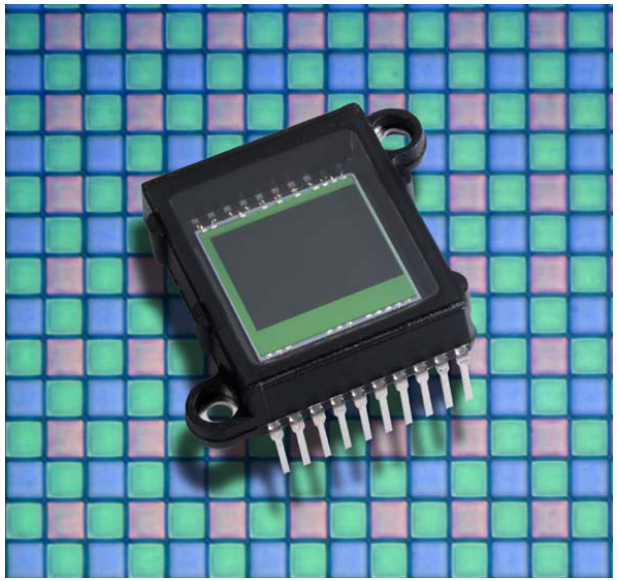
1.29 The Image Sensor—Replacing Film

The biggest difference between film and digital cameras is how they capture the image. Digital cameras use a solid-state image sensor that captures light and electronically amplifies it instead of film that is exposed and then chemically developed.



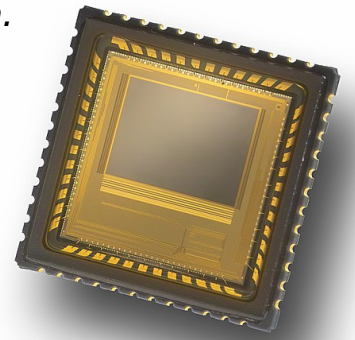
➤ Image sensors, like computer chips, are created on a large disk of silicon called a wafer (left). The individual sensors are then cut apart and mounted (right). The gold dots along the edges of the mounted sensor are used for electrical connections to other parts of the camera.

Courtesy of IBM at www.ibm.com and Foveon at www.foveone.com.



➤ Here an image sensor sits against a background enlargement of its square photosites, each capable of capturing one pixel in the final image.

Image courtesy of IBM at www.ibm.com.



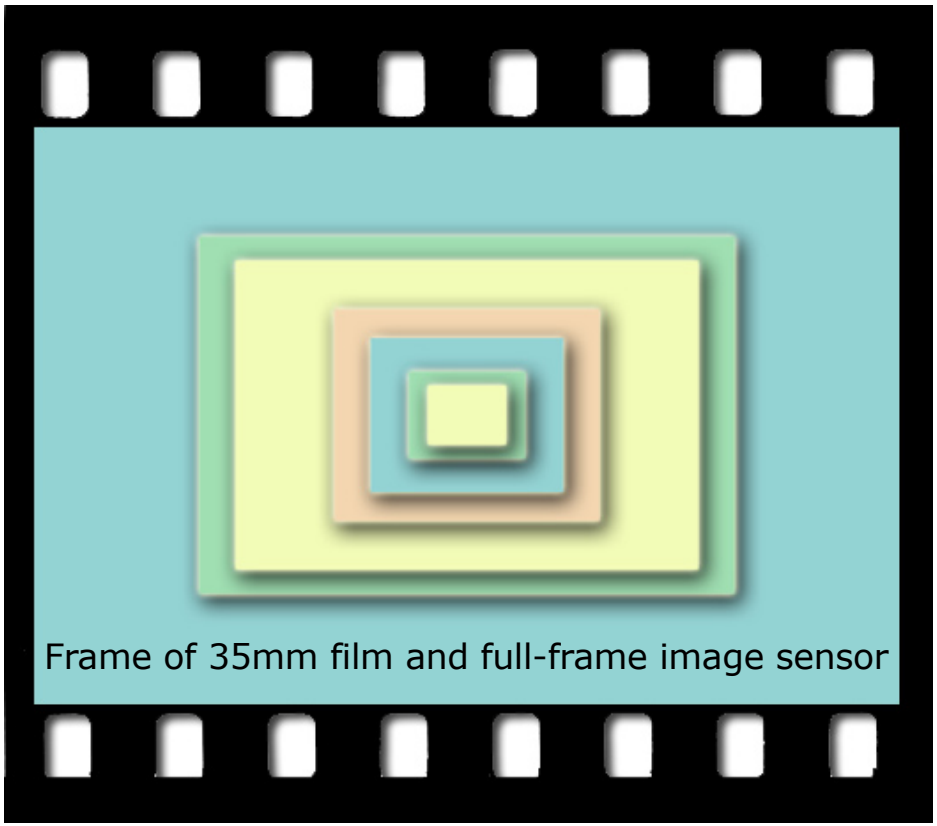
Click to visit the companion Web site

1.30 The Image Sensor—Sizes

Animation

Image sensors come in a variety of sizes with the smallest ones used in point and shoot cameras and the largest in professional SLRs. Consumer SLRs use sensors having the same size as a frame of APS film. Professional cameras use sensors the same size as a frame of 35mm film—called *full-frame sensors*.

Size	Width (mm)	Height (mm)
1/4	3.2	2.4
1/3	4.8	3.6
1/2	8	6.4
2/3	11	8.8
1	16	12.8
APS-C	22.2	14.8
Full Frame	36	24

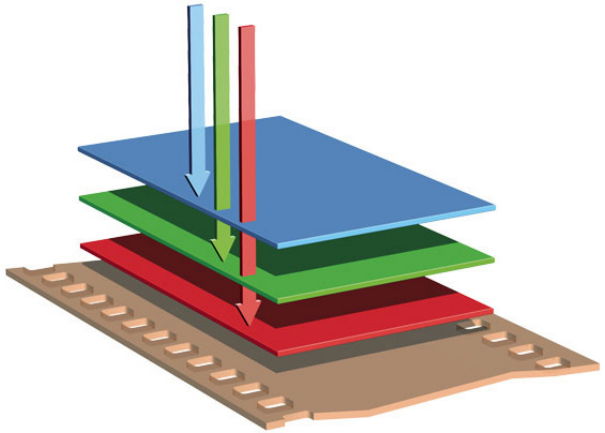


Frame of 35mm film and full-frame image sensor

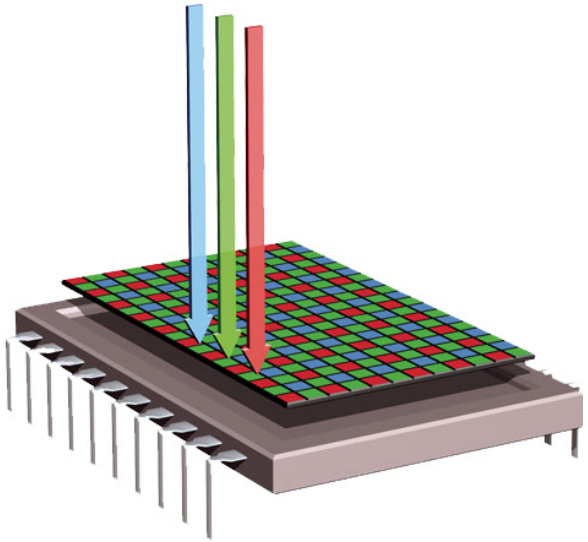
➤ Larger image sensors make it possible to have larger photosites that capture more light with less noise. The result is pictures that are clearer, brighter, and sharper. Because the size of photosites is so important a large 6 megapixel sensor will often take better pictures than a smaller 8 megapixel sensor. Not only is noise a problem but smaller sensors also require better, more expensive lenses, especially at wide-angle coverage.

1.31 The Image Sensor—Types

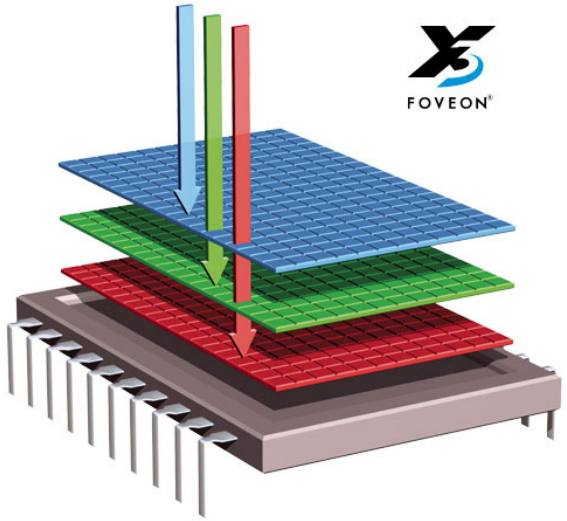
Here you can see the differences between film, regular image sensors, and Foveon sensors in the way they capture the three colors—red, green and blue:



▲ Color film uses three emulsion layers, each capturing a separate color.



▲ Image sensors use a matrix of filters to capture the colors so each pixel captures only one color.



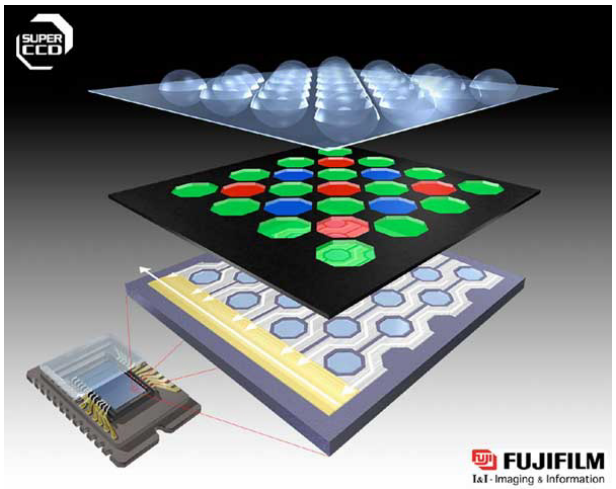
▲ Foveon image sensors use a separate layer of silicon to capture each color so every pixel records all three colors.

Foveon, the stylized "F" logo, X3, and the X3 logo are registered trademarks of Foveon, Inc. Copyright (c) 2002-2005 by Foveon, Inc. Illustrations used with permission.

1.32 The Image Sensor—Types, con't.

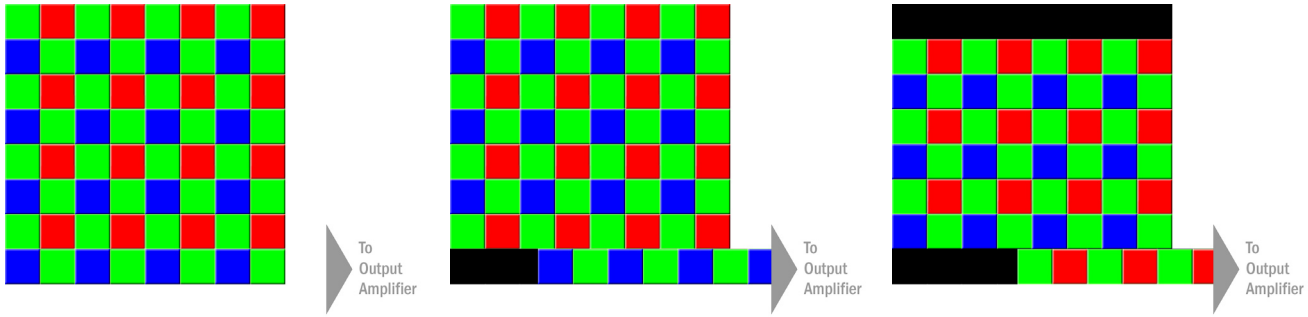
Animation

Here you can see the differences between film and image sensors in the way they capture the three colors—red, green and blue:

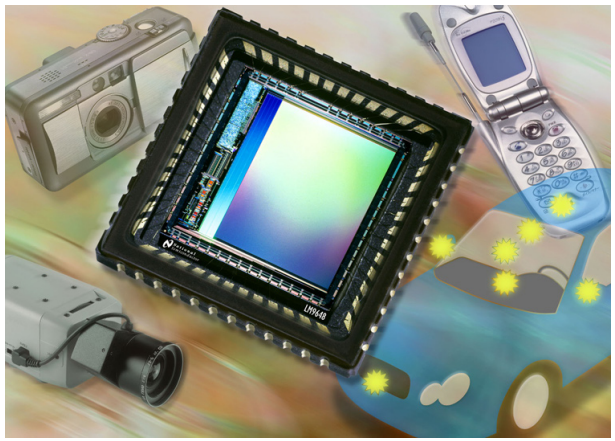


▲ Image sensors use lenses to concentrate the light (top), filters to capture one of the primary colors—red, green, or blue (middle), and photosites to record the image (bottom).

Courtesy of Fujifilm at www.fujifilm.com.



▲ The name "charge-coupled device" comes from the way a CCD feeds one row of pixels at a time to the output amplifier. Each row is coupled to the next so they are fed out a row at a time, much the way a church empties after a wedding or a bucket brigade passes along buckets of water at a fire.



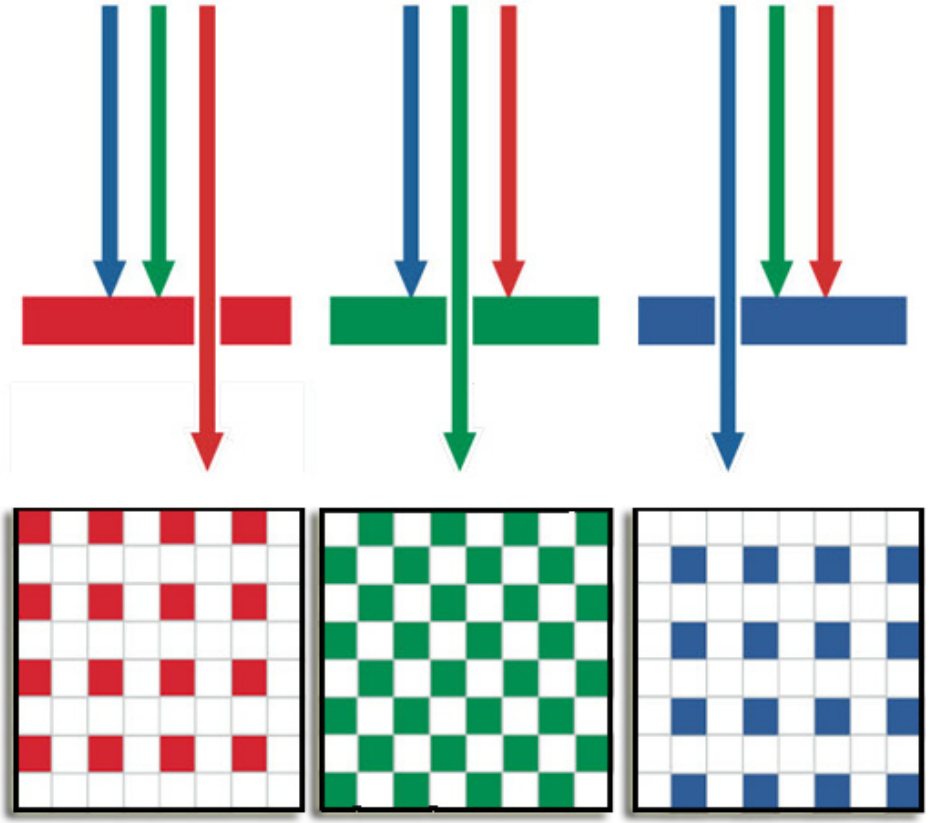
◀ CMOS sensors differ from CCDs. Each photosite can be read directly without having to read a row at a time.

Photo courtesy of National Semiconductor.



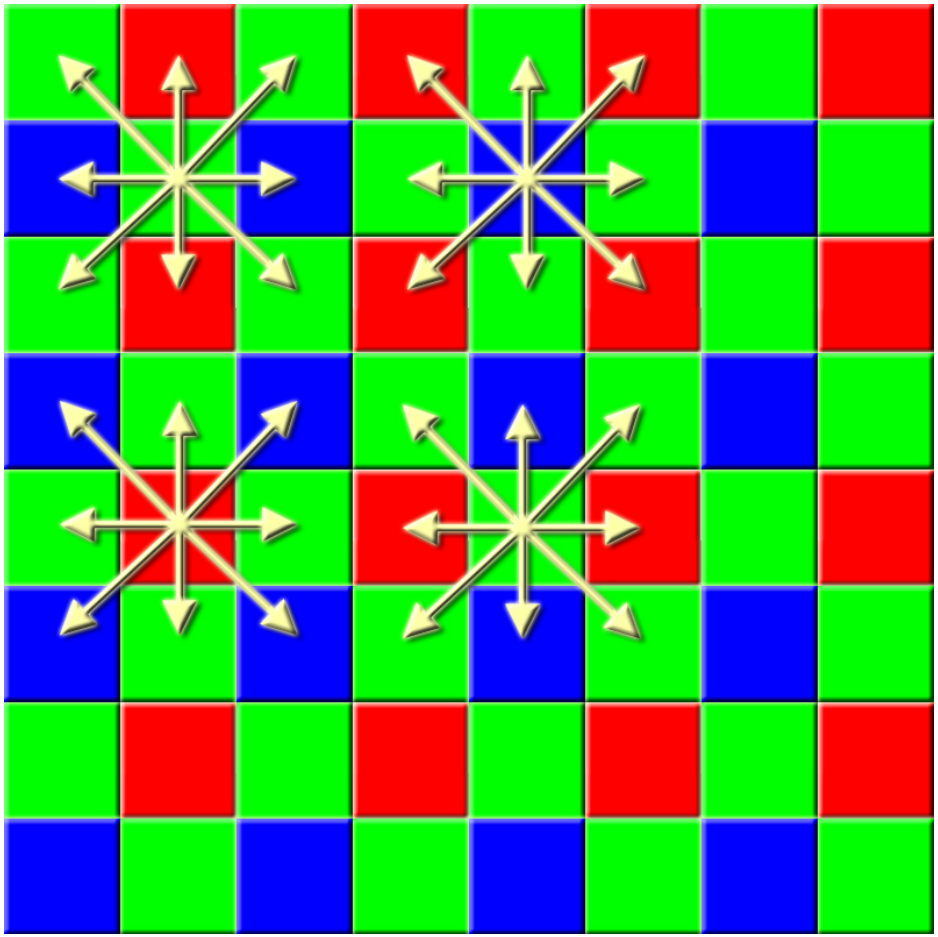
Click to visit the companion Web site

1.33 Digital Color—RGB



➧ Because each pixel on the sensor has a color filter that only lets in one color, a captured image records the brightness of the red, green, and blue pixels separately. (There are usually twice as many photosites with green filters because the human eye is more sensitive to that color.)

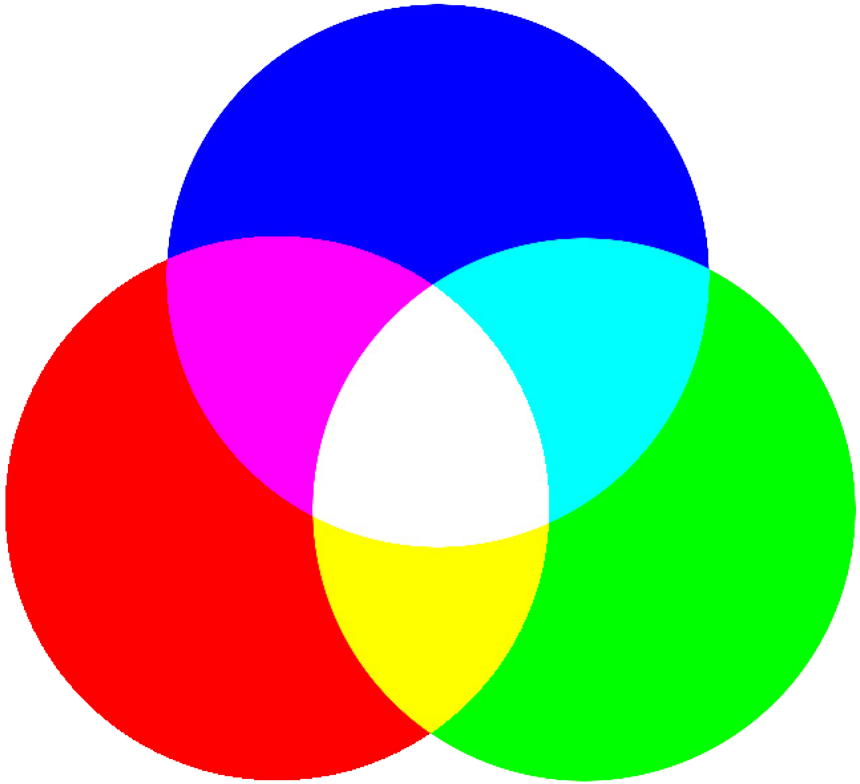
Illustration courtesy of Foveon at www.foveon.com.



➧ To create a full color image, the camera's image processor calculates, or interpolates, the actual color of each pixel by looking at the brightness of the colors recorded by it and others around it.

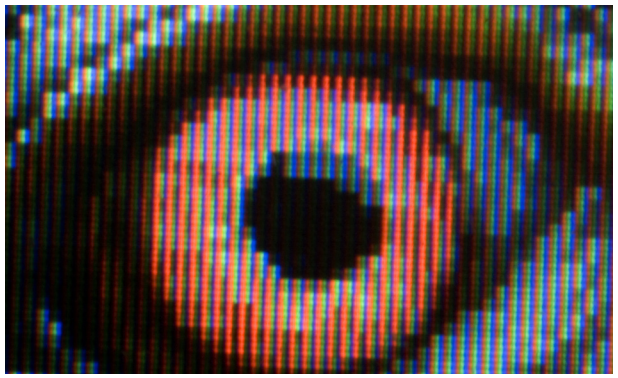
1.34 Digital Color—RGB

Animation



➤ Digital photographs are displayed on the screen using only three colors: red, green, and blue or RGB.

- Where all three colors overlap with equal brightness, they form neutral grays.
- Where all three overlap at full brightness, they form white.
- Where the colors overlap at different brightness, there are color tones.
- Where none of the colors are, it is black.



➤ The photo of the dots on the monitor that you saw earlier uses red, green and blue subpixels to form the picture.



➤ Red, Green, and blue LEDs in a camera phone flash create white light when the three colors are mixed.

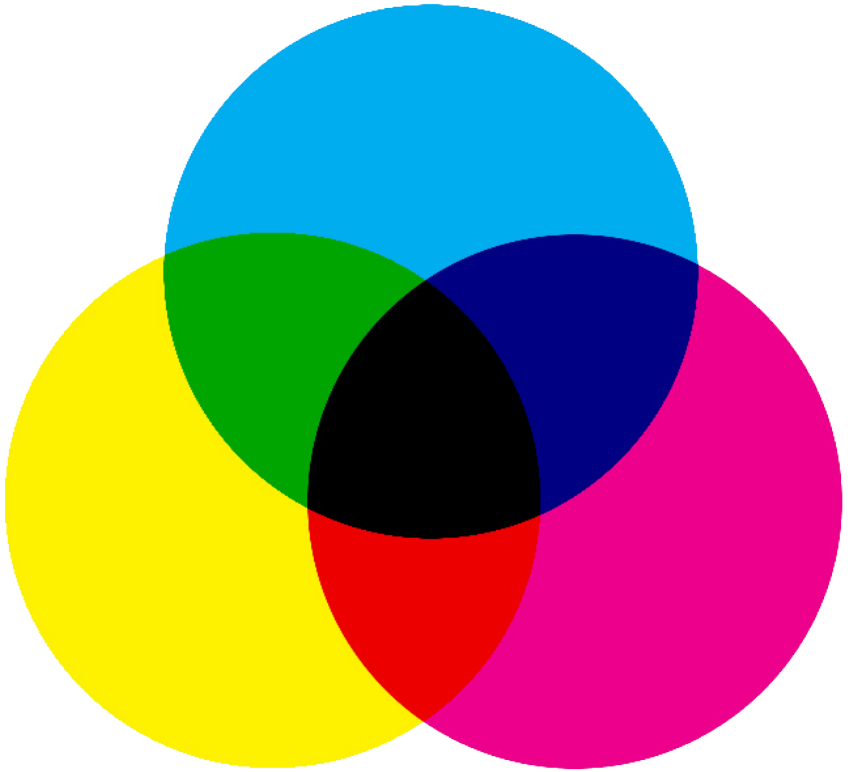
Photo courtesy of Siemans at w4.siemens.de.



Click to visit the companion Web site

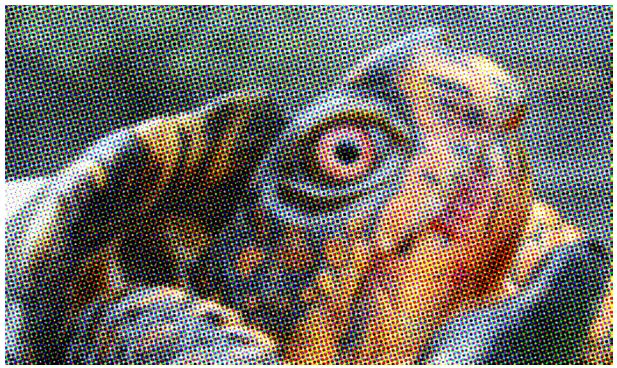
1.35 Digital Color—CMYK

Animation

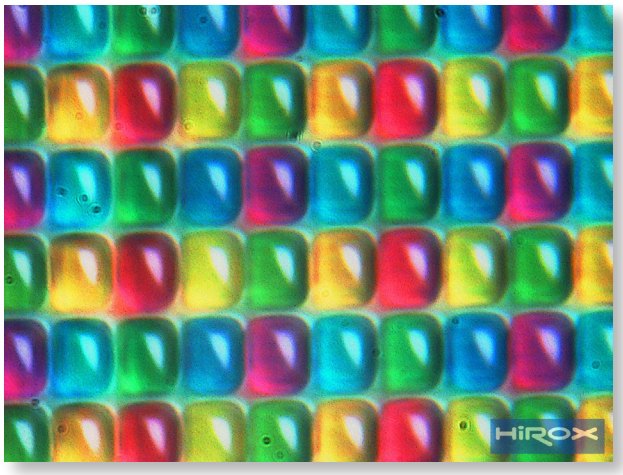


➤ Digital photos are printed using three colors that are the compliments of RGB: cyan, magenta and yellow or CMYK (the K stands for black which is added because blacks formed from the three colors are weak).

- Where all three colors overlap with equal brightness, they form neutral grays.
- Where all three overlap at full brightness, they absorb all of the light to form a weak black.
- Where the colors overlap at different brightness, there are color tones.
- Where none of the colors are, the area takes on the color of the paper you are printing on.



➤ The printed photo you saw earlier is printed with cyan, magenta, yellow and black dots.



➤ This CMYK CCD chip has been magnified 7000x so you can see the colored filters and lenses over the pixels.

Image courtesy of Hirox at www.hirox-usa.com.

Click to visit the companion Web site

1.36 Image Sizes

Animation

Image sizes, sometimes referred to as their resolution, are specified in pixels.



▲ Here the image is 3504 pixels wide and 2336 pixels deep. It's referred to as being "3504 by 2336" or having approximately 8 megapixels (3504 x 2336).

➤ Many cameras let you choose more than one image size. Larger images are better for prints; smaller ones better for e-mailing or posting on Web sites.





➤ A few camera companies, even some that are otherwise respectable, try to deceive you into thinking their cameras have higher resolution than they really do. They use software to inflate the size of a captured image and then use this inflated size in advertising claims about the camera. This way each captured pixel can suddenly become four, and voila' a 2 megapixel image suddenly and magically becomes 8.



Click to visit the companion Web site

1.37 Image Sizes–Calculating

Excel Resource

To calculate the total number of pixels in an image you multiply the number of pixels on each row of the sensor or image (the width) times the number of rows (the height).

Clicking the Excel Resource *button on the title bar opens Microsoft Excel, if it is on your system, and then loads the calculator worksheet you use to explore this concept.*

Calculating Image Sizes			
1	Width of image (in pixels)	3,000	pixels
2	Height of Image (in pixels)	2,000	pixels
3	Total number of pixels in image	6,000,000	pixels
4	Aspect ratio	1.50	to 1

ENTRIES

1. Width of image (in pixels) is where you enter the image's width in pixels. Here it is 3,000 pixels.

2. Height of image (in pixels) is where you enter the image's height in pixels. Here it is 2,000 pixels.

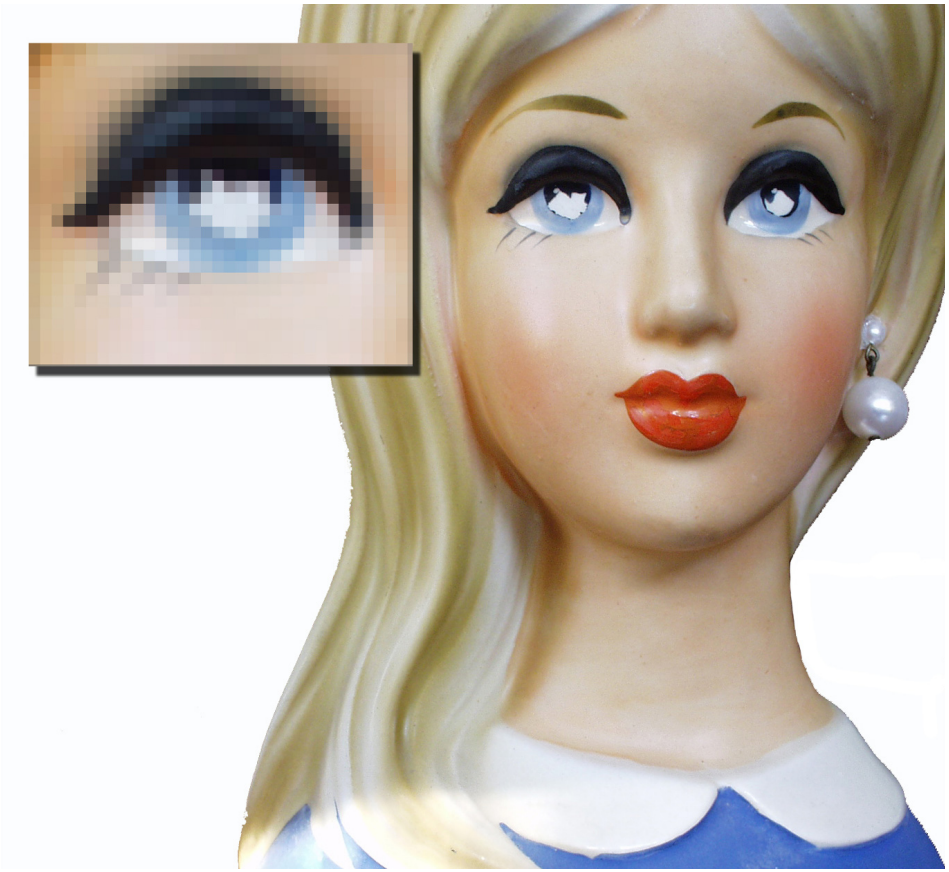
ANSWERS

3. Total number of pixels in image is calculated by multiplying the image's width by its height. Here, 3,000 x 2,000 equals 6,000,000 pixels. To avoid using such large numbers, this would be called 6 megapixels—where mega stands for millions.)

4. Aspect ratio, the ratio between the width and height of an image or image sensor, is calculated by dividing the image's width by its height. Here the ratio is 3,000 to 2,000 which can be expressed as 3:2 or 1.5:1.

1.38 Image Sizes–Pixelization

When any image is enlarged far enough, the pixels eventually become obvious—a condition called *pixelization.*



▲ When a digital image is displayed at the correct size for the number of pixels it contains (the head), it looks like a normal photograph. When enlarged too much (the eye), its square pixels begin to show.



▲ A low resolution image (bottom) can't be enlarged as much as a higher resolution image (top) because the image becomes pixelated sooner.

1.39 Image Sizes—Cropping



➤ One advantage of a large image size is that it gives you the freedom to crop the image and still have it be a usable size. One disadvantage is that the cropped image has fewer pixels so can't be enlarged as much.



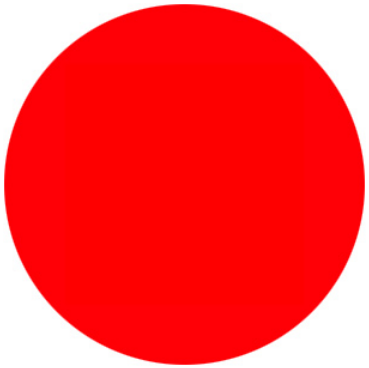


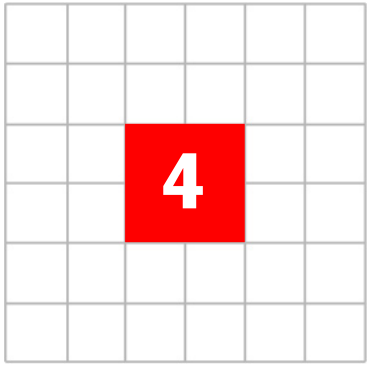
➤ If someone tells you they never crop, just smile. Every picture, other than those taken with the original Kodak #1, crop a rectangular area out of the round image circle cast by the round elements in the lens.

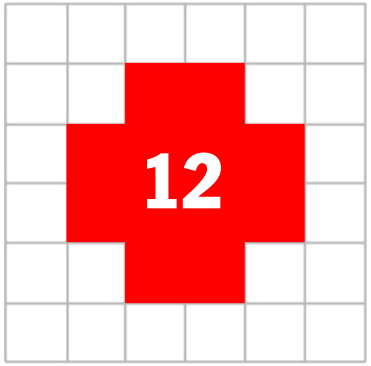
1.40 Image Sizes—Sharpness & Detail

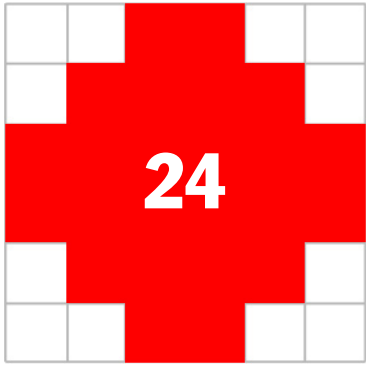
Animation

Square pixels are arranged in patterns to form curved lines and edges in a photo. The more pixels used, the smoother these curves will be.



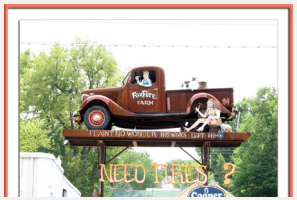






➤ Here the same red ball is represented by 4, 12, and then 24 square pixels. As more pixels are added, edges become more refined and the shape becomes more like the original.

➤ When a scene (left) is photographed at low (middle) and high (right) resolutions and then enlarged you can see how the number of available pixels affects the clarity of details and sharpness of edges.



Original scene



Low Resolution



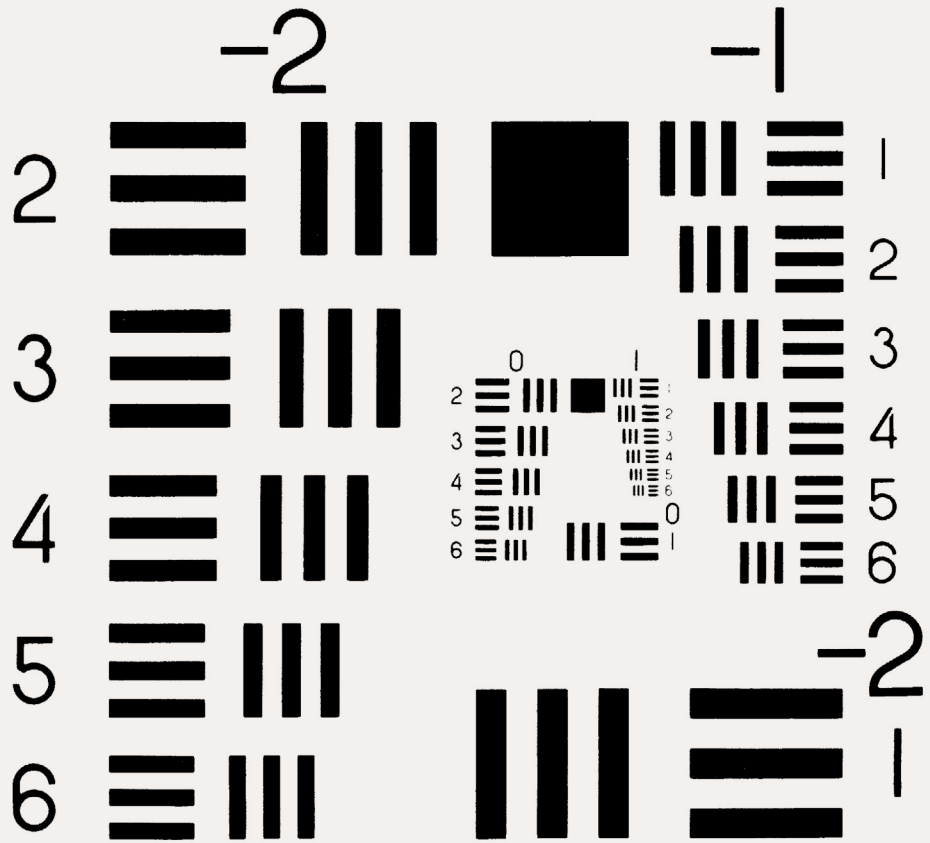
High Resolution

Click to visit the companion Web site

1.41 Image Sizes–The Other "Resolution"

Animation

Before computers and digital cameras came along, the term "resolution" only applied to the ability of a camera system to resolve between pairs of black and white lines.



▲ A typical resolution chart used to test lenses.



▲ High resolution, in both senses of the term, helps capture fine details so images appear crystal clear, almost like looking through windows out to the real world. Low resolution images look like they are behind frosted glass or like faded signs—soft and even slightly out of focus.

Click to visit the companion Web site

1.42 Image Sizes—Standard Screen Sizes

Animation

Computer screens and those found on other electronic devices generally have a standard resolution. It's this resolution that determines how many pixels are used to display an image.

CGA	320 x 200
EGA	640 x 350
VGA	640 x 480
SVGA	800 x 600
XGA	1024 x 768
SXGA	1280 x 1024
WXGA	1366 x 768
SXGA+	1400 x 1050
UXGA	1600 x 1200
WSXGA+	1680 x 1050
WUXGA	1920 x 1200
QXGA	2048 x 1536
QSXGA	2560 x 2048

➧ Here are the names and sizes of resolutions offered on standard screens. Most monitors will support more than one resolution.



➧ The output device determines the size of an image. For example, if your computer's monitor is set to 1024 x 768, images that size or smaller will be displayed in their entirety. Larger images are only partially displayed. Many programs are designed to reduce images automatically so you don't have to scroll to see parts of them.

Click to visit the companion Web site

1.43 Image Sizes—Calculating Screen Display

Excel Resource

How many pixels are displayed per inch and how large an image is when displayed on the screen depend on the screen's resolution and width.

Clicking the Excel Resource *button on the title bar opens Microsoft Excel, if it is on your system, and then loads the calculator worksheet you can use to explore this concept.*

Displaying Images			
1	Width of image (in pixels)	3,000	pixels
2	Height of image (in pixels)	2,000	pixels
3	Screen's horizontal width (in inches)	16	inches
4	Screen's horizontal resolution (in pixels)	1,024	pixels
5	Screen's ppi	64.0	ppi
6	Width of image on screen (in inches)	46.9	inches
7	Height of image on screen (in inches)	31	inches
8	Will image fit on screen?	NO	

ENTRIES

1. Width of image (in pixels) is the image's width in pixels.

2. Height of image (in pixels) is the image's height in pixels.

3. Screen's horizontal width (in inches) is your screen's width in inches (not its advertised diagonal measurement).

4. Screen's horizontal resolution (in pixels) is your screen's horizontal resolution. For example, if resolution is set to 800 x 600, enter 800. If it's set to 1024 x 768, enter 1024.

ANSWERS

5. Screen's PPI (pixels per inch) is calculated by dividing the screen's horizontal resolution in pixels (line 4) by its horizontal width in inches (line 3).

6. Width of image on screen (in inches) is calculated by dividing the width of the image in pixels (line 1) by the screen's ppi (line 5).

7. Height of the image on screen (in inches) is calculated by dividing the height of the image in pixels (line 2) by the screen's ppi (line 5).

8. Will image fit on screen? is calculated by comparing the width of the image in pixels (line 1), with the screen's horizontal resolution in pixels (line 4).

1.44 Image Sizes—Prints



Although greatly different in the number of pixels they contain, the different output devices will render them the same size—4 x 5 inches. The larger image is made smaller because it's printed at 300 ppi and the smaller image is made larger because it's displayed at 72 ppi.





Here are the relative sizes in pixels of two images sized to be printed or displayed at 4 x 5 inches.

- The larger image (1500 x 1200 pixels) will print at 300 pixels per inch (ppi).
- The smaller one (360 x 288) will be displayed on the screen at 72 ppi.

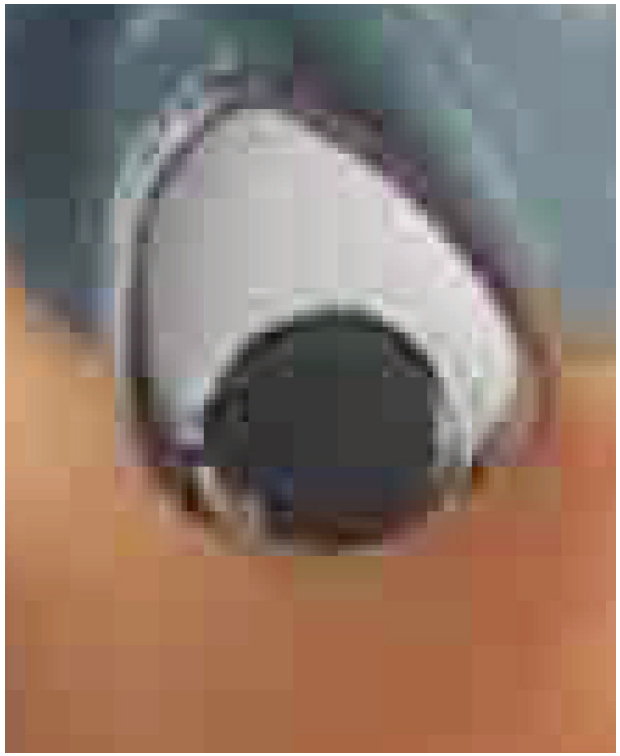
1.45 Image Quality–Compression

Animation

The JPEG camera format compresses images in the camera and throws out some information in doing so.

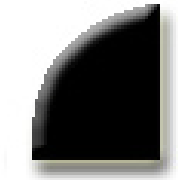


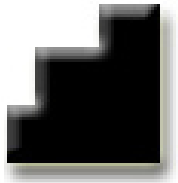
▲ An image that hasn't been compressed.



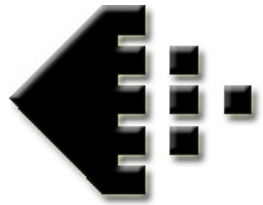
▲ A JPEG image that has been compressed repeatedly.

➤ Most cameras let you specify image size and quality. Here are Canon's icons for fine (top) and normal (bottom) quality.





➤ A fairly common image quality icon.



➤ On many cameras you can change compression using a menu.





Click to visit the companion Web site

1.46 File Formats

Animation

All digital cameras store still images in the JPEG format, but some also let you select TIFF or CCD RAW.

JPEG

JPEG, named after the Joint Photographic Experts Group and pronounced "jay-peg," is by far the most popular format for photographic images. A JPEG image is compressed to reduce filesizes to 1/2, 1/4, 1/8, or even 1/16 their original size. Most let you choose between lower compression and higher image quality, or greater compression and poorer quality. The reason for poorer quality is that the more an image is compressed, the more data is just thrown away.

TIFF

TIFF (Tag Image File Format) or its new variety TIFF/EP (Tag Image File Format—Electronic Photography), may store images in uncompressed form so no data is lost as it is with JPEG images.

RAW

CCD RAW format stores the data directly from the image sensor without first processing it. This data contains everything captured by the camera and is processed into a final image on your computer. The increased computing power and space to work in can make a significant difference in the results. You don't get the artifacts (image flaws) that sometimes appear in JPEG images. In addition, you can save the original raw data and process it with other software, or in different ways. This is unlike a JPEG image where data are permanently changed or deleted during processing in the camera and can never be recovered.

For total control over exposure, white balance, and other settings, this is the best possible format to use. Only four camera settings permanently affect a RAW image. They are the aperture, shutter speed, ISO, and focus. Other settings may affect the appearance of the thumbnail or preview but their effects can be undone in an editing program.



➤ On many cameras you can change file formats using a menu.

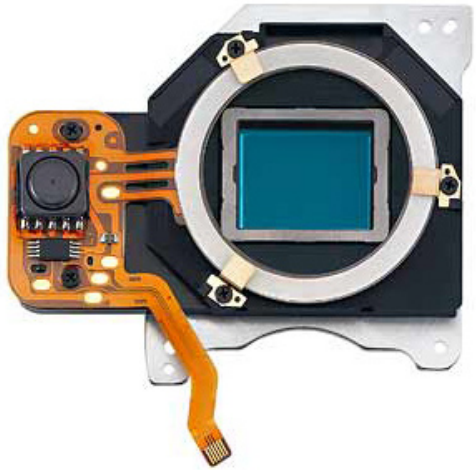
1.47 Image Quality–A Dirty Little Secret

Animation

When you change lenses on an SLR it's surprisingly easy to get dust on the image sensor that then shows up as dark spots in your images. Cleaning your image sensor is risky and you can easily damage it. However, dust is such an ongoing problem, we all have to learn how to do it or always have our camera in the mail to a repair service.



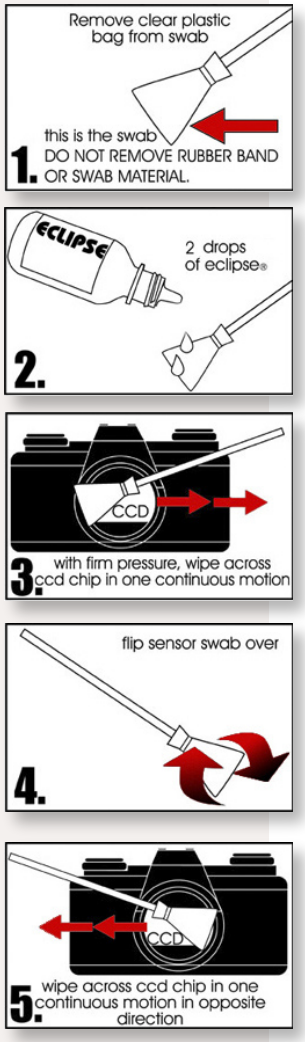
▲ This beach with blowing sand is not the kind of place where you would change lenses. But dust is everywhere so it can get on the sensor in much less hostile environments than this. One person suggested that the only way to avoid it entirely is to buy a camera body for each lens so you never have to change them.

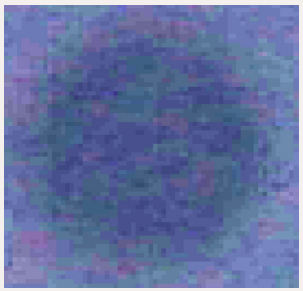


▲ Olympus is the first to try combatting dust on the image sensor. Their Supersonic Wave Filter™, positioned between the shutter and the sensor, vibrates 35,000 times per second to shake loose dust and other particles. As these particles descend from the image sensor, they are conveniently caught by an adhesive material where they remain out of harm's way.

➤ Here are the five steps recommended by Photographic Solutions for cleaning your image sensor after using the camera's command to lock the mirror out of the way.

Courtesy of www.photosol.com.





▲ A spot of dust can cover hundreds or thousands of pixels.

Click to visit the companion Web site



Photo COURSE

The Digital Darkroom

Chapter 2

2.1 Storing Images in the Camera

When you take pictures, the camera stores them on a storage device—usually a flash memory card, but sometimes a hard drive. After copying the images to the computer or other device, you delete them from the camera's storage device so you have room for new ones.



➤ Most cameras store images on a memory card that slides into a slot in the camera.

Courtesy of SanDisk at www.sandisk.com.



➤ When you have more than one card, a case protects your spares.

Courtesy of In Any Case at www.inanycase.com.



➤ The Microdrive is a hard drive for use in cameras with Type II CompactFlash slots.

Courtesy of Hitachi at www.hitachi.com.

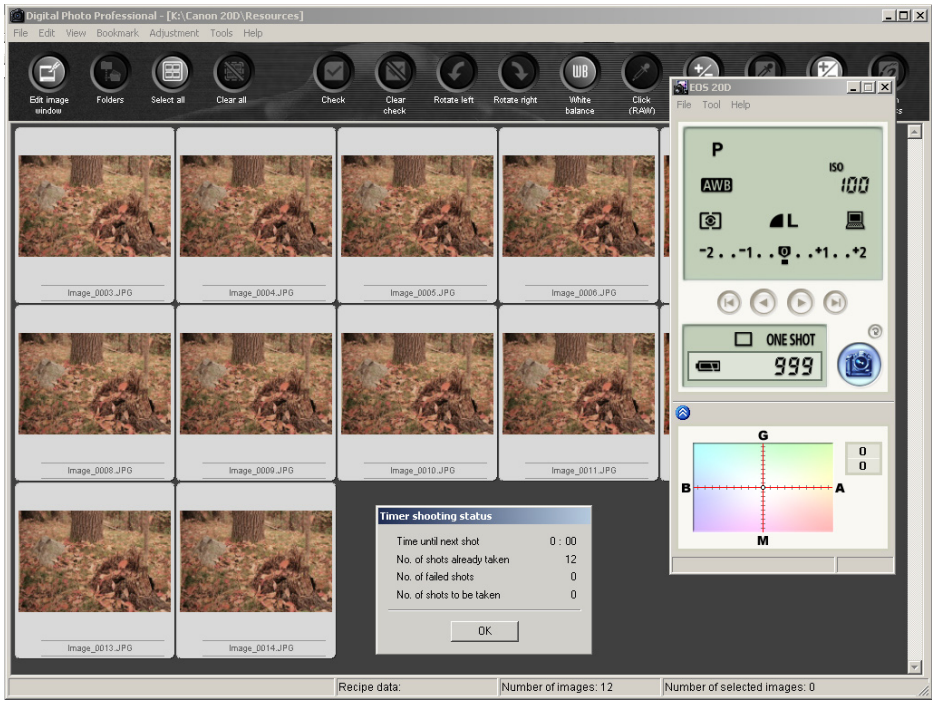


➤ Flash memory cards come in a variety of shapes and sizes. The most popular at the moment are CompactFlash (CF) for SLRs and the smaller SecureDigital (SD) for point and shoot cameras.

Courtesy of SanDisk.

2.2 Storing Images in the Camera, Con't.

➤ Some cameras come with software that lets you connect the camera to the computer (called tethering it) and operate it from there. Captured images can be stored on the computer's hard drive instead of on the camera's memory card. Although this approach is frequently used in the studio, it's occasionally used by landscape photographers when they want to immediately evaluate images on the computer's much larger screen.





➤ The Kodak EasyShare has 256 Megabytes of internal storage that can hold up to 1500 of your favorite pictures so they are easy to share. This keeps them separated from those you have taken and not yet transferred. You can organize the pictures into albums with a stylus and touch screen menus.

Card Types

- CompactFlash™ (CF) Type I and II
- Micro Drive
- SmartMedia™ (SM)
- MemoryStick™ (MS) and variants
- SecureDigital™ (SD)
- MultiMedia-Card™ (MMC)
- xD Picture-Card™ (xD)



Click to visit the companion Web site

2.3 Transferring Photos–Card Readers and Slots

Once you have taken some photos, the next step is to transfer them from the camera to a computer or other device. A very common way to do so is using a card reader or card slot that accepts your card with or without an adapter.



➤ Sandisk makes an SD card that folds to reveal a USB connector so it can be plugged in without using a slot or card or card reader.



➤ If a card is smaller than a slot, you can usually find an adapter that mates the two. Some adapters accept a variety of cards

Courtesy of SanDisk at www.sandisk.com.



➤ Card readers are often connected to a computer's USB port, or may even be built in. Cards inserted into a slot are treated just as if they were a removable hard drive. Cards vary in size and have different connections so many readers now have a variety of slots.

Photo courtesy of PQI at www.pqi1st.com.



➤ Some home printers, kiosks at photo stores, and even TV sets have slots that accept cards directly from your camera so you can view or print images without a computer.

Courtesy of Hewlett Packard at www.hp.com.



Click to visit the companion Web site

2.4 Transferring Photos–Cable Connections

Most devices are still connected by cables and the most popular types are currently USB 2.0 and Firewire 800 (IEE 1394b).



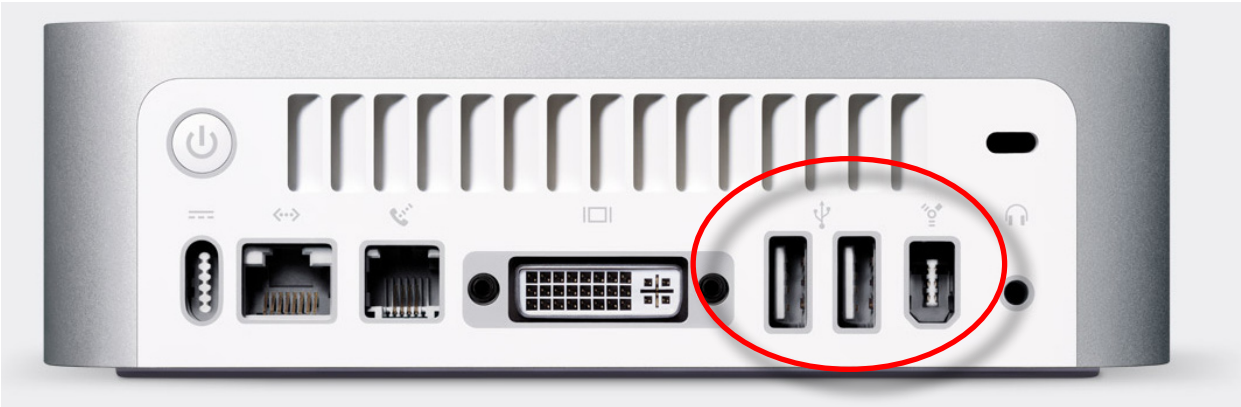
▲ Almost all cameras come with a USB or Firewire (IEEE 1394) cable you use to connect it to a computer or printer.

Courtesy of Canon at www.powershot.com.



▲ A dock lets you easily connect a camera to a printer or computer and even charge the camera's batteries. Unfortunately, docks are camera-model specific so if you buy another camera you'll need another way to make your connections.

Courtesy of Kodak at www.kodak.com.



◀ Cable connections on the back of Apple's Mac Mini with USB and Firewire (IEEE 1394) logos and connectors to the left of the headphone plug.

Courtesy of Apple at www.apple.com.

2.5 Transferring Photos–Cable Connections



▲ With USB cables, connectors on the computer end are standard but those on the camera end aren't—a source of endless frustration for those with more than one camera.

Photo courtesy of Shokai Far East Ltd at www.shokaifareast.com.





▲ Mutant Mod cables light up when plugged into a USB or Firewire port on the computer.

Courtesy of Startech at www.startech.com.



▲ You can add USB and Firewire ports to your computer using a hub that plugs into one port on the computer.

Courtesy of Belkin at www.belkin.com.



▲ Belkin's 7-in-1 Retractable Cable Travel Pack lets you organize your cable chaos.

Courtesy of Belkin at www.belkin.com.

Click to visit the companion Web site

2.6 Transferring Photos–Wireless Connections

One of the latest trends is to eliminate cable clutter using wireless connections between devices. There are three basic approaches:

- Infrared connects line-of-sight devices where the infrared beam isn't blocked.
- WiFi connects to wireless WiFi networks like those in home networks and public hot spots.
- Bluetooth connects to nearby devices such as printers and kiosks.



➤ The Kodak EasyShare One's WiFi compatibility lets you post images on a Web site or e-mail them using a home network or public hot spot.

Photo courtesy of Kodak at www.kodak.com.



➤ A Nikon camera with WiFi connectability.



➤ Many camera phones come equipped with Bluetooth so you can print images at kiosks.



➤ Camera phones send photos over the operator's network but you are at their mercy when it comes to pricing. Some phones also let you connect to WiFi networks so you can cut your transfer costs.

Photo courtesy of Sony-Ericsson at www.sonyericsson.com.

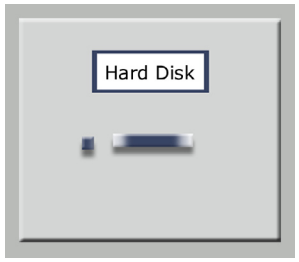


➤ A Kodak WiFi card lets a printer dock transfer pictures from a docked digital camera to a computer on the home network. It also lets you print pictures wirelessly from other WiFi-enabled devices.

Click to visit the companion Web site

2.7 How Photos are Stored in Your Camera and Computer

The process of transferring images from your camera to your computer and then organizing them is sometimes referred to as the *chain of pain*. To get more people to use digital cameras the industry is trying to simplify this process as much as possible. One thing they are doing is hiding folders from us. However, since folders are the very foundation of image management, you should take the time to understand them.



A new hard disk drive, like and empty file drawer, has no files nor organization.



Dividing a hard disk into folders is like dividing a file drawer with hanging folders.



Nesting folders, called subfolders, inside other folders is like putting manila file folders into the hanging folders.



Files, including images, can be stored in any of the folders or subfolders.

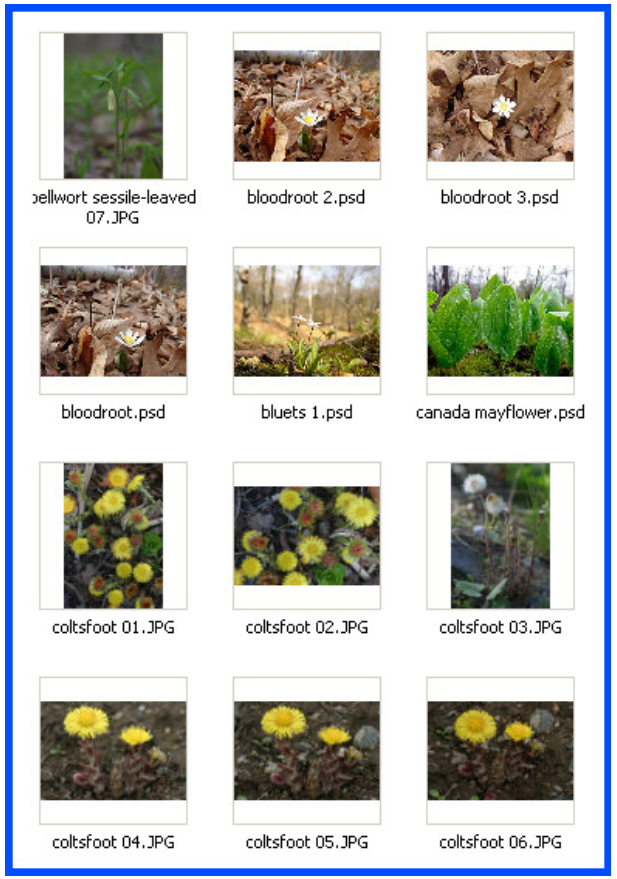


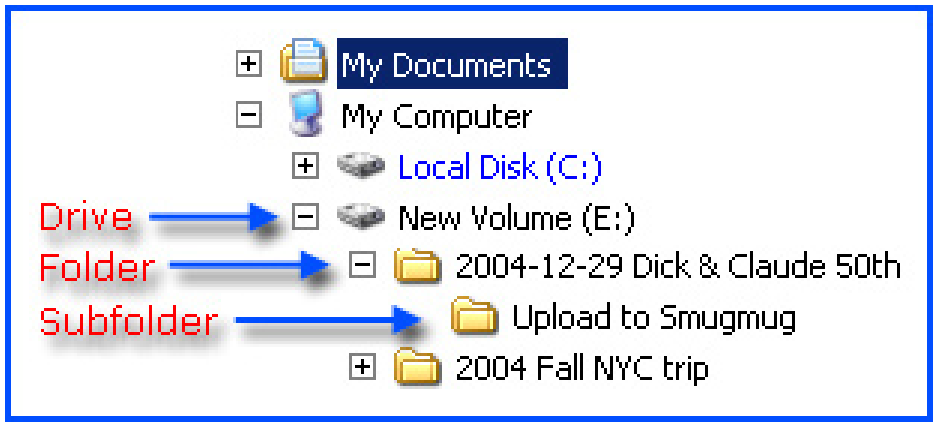
Image files stored in a folder are displayed by many programs when you select the folder—perhaps to open an image for editing. On most systems you can display files as names or thumbnails as shown here.

Click to visit the companion Web site

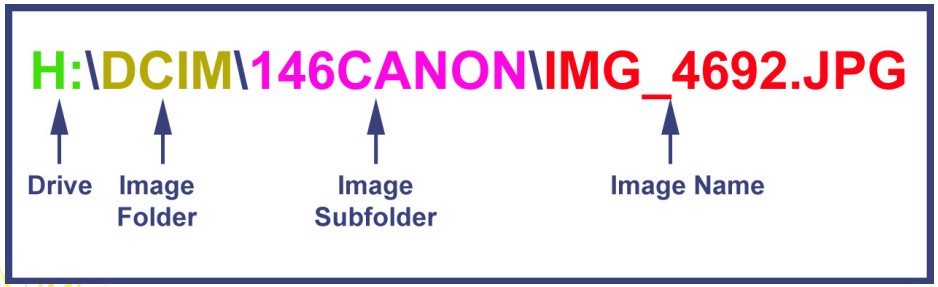
2.8 How Photos are Stored in Your Camera and Computer

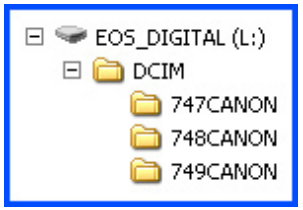
Animations

Disks, folders, and subfolders don't look the same on a computer as they do in the real world, however, they use real-world-like drive and folder icons.

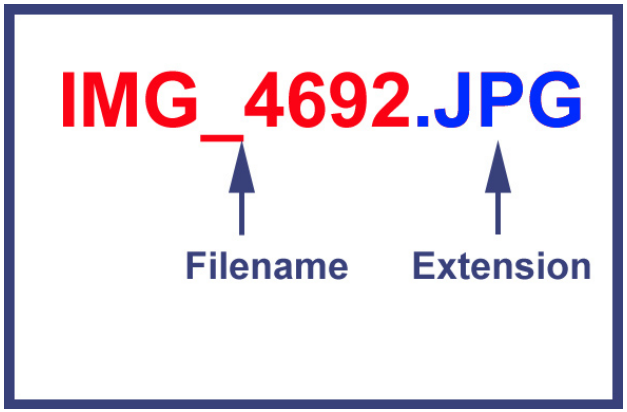


➤ Storage devices on your system are often listed as a "tree." Indenting indicates the level of each folder. For example, if a folder is indented from the one above it, it means the indented folder is nested inside the one above. On PCs the + and - icons indicate if a folder is expanded to show its contents (-) or collapsed to hide them (+).





➤ A computer treats a storage card as a disk (here it's EOS_DIGITAL (L:). On the card, a camera always creates a folder named DCIM (for Digital Camera IMages). It then creates subfolders for your image files. If you use the same card with other devices, there may also be other folders on the same card holding MP3 music or other files.



➤ Image files have an 8-character name followed by a period and a 3-character extension.

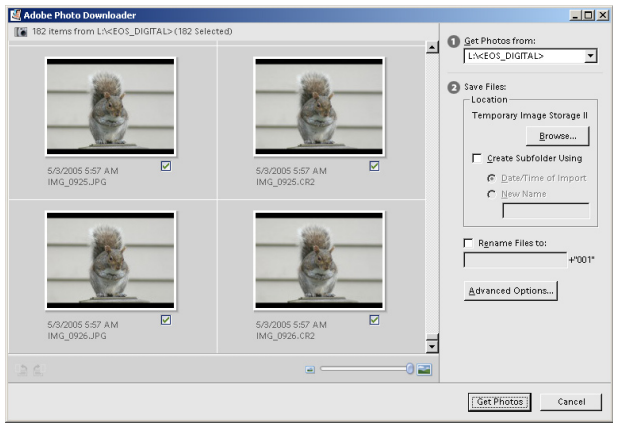
➤ At times you may encounter a reference to a path. It is just a pointer to the drive and folder in which a specific file is stored. Here is the path to the file IMG_4692.JPG in subfolder 146CANON that's in the DCIM folder on a memory card in drive H. The drive, folder, subfolder, and filename are separated by backslashes (\).

2.9 Transferring Images to the Computer–Procedures

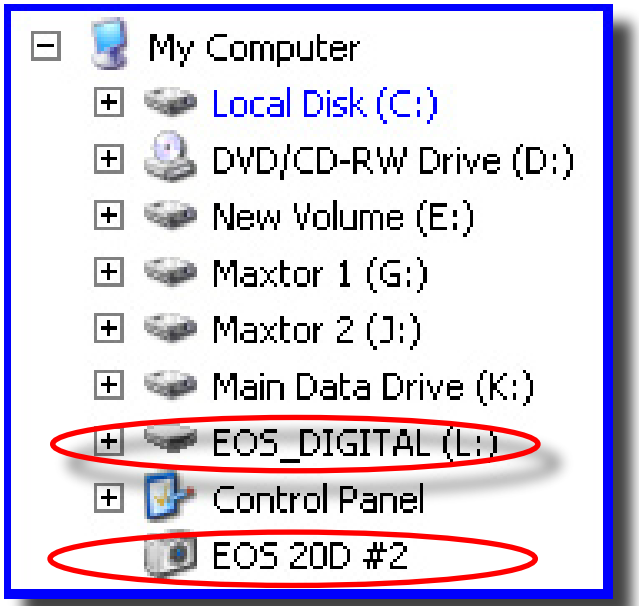
Animation

When transferring image files, you are moving or copying them between folders on storage devices that are treated as disks. Moving files copies them from the camera's storage device and then deletes them from the device. Copying files also copies the files, but doesn't delete them after doing so. To delete them so you have room for new images you have to use your computer or one of the camera's commands such as erase or format that deletes all images.

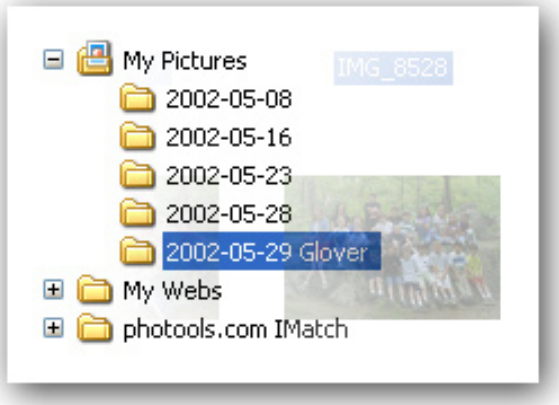
To transfer images, you select the *source folder* containing the files you want to copy or move, select the files, then drag and drop them on the *destination folder*.



➧ Most cameras and photo-editing programs include software that transfers pictures from your camera or card to the computer.



➧ Here both a memory card in a reader—EOS_DIGITAL (L:)—and a camera connected by a USB cable—EOS 20D #2—are listed as drives on the system.



➧ When you drag files or folders to a folder on the tree they appear as an outline or ghost image and the destination folder is highlighted.



➧ If you delete images by mistake, there are programs that recover them if you don't first save other photos on the same card. You can find them by Googling "digital image recovery."

Photo courtesy of Lexar Media at www.lexar.com/photorescue.

Click to visit the companion Web site

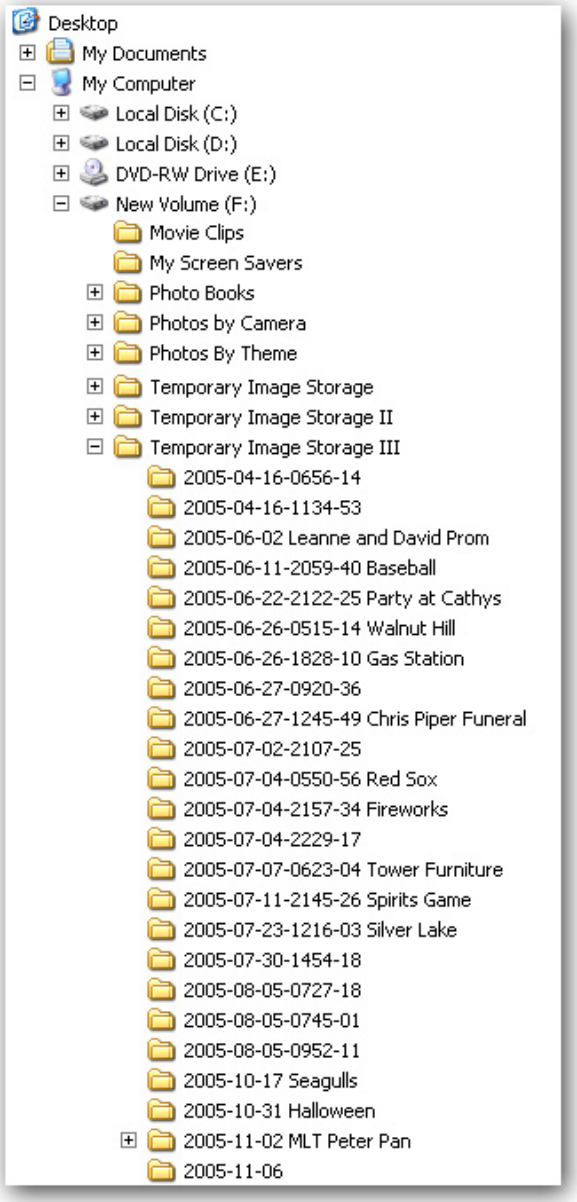
2.10 Organizing Your Photo Files

Organizing your photos as you transfer them to your computer saves you a great deal of time and frustration in the long run.

• *A chronological organization* uses folders named with dates in the format yyyy-mm-dd. For example, a folder named 2006–02–10 would contain photos taken or downloaded on February 10, 2006. When using dates, be sure to add zeros to single digit months and days or the folders won't sort into a perfect chronological order.

• *A subject organization* uses folders named after subjects, events, projects, or experiences. For example, a folder named *Christmas 2006* would contain images of that day. *Emilys Birthday 2006* would contain images of the birthday party.

These two approaches aren't mutually exclusive. For example, when organizing images chronologically, you can add a comment after the date that indicates the subject or project. You can also create folders with descriptive names and nest chronological subfolders inside them. For example, if you drive cross-country on Route 66, you can create a *Route 66 Trip* folder and then file images in subfolders for each day of the trip.



◄ Here is a tree from my system. Related photos are stored in named folders. In each are subfolders listing the dates images are downloaded. If a folder's images are predominantly of a single subject, I add a short description.

2.11 Storing Images—Hard Drives & Flash Drives

Hard drives are essential in digital photography because of their massive storage capacity and relatively fast speeds.



➤ Hard disks in portable devices like the iPod let you store and view images.



➤ The LaCie SAFE Mobile Hard Drive unlocks its files when you swipe your finger over the sensor. This protects your copyrighted photos from others if lost or stolen.



➤ When copying images between devices, USB flash drives come in very handy. You plug one into a computer's USB port and copy files to it. You then plug it into any other computer and copy the files from it.

Courtesy of Lexarmedia at www.lexar.com.



➤ Hard disks grouped together into a RAID configuration (Random Array of Inexpensive Devices) not only store information but automatically back it up. If one drive fails, it can be replaced and the damaged files are then automatically reconstructed from the remaining drives.



Click to visit the companion Web site

2.12 Storing Images—On the Road

Image storage can be a problem when traveling—especially when you shoot a lot. You can always use a notebook computer to store your images but other devices have been introduced that are smaller and lighter. You can view the stored images on the device and most also let you connect to a television.



▲ The Coolwalker comes with 30 Gigabytes of hard drive storage and can store all Nikon image formats.

Photo courtesy of Nikon Imaging.



▲ The FlashTrax comes with a hard drive and can store, but not display, all image formats.

Photo courtesy of SmartDisk at www.smartdisk.com.



➤ The Epson P-4000 is a portable storage and viewing device with a hard drive and large screen.

Courtesy of Epson at www.epson.com.



➤ If you have an iPod there are card readers and camera connectors that let you transfer your images to it until you get home.

Courtesy of Belkin at www.belkin.com.

2.13 Storing Images—CD Drives and Discs

Stand-alone CD drives are on their way out since DVD drives can also burn and read CD discs. However CD discs can also be burned in a variety of other devices, many of them portable. CDs are popular with photographers because their format is universally accepted and archival-quality CDs are available, although hard to find. CDs biggest drawback is that by today's standards, their storage capacity is quite small.



➤ CD drive.

Courtesy of LaCie at www.lacie.com.



➤ The Roadstore from Micro Solutions copies image files directly from your camera to CD-R discs without a computer involved.

Courtesy of Micro Solutions at www.micro-solutions.com.



➤ You can transfer images to a CD using Sony's Photovault and a USB cable or MemoryStick.



➤ CDs and DVDs are less expensive when you buy them on spindles. You then use envelopes to store them in drawers.

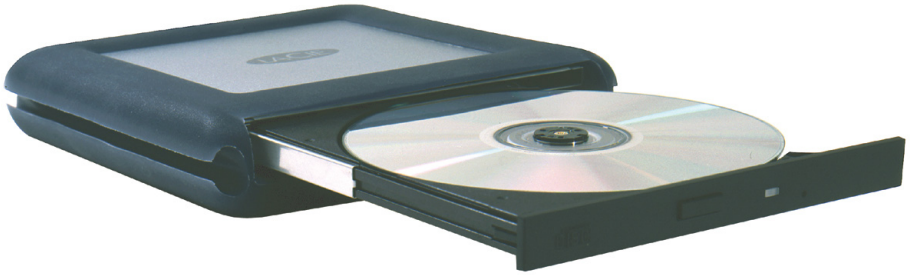


➤ Mitsui Gold CD-R discs are considered one of the best storage CDs because of a real gold added to the reflective layer.

Courtesy of Diversified Systems Group at www.dsgi.com.

2.14 Storing Images—DVD Drives and Discs

DVD drives are becoming very common but most photographers are not using them for archival storage because there are competing formats. Everyone is afraid they won't be able to read the discs in five or 10 years. And things aren't getting better. New high capacity DVD discs are also in competing formats—HD-DVD and Blu-ray. Someday these new formats may store up to 50 Gigabytes of data.



▲ LaCie makes small FireWire and USB Pocket DVD-RW drives so you can read and write DVDs on any system. Courtesy of LaCie at www.lacie.com.



▲ Many notebook computers have built-in DVD drives.

Courtesy of Sony at www.sony.com.

DVD±RW

▲ Today's DVD discs are in + (plus) or - (dash) formats and drives that can read/write both types of discs have a +/- symbol or are called Dual RW Drives.

RW DVD+R DL

▲ Double or dual layer (DL) drives and discs can store data on two layers, almost doubling the storage capacity of DVDs to 8.5 Gigabytes.

HD DVD

Blu-ray Disc

▲ Tomorrow's DVDs will have a HD DVD or Blu-ray logo.



▲ Duplicators let you duplicate all kinds of CDs and DVDs.

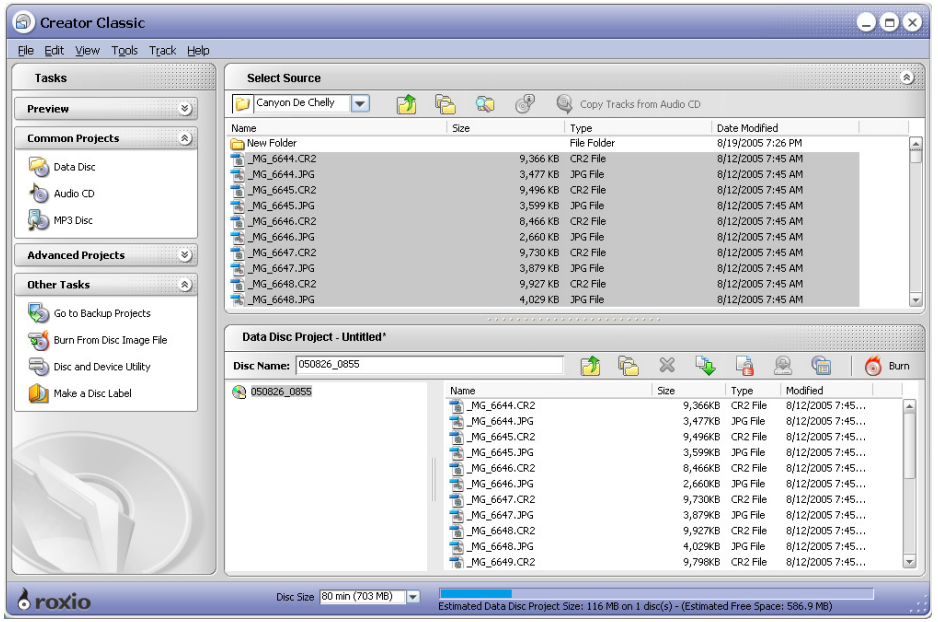
Courtesy of LaCie at www.lacie.com.

2.15 CD/DVD Burning Software

To copy files to a CD or DVD, you need recording—sometimes called *authoring* or *burning*—software. This software is readily available—for example, the latest Windows and Mac operating systems let you burn a CD or DVD directly from the operating system. In addition, most computers and new drives come with software, usually a somewhat limited version of a more powerful stand-alone program or suite of programs that you have to pay for to access all features.



Roxio combines a variety of separate utilities into an integrated program. Here is the Windows menu for both applications and tools.



Roxio can copy files to CDs and DVDs just by dragging and dropping them from one window to another.



There are so many disc formats, be sure you buy and use only those your drive can read and write.

2.16 Labeling CD/DVD Discs

Although a disc is labeled electronically when burned, you also need to physically label it. Generally, the information should be on the disc itself, not on an envelope or insert. It's too easy for those to get separated from the disc.



▲ Always use pens designed to write on DVDs and CDs. Never use pens containing solvents (you can tell by the smell) because they will damage discs.

Courtesy of Staedtler.



▲ Avery and others make die-cut disc labels you can print and stick onto a disc.



◀ Neato makes an applicator that centers a label and the disc so the label goes on right the first time. Courtesy of Neato.



▲ Some drives, such as LaCie LightScribe drives, can also burn labels onto special LightScribe disks.

Courtesy of LaCie at www.lacie.com.

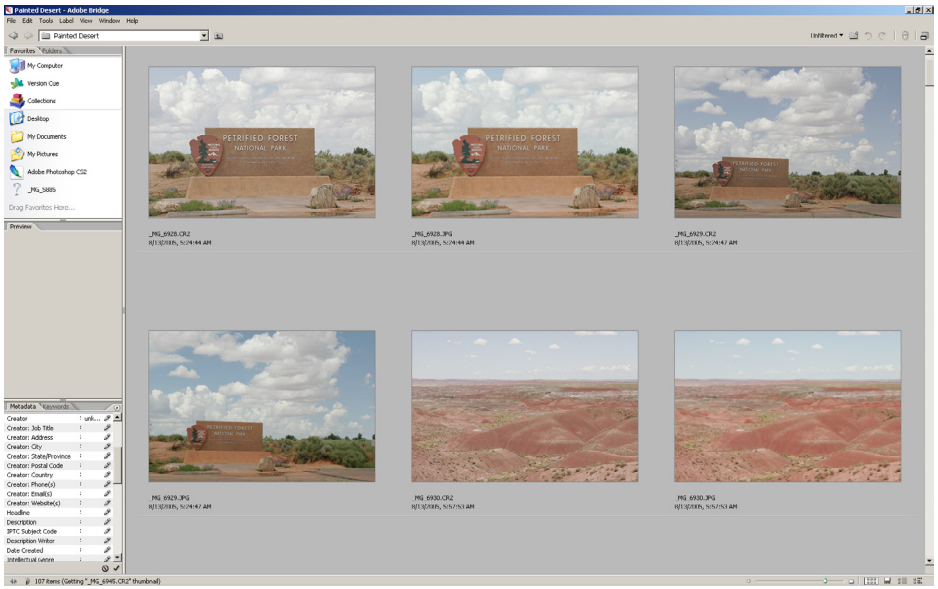


◀ Some printers print, in full color, directly onto the surface of inkjet printable CD/DVD discs.

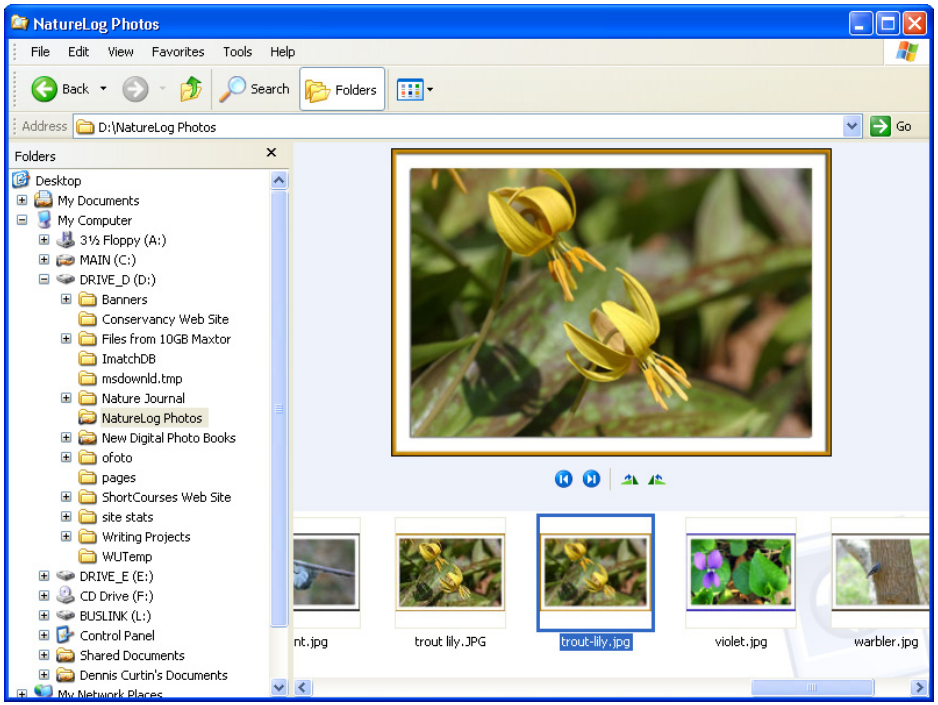
Photo courtesy of Epson at www.epson.com.

2.17 Image Management—Thumbnail Viewers

When it comes time to locate photos you have collected, it helps if you can see them. One tool you can use is a *thumbnail viewer* that lets you view images but doesn't permanently store information about them. Each time you open a folder, the thumbnails must be generated all over again and this takes time. (Some viewers temporarily store the most recently generated thumbnails in an area of memory called a *cache*.)



▲ Adobe's Bridge, introduced with CS2, is a thumbnail viewer that also lets you rate photos, attach keywords to them, and add metadata—all of which help you find them later.



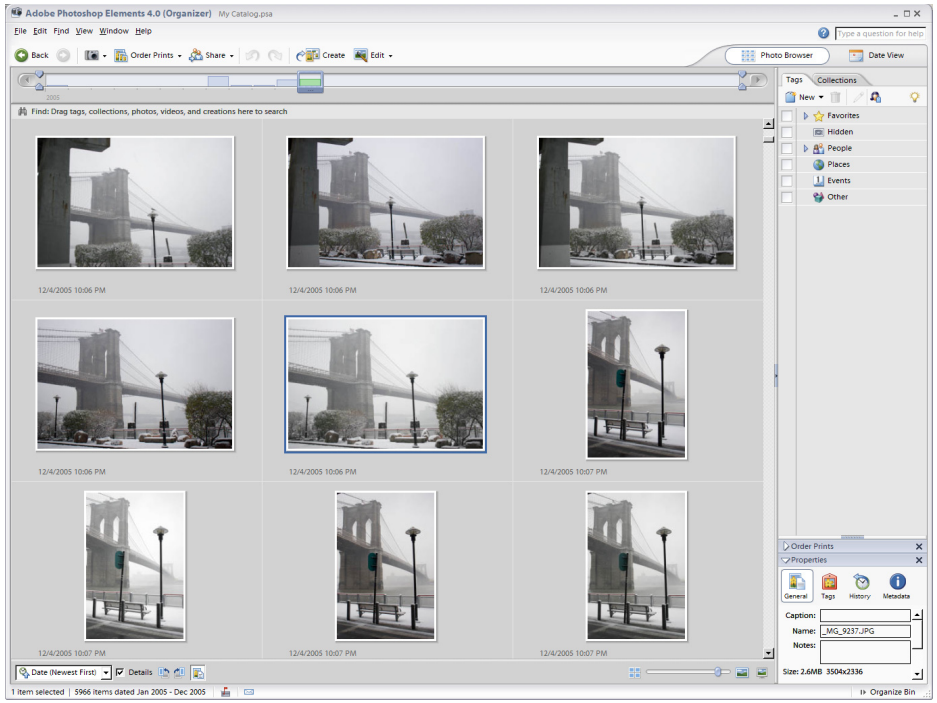
▲ Windows XP has a filmstrip view that lets you look at thumbnails, with the currently selected one enlarged so you can better evaluate it.



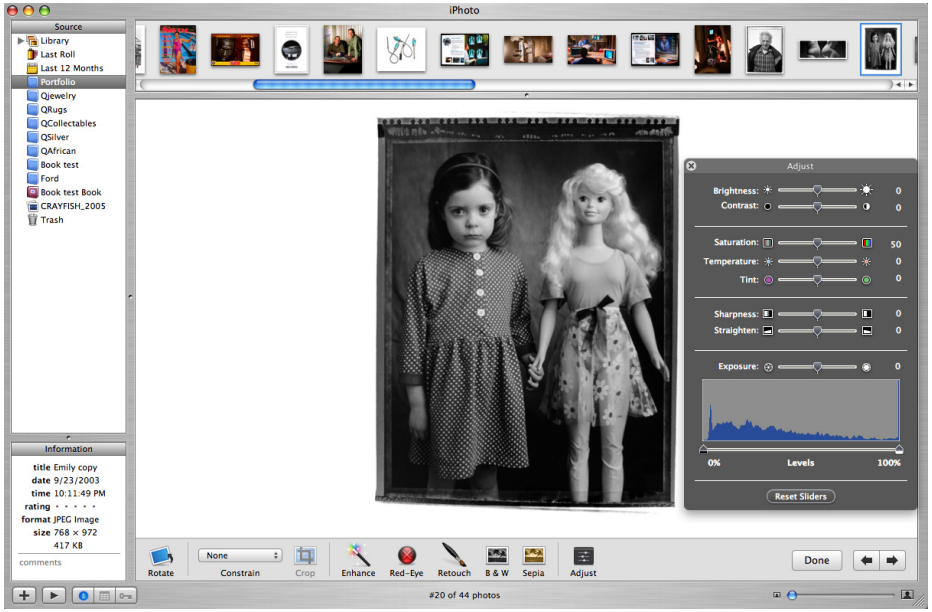
2.18 Image Management—Asset Managers

Video Resource

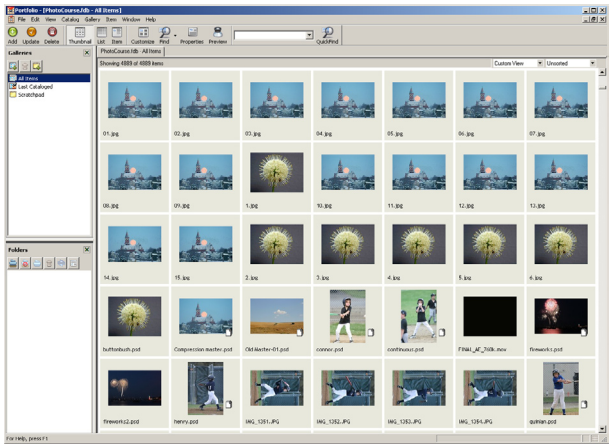
Asset management programs are more powerful than thumbnail viewers because they permanently store all of the information about your images—including thumbnails—in a database. They also let you add keywords or rate images so you can quickly find your best. You can also sort images by the date they were taken, the date they were transferred to the computer, or by the folder they are stored in.



Photoshop Elements has a very powerful database-backed asset manager called the Organizer.



Apple's iPhoto is a great asset manager for Mac users.



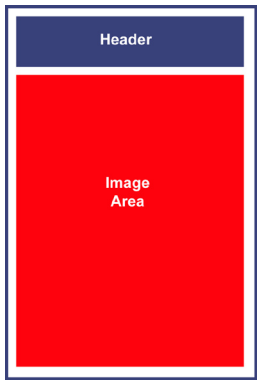
Extensis Portfolio is one of the more popular asset-managers for both PCs and Macs.

Click to visit the companion Web site



2.19 Image Management—Asset Managers, con't.

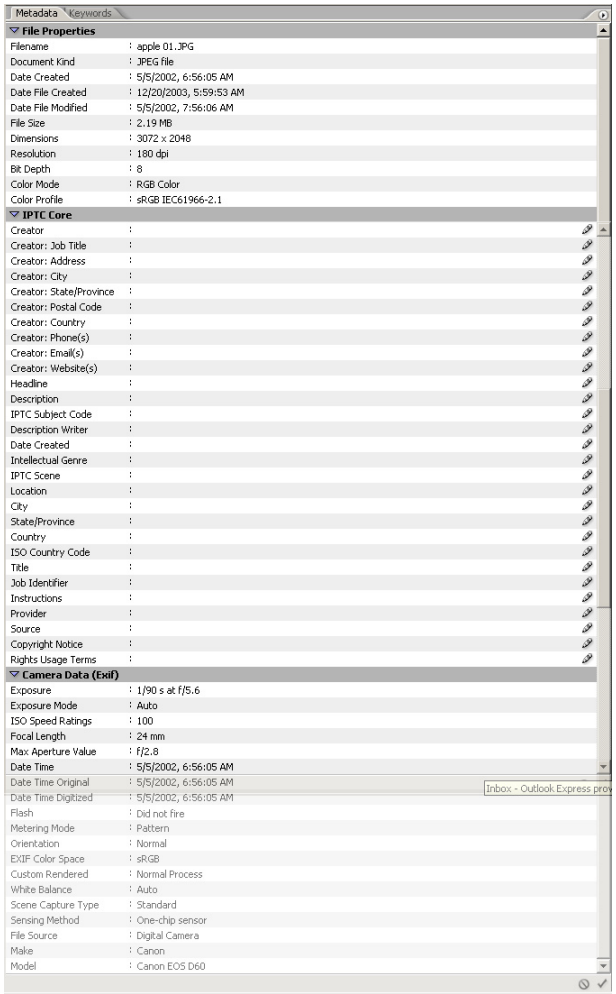
The information stored in an asset-manager is comprehensive. When you take a photo, the camera automatically records EXIF (Exchangeable Image File Format) information about the date, time and camera settings. Using an asset-manager you can also add your own IPTC (International Press Telecommunications Council) information— perhaps your name, a copyright, or a caption. This information travels with the photo because it's embedded in it. Newer operating systems and application programs can display this information and even allow you to search for images based on it.



➤ EXIF information is stored in a header—an area of the file separated from the image data.

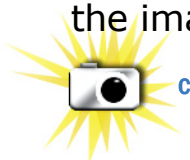


➤ Ricoh makes a camera that records the longitude and latitude in the EXIF header. Later, the image can be added to a database and linked to a spot on a map. Many people are now using Goggle for this purpose.



➤ Here is a display of information about an image in Photoshop.

- You can add information in the IPTC section.
- The camera automatically adds the File Properties and EXIF information when you take the picture.

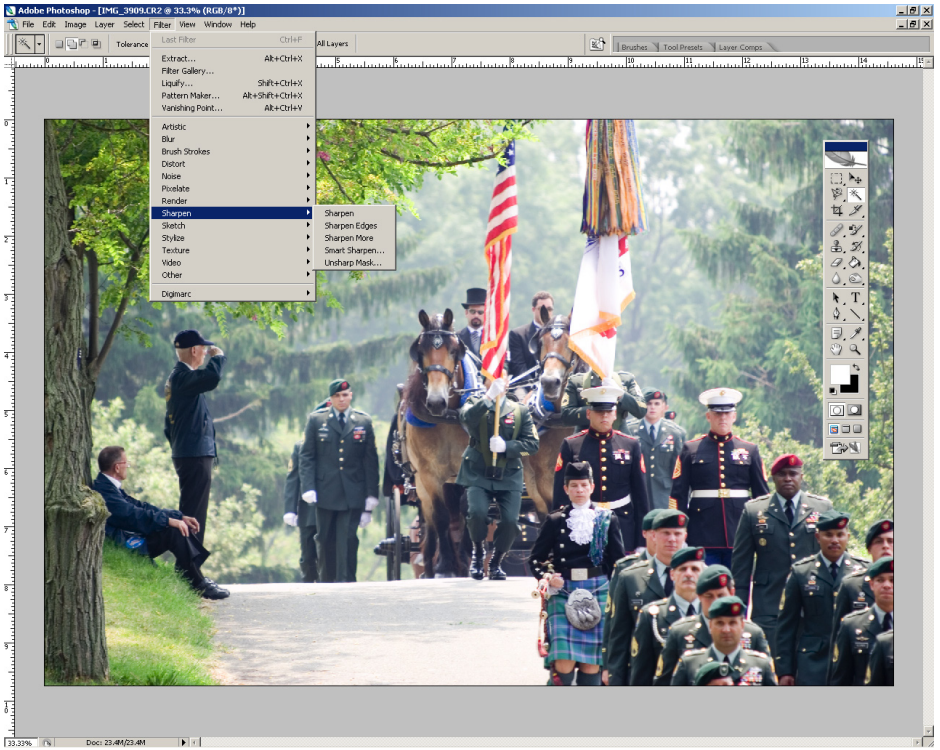


Click to visit the companion Web site

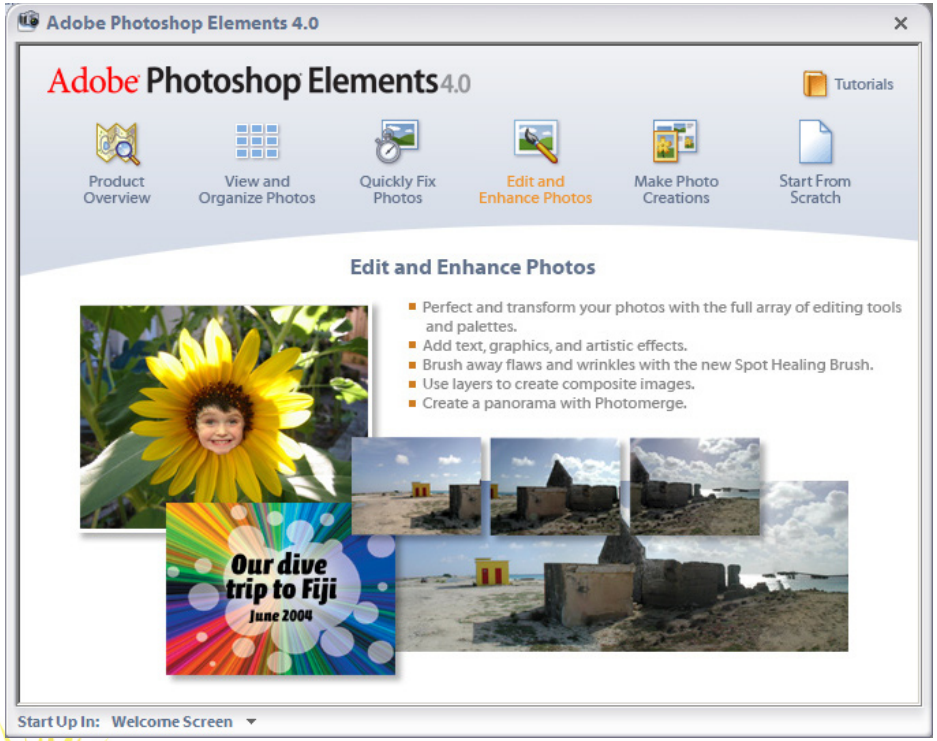


2.20 Photo-editing Tools—The Big Two

Photoshop is the editing program used by almost all professionals. The problem is that it's expensive and takes a large investment of time to learn. To reach the much larger serious amateur market, Adobe introduced the much less expensive Photoshop Elements. Since Elements is a direct adaptation of Photoshop, much of what you learn about it can be transferred to the more extensive program should you decide to migrate to it.



Photoshop provides you with tools, menus and palettes to execute commands.



Photoshop Elements is almost as feature-rich as Photoshop, a lot less expensive, but almost as difficult to learn. On PCs its organizer is a powerful database-backed asset manager that rivals professional stand-alone programs in this area.

Click to visit the companion Web site

2.21 Photo-editing Tools—Editing to Improve

It's the rare image that doesn't benefit from some kind of editing to enhance the tonal range, color saturation, and sharpness. Programs such as Photoshop are complicated to learn because they have so many features, but there are only a handful that you have to master to get dramatically better results. We'll look at them in the pages that follow.





➤ The original image of the Mojave Desert in California (left) was dark and detailess. Using just a few commands in Photoshop, the tonal range was expanded, colors were lightened and made more saturated, and details were sharpened. The result (top) is not only more attractive, it is a closer approximation of the original scene.



2.22 Photo-editing Tools—Editing to Change

Animation

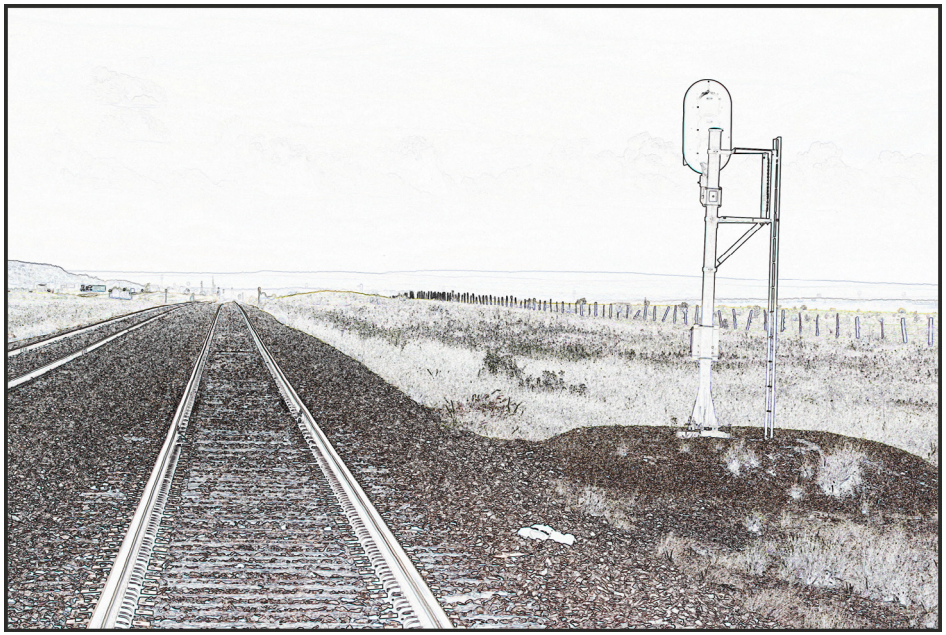
With all of the tools at your disposal in a photo-editing program, it's not hard to make a photo look like something else—perhaps an oil painting, watercolor, or stained glass window. This isn't only fun to do, it's a valuable tool for graphic artists.



▲ The original image is quite normal—railroad tracks across the American west.



◄ Here Photoshop's Rough Pastels Filter created a new form of the image.



➤ The Find Edges filter in Photoshop transforms the image into a line drawing.

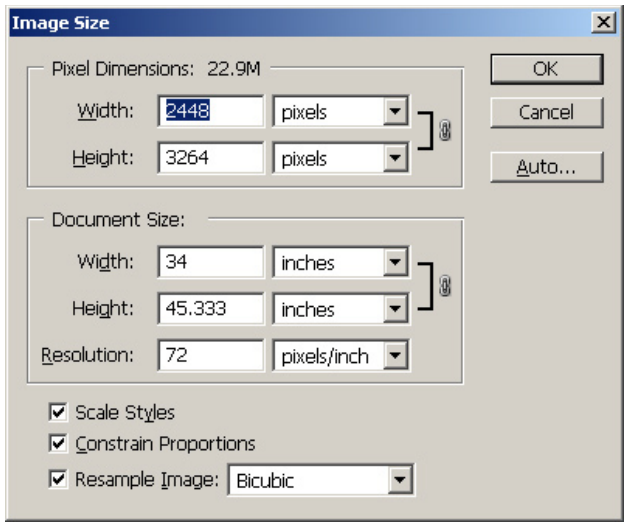


Click to visit the companion Web site



2.23 Photo-editing Tools—Resizing, Cropping and Rotating

Photo-editing programs make it easy to control the size and orientation of your images.



➧ Resizing in Photoshop can be done in two ways:

- You can change the number of pixels in the image, called its pixel dimensions, using a procedure called resampling. This process adds or deletes pixels to make the image larger or smaller. You might want to do this to reduce the size of images you will be sending by e-mail or posting on the Web. You might also want to increase the size of the image when making large prints.
- You can also change the size of the image without changing the number of pixels it contains, called its document size by specifying a new width or height. You normally do this when making a print or exporting an image to another application.



➧ Rotating an image may be necessary if you turned the camera vertically to capture a picture, or if the horizon line is tilted.



➧ The Crop tool icon.



➧ Cropping removes distracting or unimportant parts of an image or lets it fit into a layout. In Photoshop a colored shield covers the area of the image that will be cropped away (above) so you can visualize what the cropped image (bottom) will look like.



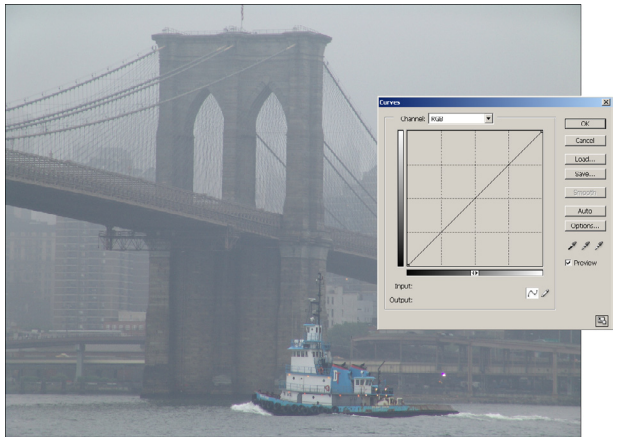
2.24 Photo-editing Tools—Adjusting the Tonal Range

Animation

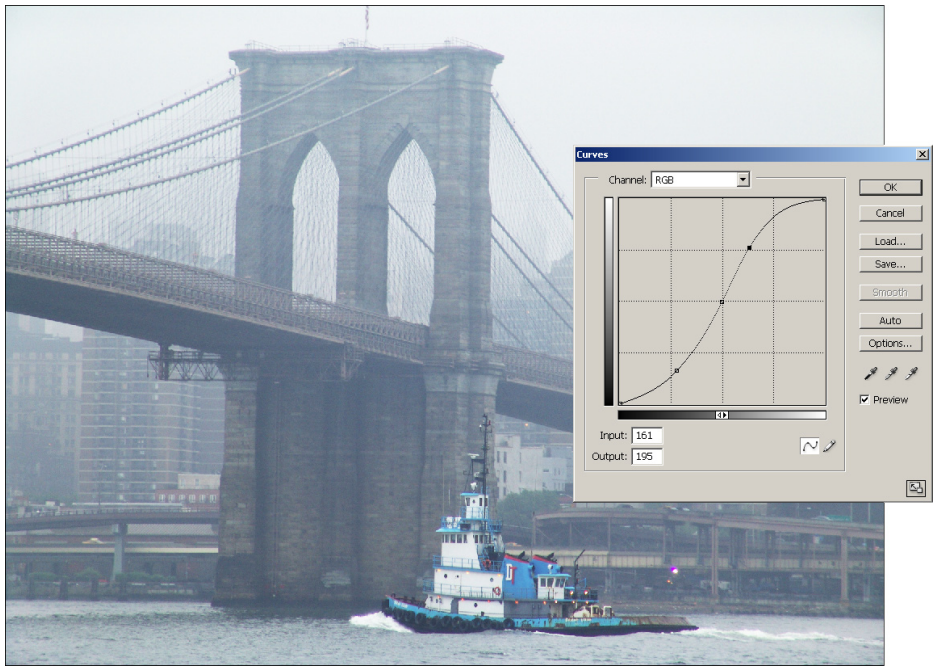
The *tonal range* or contrast in an image is the range of brightness between pure white and pure black. There are two ways to evaluate the tonal range—visually or graphically using a histogram. You should use both approaches because they are not mutually exclusive. Visually, images that use the full tonal range look rich, with smooth transitions in tones. Those that don't use the full range lack contrast, often looking flat and dull. Details may be hidden in highlight and shadow areas or the image may be too dark or light.



➤ Photoshop's Levels command can also be used to adjust an image's tonal range.



➤ The captured photo of the Brooklyn Bridge in New York City was too gray (above). Using Photoshop to adjust the tonal curve (right), makes the image look more like the foggy day on which it was taken.





Click to visit the companion Web site

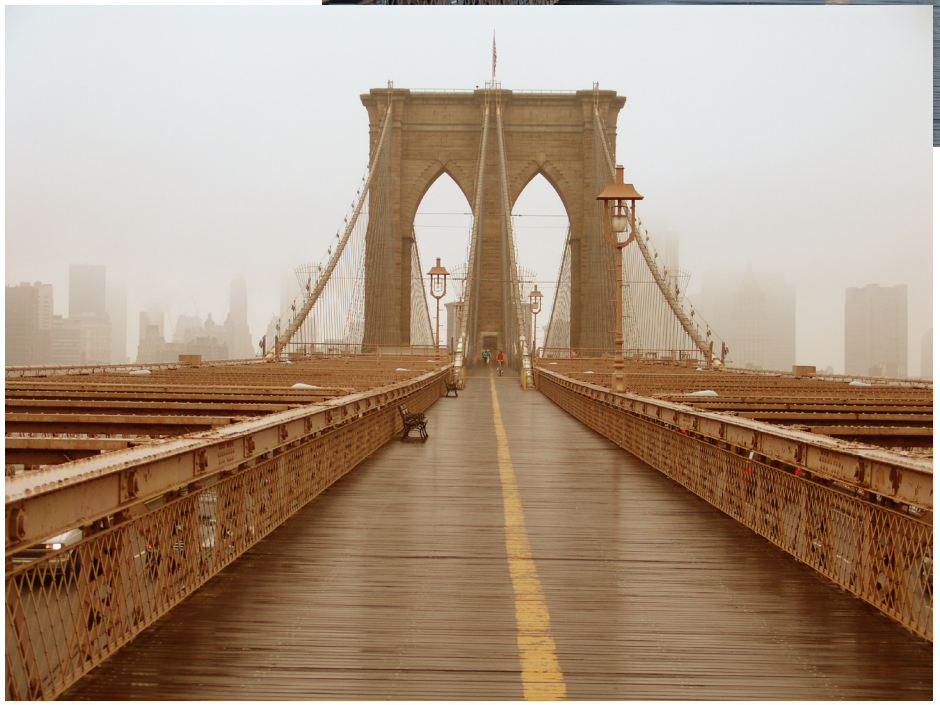
2.25 Photo-editing Tools—Removing Color Casts

Color casts can be removed so that white or gray areas are neutral and free of any color tint. One way to do this is to include a gray card in one of the shots so you have a standard known reference to adjust. If you then make the card a neutral gray, all of the other colors will also be free of color casts. If you don't have a gray card, you can adjust any area in the image that should be a neutral white, gray, or black.



▲ The middle eyedropper in Photoshop's Levels and Curves dialog boxes is used to remove color casts.

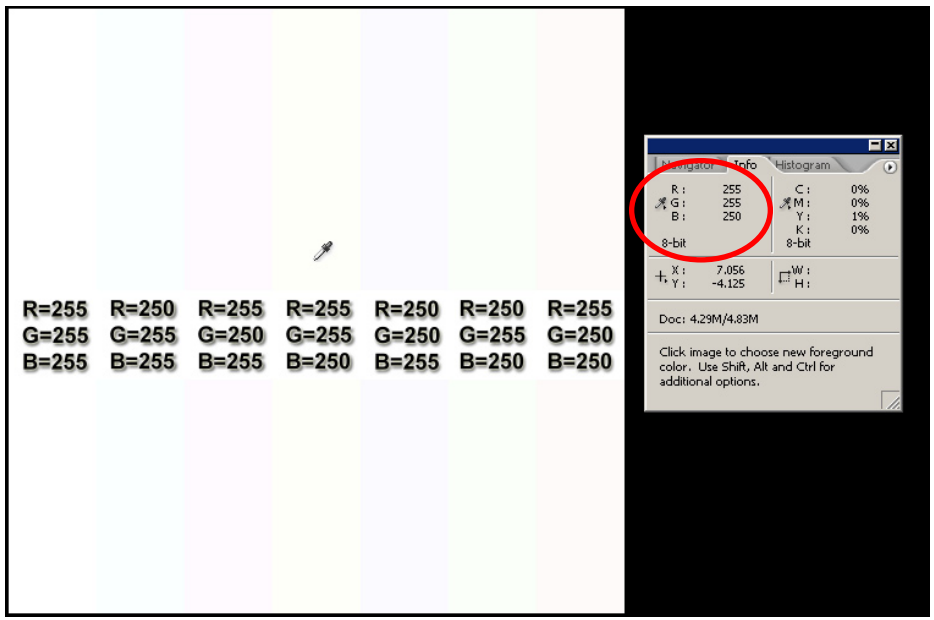




➤ The overcast skies gave a bluish cast to the original image (top right) that was removed in Photoshop (right) by making the sky a neutral color without any cast. The other colors all adjusted automatically.

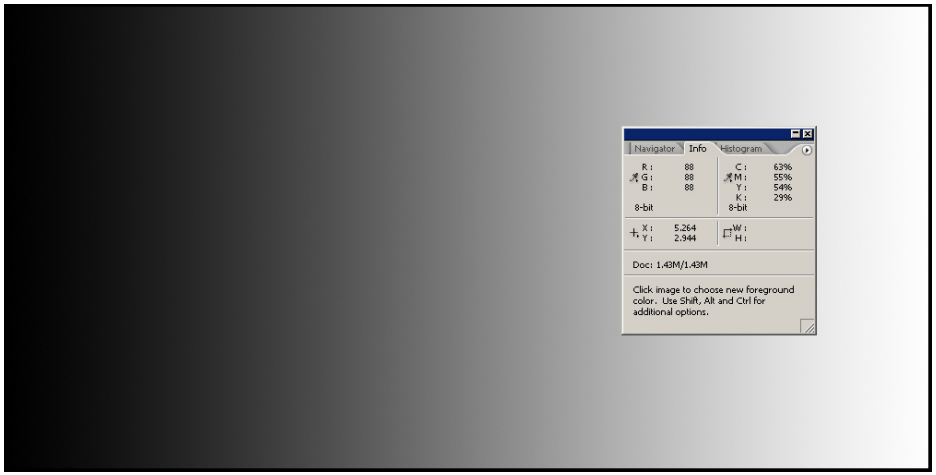
2.26 Photo-editing Tools—Removing Color Casts, A Word About Neutral

The term "neutral" refers to colors that have identical RGB values. For example, a color with a value of 127 (out of a possible 255) for R, G and B is middle gray. One with values of 255 is white and with 0s is black. If the values are not identical, the color is no longer neutral and has a color or color cast.



➤ Here seven strips each have different RGB values. Only one of the strips, the one on the far left, is neutral. Each of the others has a color cast that depends on which of the three values are off. (These differences are so subtle you may not be able to see them in a printed edition of this work.)

➤ Photoshop's info palette displays the RGB values of the pixels under the mouse pointer (here it's the eyedropper) so you can check that tones that should be neutral have equal R, G and B values so they don't have a color cast.



➤ A range of neutral tones from pure black to pure white.

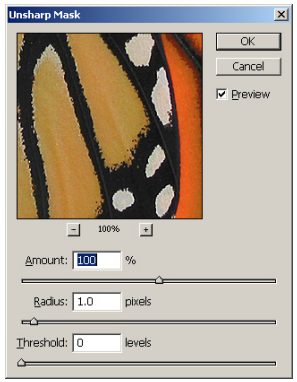
2.27 Photo-editing Tools—Sharpening

Animation

The apparent sharpness of an image depends a great deal on how much contrast there is along edges and lines. If an image looks soft, it can often be improved by sharpening with an *unsharp mask filter*.

This filter locates pairs of adjacent pixels that have a difference in brightness that you specify—the *threshold*. It identifies these as edges, and increases their contrast by the *amount* you specify. The changes affect not only the adjacent pairs of pixels, but also any that fall within a specified *radius*.

The term *unsharp masking* dates back to the darkroom era when images could be sharpened by aligning the original negative in the enlarger with a slightly blurred and underexposed copy of the same negative.



▲ Photoshop's unsharp mask filter dialog box has sliders you use to adjust the amount, radius, and threshold.



◀ This is the original image right out of the camera.



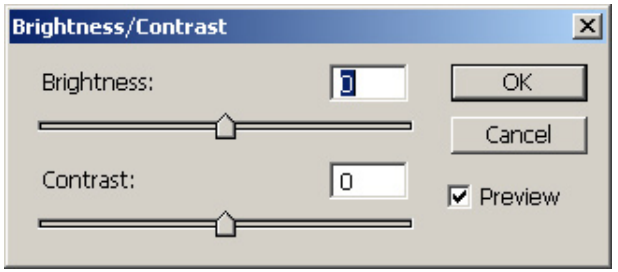
◀ This image has been sharpened using Photoshop's unsharp mask filter. Notice the change in the boundaries between the orange and black areas.



Click to visit the companion Web site

2.28 Photo-editing Tools—Brightness and Contrast





➧ In Photoshop you control brightness and contrast by dragging slider bars.

➧ Decreasing brightness darkens an image (left) while increasing it lightens it (right).

➧ Decreasing contrast makes colors in the image look more muted and "flatter" (left) while increasing it makes it look sharper and crisper (right).

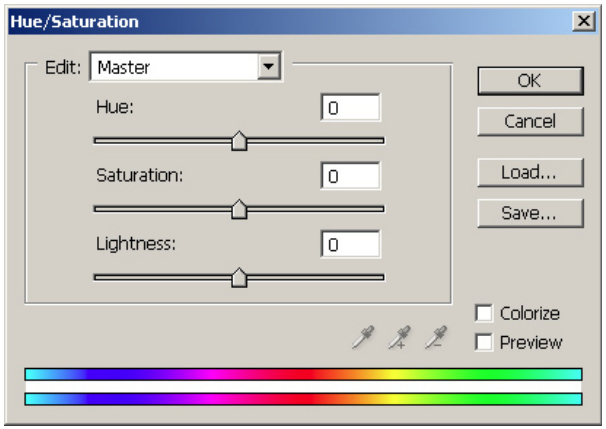


Click to visit the companion Web site

2.29 Photo-editing Tools—Hue and Saturation



➤ Hue is the property that gives colors their names. This color ring shows the primary colors (red, green and blue) separated by the secondary colors (cyan, yellow, and magenta). Complementary colors are opposite each other on the ring and include the cyan-red, magenta-green, and yellow-blue. As you increase one color in the pair, you decrease the other.



➤ Hue, saturation, and lightness are adjusted with Photoshop's slider bars.

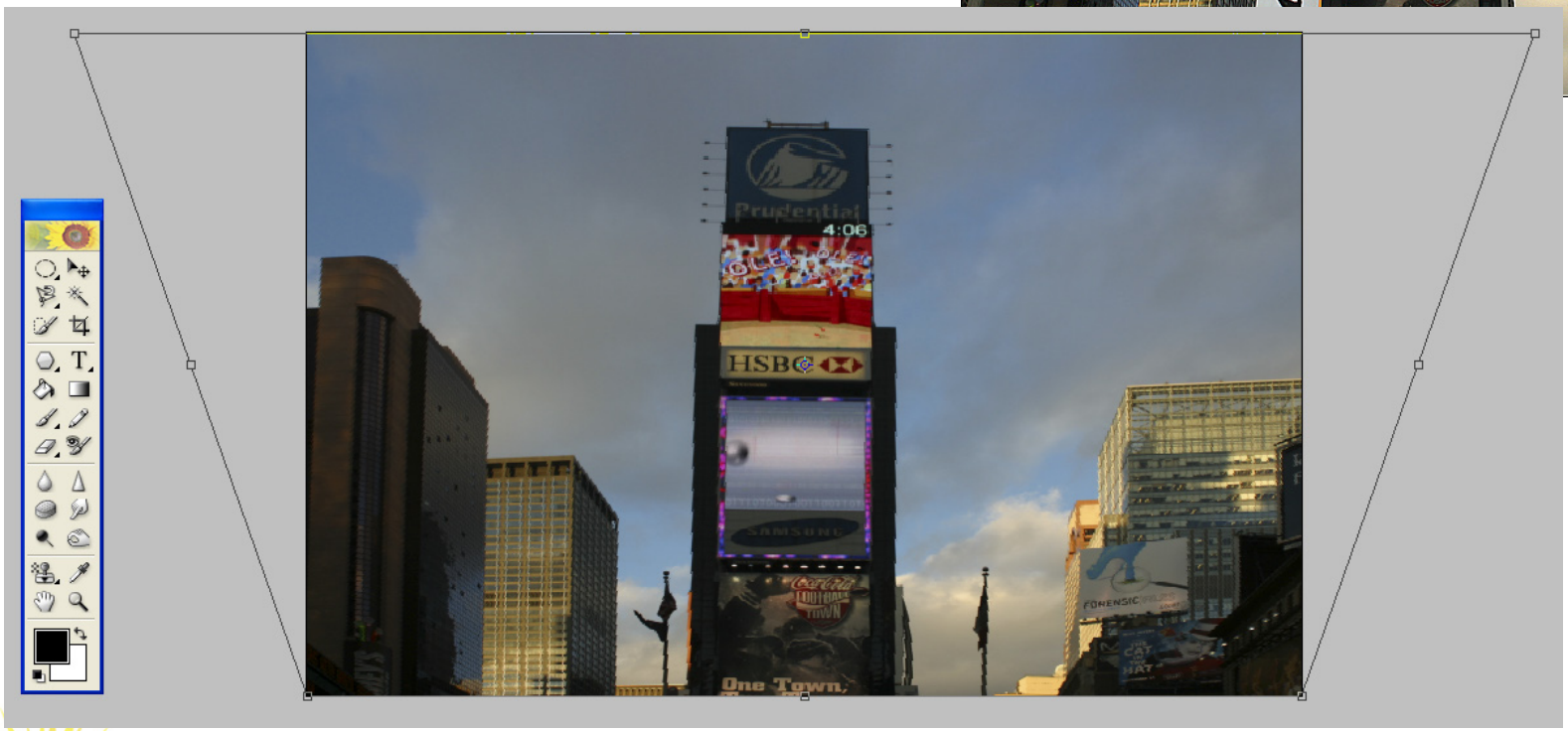


➤ Saturation refers to the intensity of a color. You can adjust all colors together or select just red, green, or blue for adjustment. Here the original colors (middle) are desaturated (left) and made more saturated (right).

2.30 Photo-editing Tools—Transforming

You can scale, rotate, skew, distort, and apply perspective to all or part of an image just by dragging handles on a selection box. One use of these tools is to correct the keystoning (converging vertical lines) you get when you point the camera up to photograph buildings.

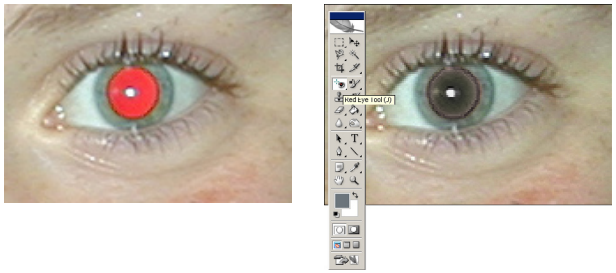




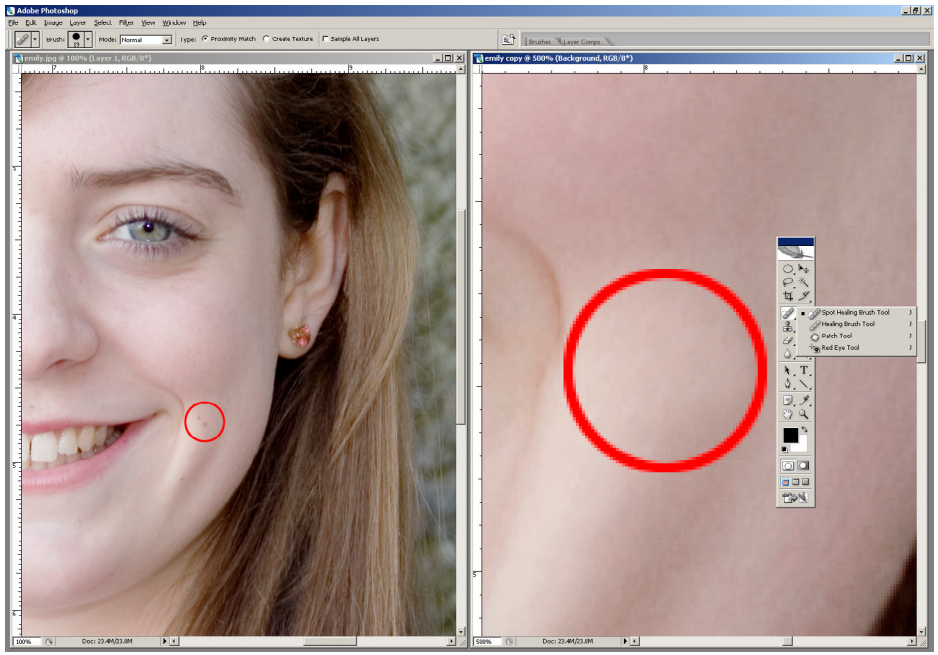
➤ An image with converging verticals (top) can be corrected by selecting the Perspective command and dragging one of the top corner handles until the verticals in the image are parallel (bottom).

2.31 Photo-editing Tools—Touching Up

Many images have small imperfections that can be retouched with a variety of tools. For example, a portrait subject might have a small blemish that will be very noticeable in an enlargement. There may be reflections, or even telephone wires you want to remove. Small areas may benefit by being made a little lighter or darker than their surroundings. Portrait subjects may have red-eye caused by flash in a dark room.



➤ Here is red-eye before (left) and after the Red Eye Removal tool was used to correct it (right).



➤ Many photos have dust spots or minor blemishes (left) that you can easily remove (right) with the Healing Brush tool.



➤ Photoshop's cloning tool was used to remove the telephone wires from the right side of the image.



Click to visit the companion Web site

2.32 Photo-editing Tools—Selecting

Normally, your adjustments affect the entire image. However, if you first select an area of the image, you can edit just that area without affecting other, unselected, areas. You can also copy, move, or delete selected areas, perhaps to remove a background or create a composite image.







➤ In this example, the background of the monster has been selected and removed (top left). A new photo was then opened (bottom left) and the monster pasted in (above) to create a composite image.

2.33 Photo-editing Tools—Adding Text

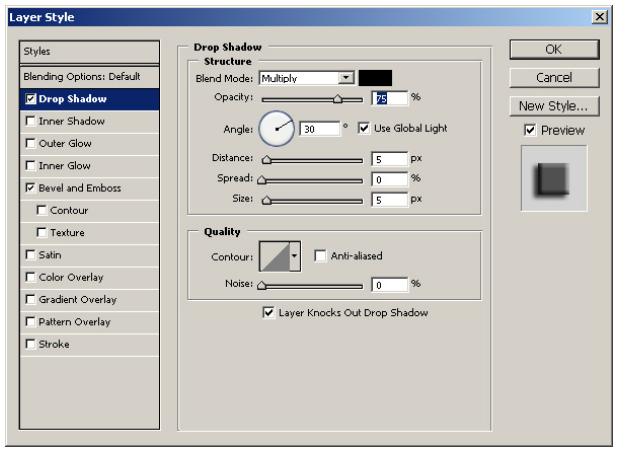
Adding text to images is usually the realm of graphic designers. However, you should know how to do this so you can create title slides for your slide shows, add copyright notices to your images, or just invent ways to combine text and images in creative ways.

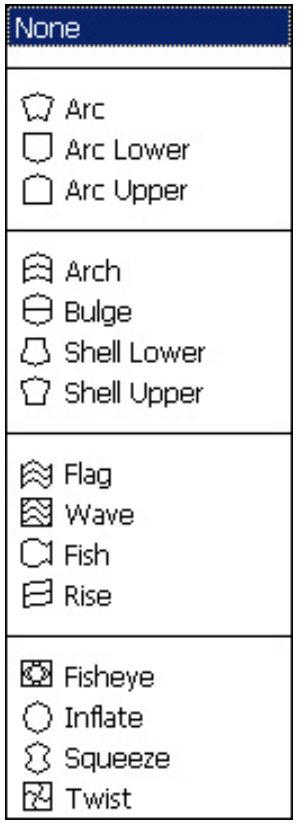


➤ Text can be easily formatted (above) using the Layer Style palette (right).

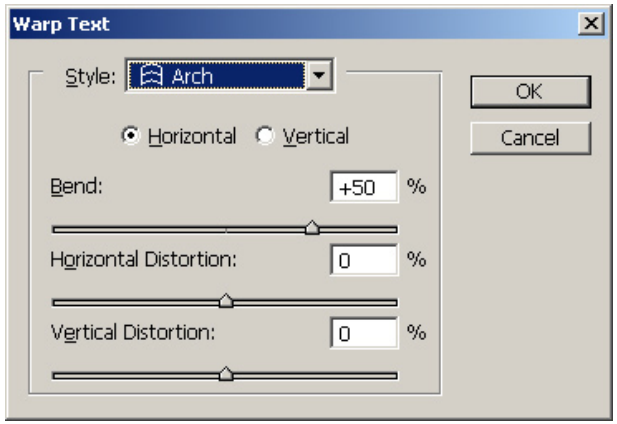


➤ Here text was typed over an image of pine needles and then selected, cut, and pasted into another image.





➤ When you click the Warp Text button it displays the menu (left) and selecting a choice displays the dialog box (below).



2.34 Photo-editing Tools—Layers

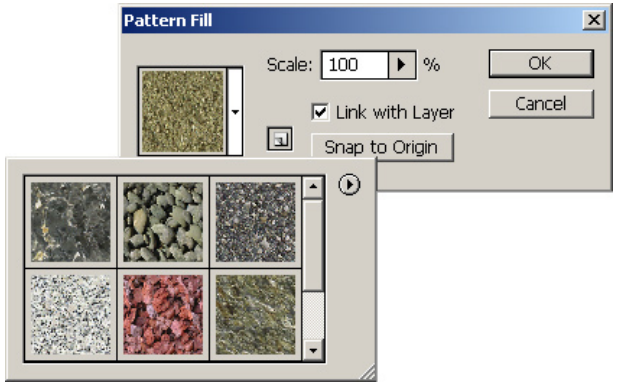
Layers let you overlay changes on the original image without permanently affecting it. You add layers as you edit and if you then hide or delete the layers, the image reverts to its original form. Before layers were introduced, changes were made to the original image and were difficult or impossible to undo later. Every change had to be well planned, as if you were carving in stone. The more you learn about layers the more uses you will find for them—even using them to create animations.



➤ Adjustment layers affect the layers below them. Here a Photo Filter adjustment layer has been added to make the colors warmer.



➤ The Layers palette displays all of the layers in an image. Here they include (from bottom to top), the background layer, an adjustment layer, and a text layer.



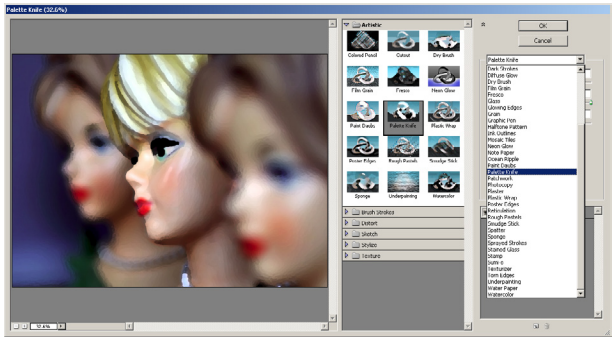
➤ Layers can be filled with solid colors, gradients, and fills like the patterns shown here.

Click to visit the companion Web site

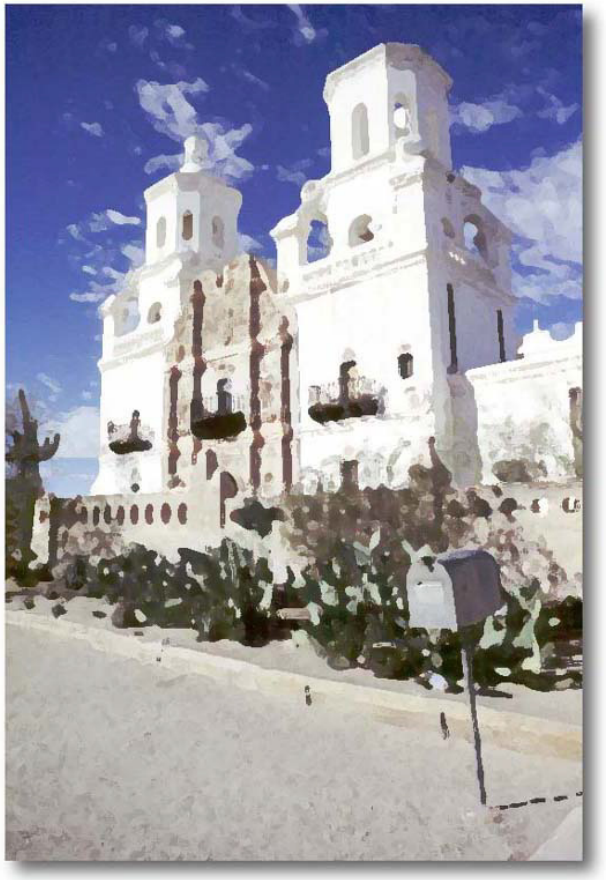
2.35 Photo-editing Tools—Filters

Since one of the most interesting things to do with digital images is to modify them in some way, filters are a great place to start. Many, such as the unsharp filter are used to make your images look more like the original scene. However, many others can make photos look like paintings, stained glass windows, or other objects. You can emboss images, twist and twirl them, add textures, and create all kinds of creative havoc. Filters are easy to use, you just select one and sit back and watch your computer go to work. If you don't like the result, just use the undo command. And don't stop with just one filter, use two or more in succession on the same image and watch as it moves further and further from reality.

➤ Photoshop gathers many of its filters together into a gallery with small thumbnails illustrating each filter's effects.



➤ The watercolor filter makes a photo look like a painting.







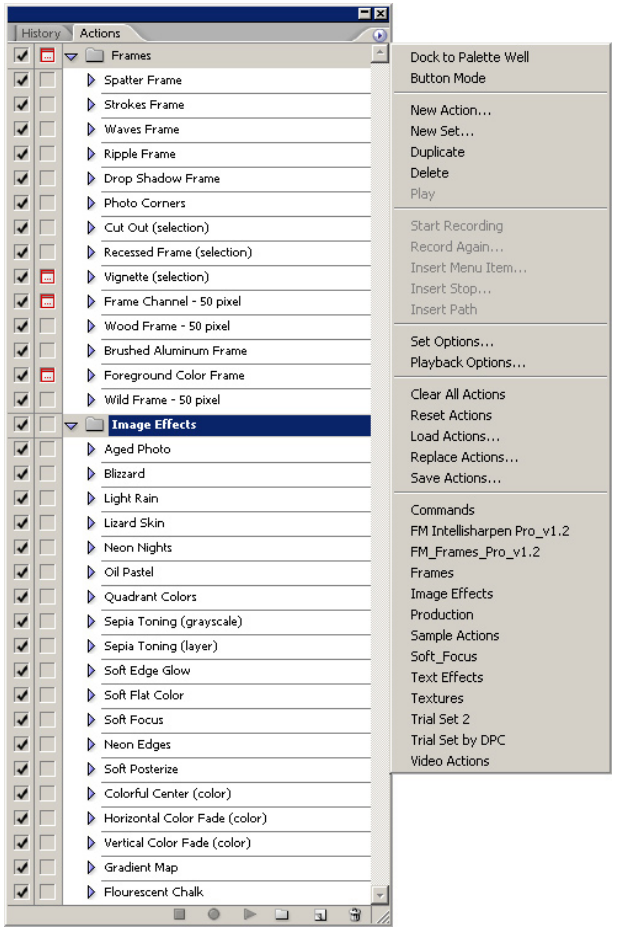
➤ The original image (left) was altered with a filter that traced edges in neon (right).

2.36 Photo-editing Tools—Actions

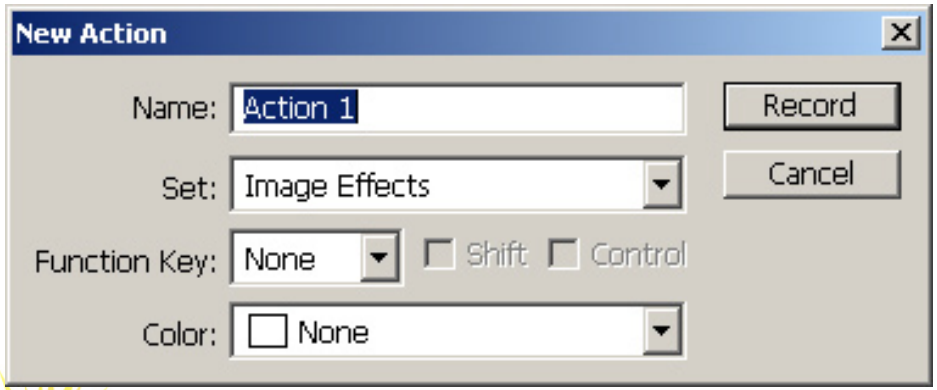
Photoshop lets you automate tasks by grouping a series of commands into a single command. Photoshop calls these *actions* but they are similar to macros in other programs.



➤ Here an action was used to add a simulated mat and frame to an image.



➤ Photoshop's Action palette lists any actions you have created or loaded and has a cascading menu that you use to create and manage your actions.



➤ When you select New Action from the Actions palette menu, a dialog box lets you name it and assign it to a set.



Photo COURSE

Controlling Exposure

Chapter 3

3.1 Understanding Exposure

Animation

Photography begins with an exposure when you press the camera's shutter button. The shutter opens and light reflected from the scene enters through the lens aperture and strikes the image sensor to create the image. By controlling how much light reaches the sensor you control how light or dark the picture is.



Less light makes an image darker (left) and more light makes it lighter (right).



There are at least 256 tones captured for each color—red, green, and blue. The sensor only captures brightness and the colors are created by image processing software and hardware. Only one tone at the shadow (black) end of the range and one at the highlight (white) end are pure and have no detail.

3.2 Understanding Exposure, con't.

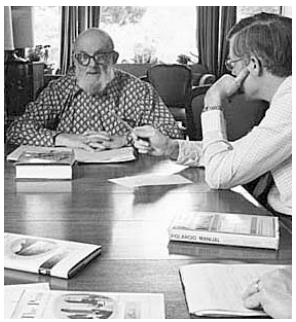
Knowing how to control exposure is one of the most important aspects of photography. When a scene has both very light and very dark areas, getting the perfect exposure is a lot like parking a large car in a small garage—there isn't much room for error. The goal is to hold details in both the darkest and lightest areas so pure white is used only for spectral highlights such as reflections and pure black is used only for areas of the scene that are black with no details.



▲ In this scene there are details in all of the whites that give them texture and form. The small white square has been added to give you a reference to what pure, detailess white would look like.



▲ In this scene there are details in the darkest shadows. The small black square has been added to give you a reference to what pure, detailess black would look like.



◀ One of the things that makes an Ansel Adams print so stunning was his ability to hold details in both the brightest and darkest parts of a scene. To do this with film he developed the Zone System that guided him in adjusting exposure and development times for the best results. Today the adjustments are made with Photoshop.

3.3 Understanding Exposure–The Controls

The shutter speed and aperture settings both affect the exposure, the total amount of light reaching the image sensor, and thus control how light or dark a picture is. However, as you'll see shortly they are also the most creative controls you have on any camera.

•The *shutter* opens to begin an exposure and closes to end it. The shutter speed setting determines how long the shutter opens to expose the image sensor.

• The *aperture* is the hole through which light enters the camera. The size of the hole can be changed to control the brightness of the light that reaches the image sensor.



➤ It's not just old cameras that use waterhouse stop. The Lensbaby "a selective focus SLR camera lens" comes with four apertures you can insert into the lens.



➤ In the early days of photography, a plate called a waterhouse stop, was inserted into a slot in the lens. The size of the stop's hole acted just like the iris apertures used today. A lens cap was removed and then replaced to begin and end the exposure—a primitive version of a shutter. This vintage camera is surrounded by waterhouse stops (apertures) and a lens cap (the shutter) leans against it.

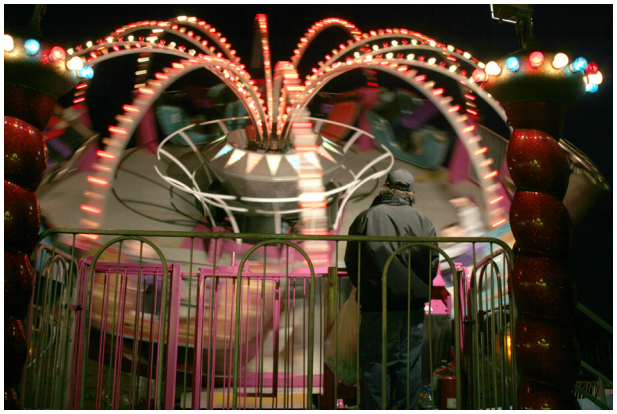
Photo by Ake Borgstrom at www.photographica.nu.



Click to visit the companion Web site

3.4 Understanding Exposure–Why Choices?

Many digital cameras let you change shutter speed and aperture settings. Since you only need one combination of these settings for a good exposure, why are there choices? It's because they give you creative control. By selecting the right combination you can freeze or blur motion or make the background in a portrait sharp or blurred.





➤ A fast shutter speed freezes a spinning amusement park ride (top) and a slow shutter speed blurs it (bottom).





➤ A small aperture increases depth of field so foreground and background are sharp (top) and a large aperture decreases depth of field so the background is soft (bottom).

3.5 Understanding Exposure–The Range of Choices

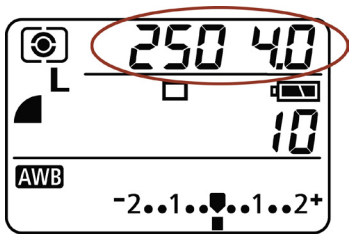
A change in the aperture or shutter speed doubles or halves the exposure. For example, a change from f/11 to f/16 halves the exposure while a change from f/11 to f/8 doubles it. These traditional settings are called *stops* or *full stops* and are shown bold on the accompanying tables. However, many cameras also let you change exposure settings in one-half or one-third stop increments for more precise control. In the table one-third and one-half stops are shown in red and blue respectively.

Apertures		
f/1.4		
	f/1.6	f/1.7
	f/1.8	
f/2.0		
	f/2.2	f/2.5
	f/2.6	
f/2.8		
	f/3.2	f/3.4
	f/3.6	
f/4.0		
	f/4.5	f/4.7
	f/5.0	
f/5.6		
	f/ 6.3	f/6.7
	f/ 7.0	
f/ 8.0		
	f/9.0	f/9.5
	f/10	
f/11		
	f/13	f/13
	f/14	
f/16		

➤ Apertures, called f/stops and preceded by f/, are usually between f/1 (the largest) and f/64 (the smallest) although few cameras have the full range and it's possible to have both smaller and larger apertures. On SLRs the aperture range is determined by the lens you are using.

Shutter Speeds		
1"		
	1"3	1/5
	1"6	
1/2		
	1/2.5	1/3
	1/3	
1/4		
	1/5	1/6
	1/6	
1/8		
	1/10	1/11
	1/13	
1/15		
	1/20	1/20
	1/25	
1/30		
	1/40	1/45
	1/50	
1/60		
	1/80	1/90
	1/100	
1/125		
	1/160	1/180
	1/200	
1/250		
	1/320	1/350
	1/400	
1/500		
	1/320	1/350
	1/400	
1/1000		

➤ Shutter speeds, are often given as fractions for parts of seconds and as whole numbers for full seconds. They usually range between 30 seconds and 1/8000 second although most cameras don't have this full range.



➤ Many cameras display the current aperture and shutter speed settings on the monitor, in the viewfinder, or on a separate LCD panel when you press the shutter button halfway down.



➤ On older film cameras you select apertures by turning a ring on the lens.



➤ On older film cameras you select shutter speeds with a dial.

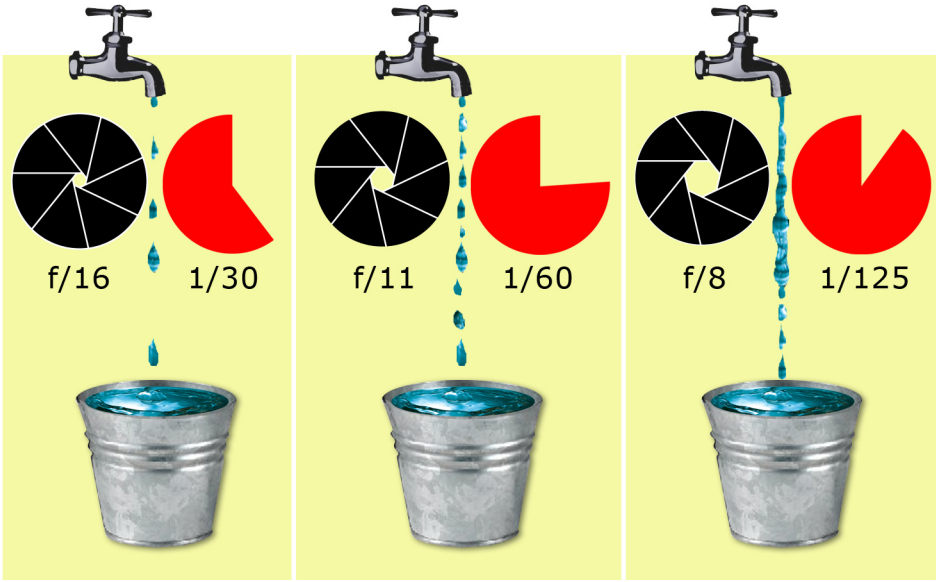
3.6 Understanding Exposure–Analogy #1

One way to think of apertures and shutter speeds is as a faucet and stop watch.

- When you open a faucet all the way, water gushes out so you fill a bucket in a very short time. This is the same as pairing a large aperture and fast shutter speed to let in bright light for a short time.

- When you open a faucet just a little, water trickles out and so it takes a much longer time to fill a bucket. This is the same as pairing a small aperture and slow shutter speed to let in dim light for a longer time.

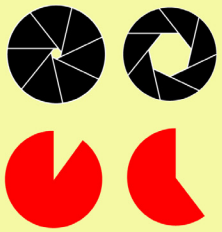
No matter which combination you choose, the bucket is filled the same amount. Likewise, an image in a camera can be exposed the same amount by various aperture and shutter speed combinations while also controlling motion and depth of field.



1. We start with the aperture set to f/16 and the shutter speed to 1/30.

2. When you open the aperture one stop to f/11 the shutter speed has to decrease to 1/60 to keep the exposure the same. This change decreases depth of field slightly and freezes action better.

3. When you open the aperture another stop to f/8 the shutter speed has to decrease another stop to 1/125. This change decreases depth of field even more and freezes action even better.



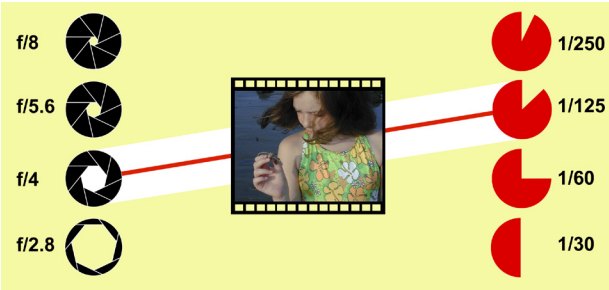
- Our aperture icons in this book indicate small apertures with small holes and large apertures with large holes.
- Our shutter speed icons indicate speeds with pie shaped slices, much like those that would be swept by the hand on an analog stop watch. A short sweep indicates a fast shutter sheep and a long sweep a slow one.

3.7 Understanding Exposure–Analogy #2

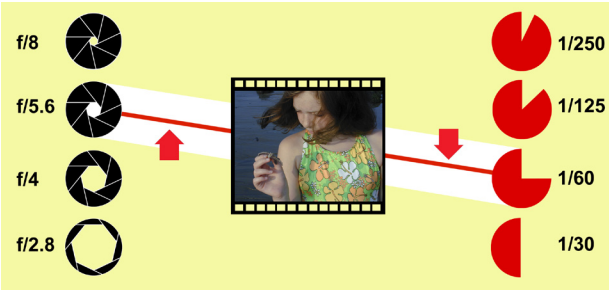
Animation

Another way to think of exposure is as a seesaw. As one child rises a given distance, the other falls by the same amount but their average distance from the ground is always the same. With your camera, when you or the camera changes the aperture or shutter speed to let in more or less light, you or the camera must also change the other setting in the opposite direction to keep the exposure constant.

The illustrations below show how a change in the aperture setting must be matched by a change in the shutter speed and vice versa. As these offsetting changes are made, the exposure stays constant but depth of field changes slightly and subjects are more or less likely to be frozen.



1. Here the aperture is f/4 and the shutter speed is 1/125.



2. If you reduce the aperture one stop to f/5.6 the shutter speed has to decrease one stop to 1/60 to keep the exposure the same.

Depth of field increases slightly and the possibility of subject blur increases.



3. If you reduce the aperture one more stop to f/8 the shutter speed has to decrease one more stop to 1/30 to keep the exposure the same.

Depth of field increases even more as does the possibility of subject blur.

3.8 Exposure Modes—Selecting

Animation

Since the aperture and shutter speed are so important, many cameras give you more than one way to control them. Almost all digital SLR cameras and most high-end fixed lens cameras have a mode dial that let's you select from a variety of exposure or shooting modes. Point and shoot cameras often let you achieve the same end with buttons or menu choices. You can get similar results in any of the modes but each has certain advantages in specific situations.



➤ Modes and how they are designated on the camera vary from model to model. Those that give you the most control, available only on more advanced cameras, are usually indicated with letters. Those that are fully automatic, often called scene modes, are indicated with icons like those shown here on this Canon mode dial.

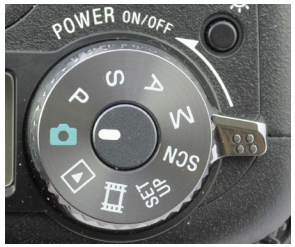
- A-DEP (auto depth of field)
- M (manual)
- Av (aperture-priority)
- Tv (shutter-priority)
- P (Programmed AE)
- Auto
- Portrait
- Landscape
- Macro
- Sports
- Night Portrait



➤ On some cameras you select exposure modes using buttons or a menu.



➤ A Nikon mode dial.



➤ A Sony mode dial.



Click to visit the companion Web site

3.9 Exposure Modes—Auto & Programmed

Almost every camera has an automatic exposure mode that selects both the aperture and shutter speed for you. Higher-end cameras also have a *program mode* that, although fully automatic, lets you change some settings that you can't change in auto mode. One version is called *flexible program mode*. It lets you select from all of the available aperture-shutter speed pairs that give the same exposure so you can portray motion or depth of field the way you choose.



➤ The auto mode icon is usually the word "AUTO" or a camera icon.



➤ Program mode is often indicated on mode dials with the letter P.



➤ On a cloudy bright day there are no black shadows or bright highlights that can confuse an exposure system so auto and program modes usually works very well.



➤ Landscapes and other outdoor scenes are usually captured very well in auto or program mode.

3.10 Exposure Modes—Scene Modes

Many cameras offer scene specific modes that are fully automatic but have settings preset for specific situations. The choices are limited only by the camera designer's imagination.



➤ Portrait mode uses a large aperture for minimum depth of field so a portrait or other subject will have a soft, and less distracting, background.



➤ Landscape mode uses a small aperture for maximum depth of field so everything is sharp from foreground to background.



➤ Sports mode uses a fast shutter speed to freeze motion.



➤ Macro or close-up mode is used to photograph small objects such as flowers where you want to get as close as possible to enlarge the subject in the image.



➤ Night landscape mode uses a slow shutter speed to capture a landscape, and especially a cityscape, at dawn, dusk, or night.



➤ Night portrait mode captures a foreground subject against a night sky or cityscape. It illuminates foreground subjects with the flash and uses a slow shutter speed to lighten the background.

Other scene modes you might encounter include:

- Party/Indoor is for dimly lit scenes where flash is required.
- Beach/Snow overexposes slightly to lighten snow, sand and sunlit water scenes.
- Sunrise/Sunset captures the vibrant colors of sunrises and sunsets.
- Museum takes pictures with the flash off.
- Fireworks captures fireworks at night.
- Copy captures black and white photos of text or drawings from a whiteboard or printed matter.
- Back Light fires the flash automatically in backlit scenes to lighten shadows.

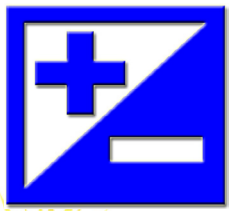
3.11 Shutter-Priority–Introduction

Animation

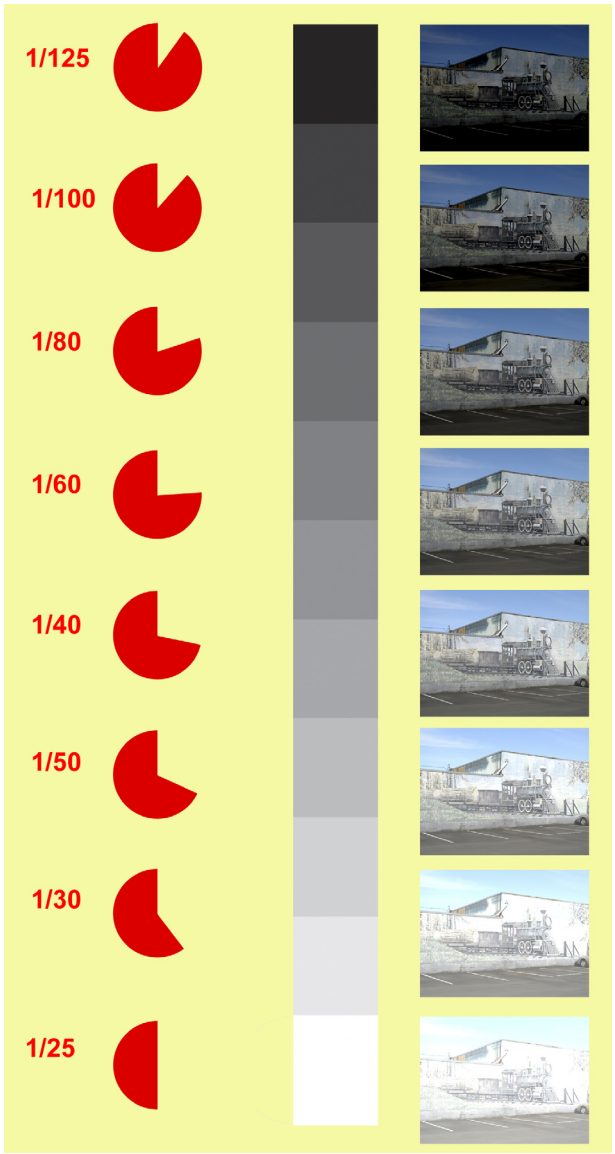
In *shutter-priority* mode (sometimes called Tv or time-value mode), you select a shutter speed and the camera selects a matching aperture. Since changing the shutter speed doesn't change the exposure in this mode, you usually do it to control how motion is portrayed in your images. However, since changing the shutter speed also changes the aperture, you can indirectly control depth of field.

Shutter Speed	Readout
30 seconds	30”
4 seconds	4”
2 seconds	2”
1/2 second	2
1/4 second	4
1/30 second	30

➤ On many cameras a quotation mark (”) indicates full seconds and a fraction's denominator without a quotation mark indicates fractional seconds. For example, 2” means 2 seconds and 2 means 1/2 second.



➤ Changing the shutter speed doesn't change the exposure but exposure compensation and other techniques will lighten or darken the image.



➤ As the shutter speed gets slower, the image gets lighter. The reason you don't usually see this effect in your images is because when you or the camera change the shutter speed, the camera changes the aperture to keep the exposure constant.

3.12 Shutter-Priority–Types of Shutters

Animations

There are three different kinds of shutters used in digital cameras—leaf, electronic, and focal plane.

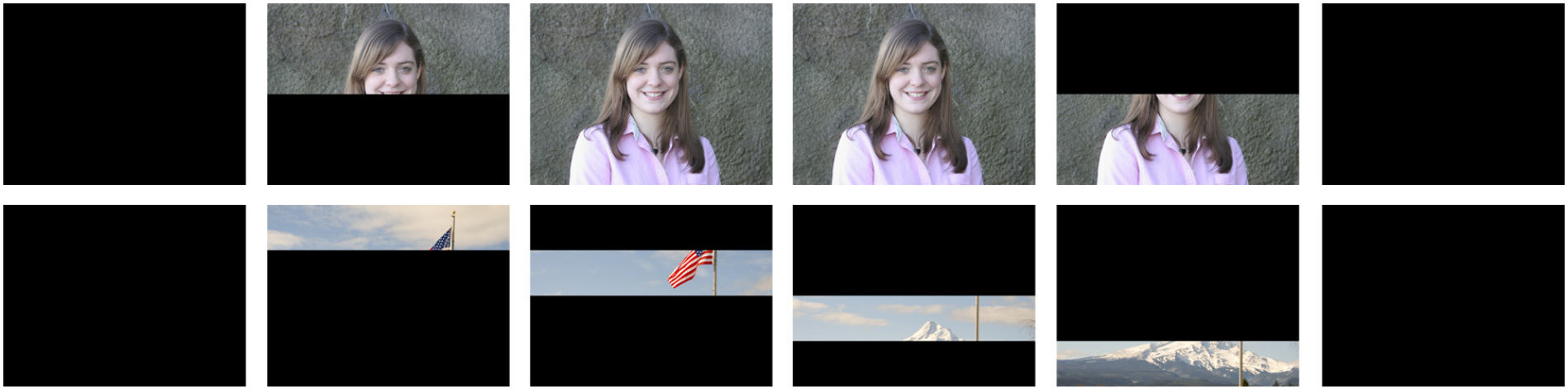
➤ Leaf shutters, alone or combined with an electronic shutter are used on some point and shoot cameras. On some inexpensive cameras, the shutter also acts as the aperture by varying how far it opens.



➤ Leaf and focal plane shutters are both mechanical and have moving parts—leaves or curtains. There are also electronic shutters that simply turn the sensor on and off to capture the exposure. It's like turning a vacuum cleaner on to start accumulating dust and off to stop.

Courtesy of Dyson Ltd. at www.dyson.co.uk





➤ All SLRs and some expensive rangefinder cameras use a focal plane shutter that opens one curtain to begin an exposure and closes another curtain to end it (top). At high shutter speeds, there is a slit between the two curtains moving across the image sensor (bottom).

3.13 Shutter Priority—Freezing and Blurring Motion

Animation

When the portrayal of motion is important, you select a shutter speed that gives you the effect you want. A fast shutter speed opens and closes the shutter so quickly a moving subject doesn't move very far during the exposure so it appears frozen. A slow speed allows a moving subject to move sufficiently to blur its image on the image sensor.



➤ A fast shutter speed freezes a crane as it lands on its nest.



➤ A spinning windmill is blurred with a slow shutter speed (left) and frozen with a fast one (right).

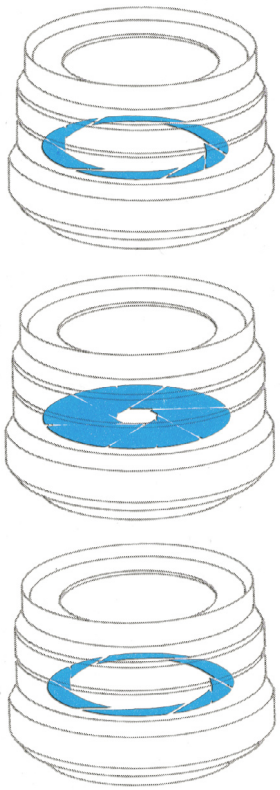


➤ Photographers use slow shutter speeds to blur water as was done with this waterfall along the Columbia River in Oregon.

3.14 Aperture-Priority—Introduction

Animations

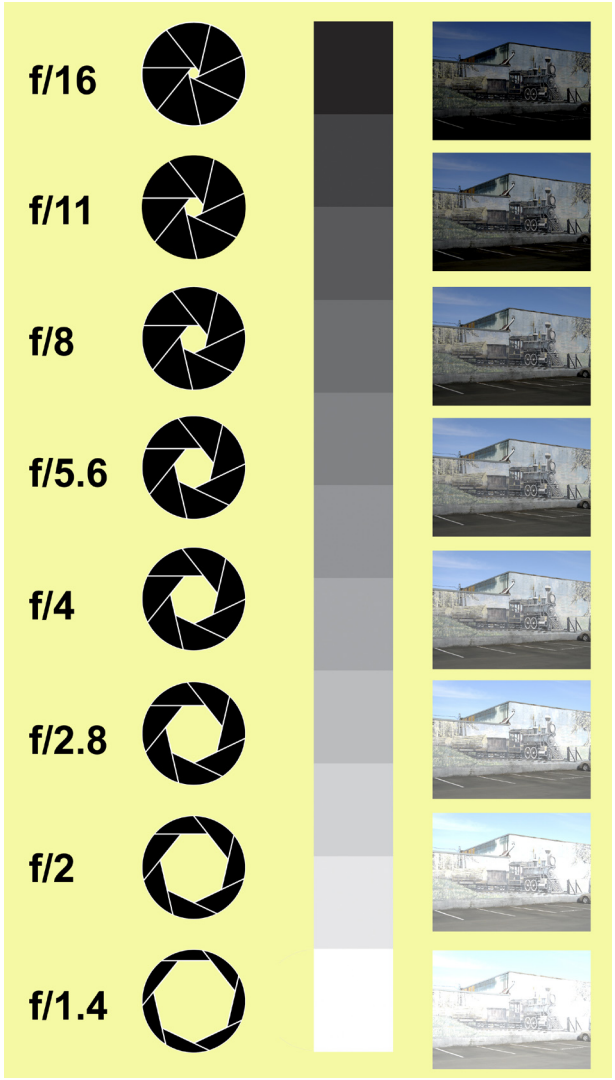
In *aperture-priority* mode, you select an aperture and the camera selects a matching shutter speed. Since changing the aperture doesn't change the exposure in this mode, you usually change it to control how depth of field is portrayed in your images. However, since changing the aperture also changes the shutter speed, you can indirectly control the portrayal of motion.



➤ The aperture is a series of overlapping leaves located between the glass elements in the lens. When focusing and composing an image on an SLR the aperture is wide open. When you take a picture it closes down to the selected aperture and then reopens.



➤ The largest aperture on a lens is called its maximum aperture. The larger this is, the faster, and generally the more expensive, the lens. Leica makes an f/1 lens shown here.



➤ As the aperture number gets smaller (for example, from f/16 to f/11) the aperture opening gets larger and the image gets lighter. The reason you don't usually see this effect in your images is because when you or the camera change the aperture, the camera changes the shutter speed to keep the exposure constant.



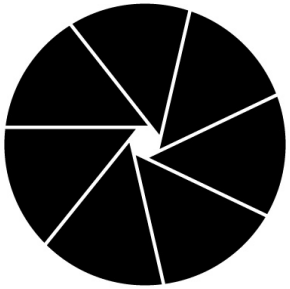
Click to visit the companion Web site

3.15 Aperture-Priority—Depth of Field

Animation

Choosing an aperture is one way you control depth of field—what is sharp in your picture from foreground to background. Smaller apertures give you greater depth of field than larger ones.

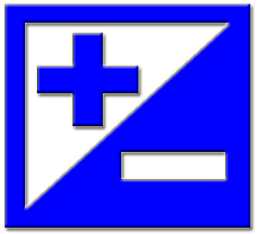








➤ Smaller apertures give greater depth of field (top) than do larger apertures (bottom). In both images the camera was focused on the same gray house and only the aperture was changed.



➤ Although changing the aperture doesn't change the exposure in this mode, you can use exposure compensation and other techniques to lighten or darken the image.



➤ At close distances, depth of field is very shallow, even when you use a small aperture (left). The same aperture at a greater distance will give you great depth of field (below).

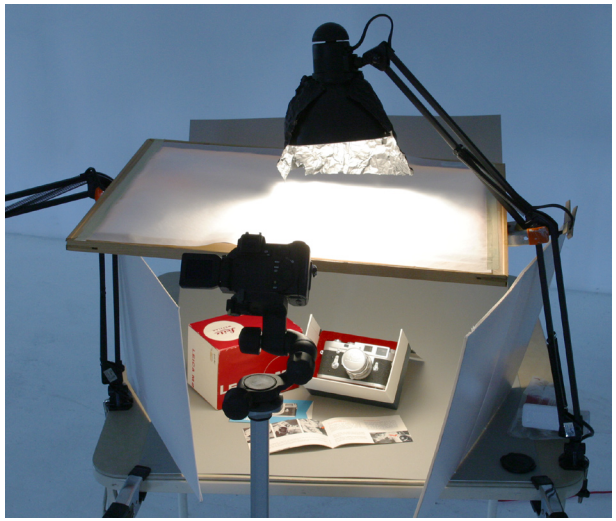


3.16 Manual Mode

When you want total control over exposures, you can switch to manual exposure mode and select both the shutter speed and aperture. Since automatic exposure combined with exposure compensation is so easy to use, most photographer's only use manual mode in those rare situations where other modes can't give them the results they want—especially in situations where they are shooting a series of related photos and want the exposure constant from frame to frame.



▲ On many cameras an exposure scale or some other indicator shows you how much you are under (-) or over (+) the exposure recommended by the camera (0). If the -2 or +2 are flashing it means you are off by more than two stops.



◀ Manual mode is often used in studio settings where you want to keep the exposure constant for the main subject but try lighting variations on the background.



◀ When capturing images for an animated GIF, manual exposure keeps exposures constant so the animation doesn't flicker when it's played back.



▲ When shooting a series of photos to be stitched into a panorama like this one of the Cadillac Ranch, manual exposure keeps the lighting even from frame to frame. This makes it possible for them to blend together seamlessly.

3.17 Manual Mode–Bulb

Some cameras have a *bulb mode* that lets you keep the shutter open as long as you hold down the shutter button. You control the exposure by varying the time you keep the shutter open and by varying the aperture.





➤ Bulb is used to capture light trails. On a dark night just set the camera to bulb in a place where lights are moving and they will appear as streaks in the image.



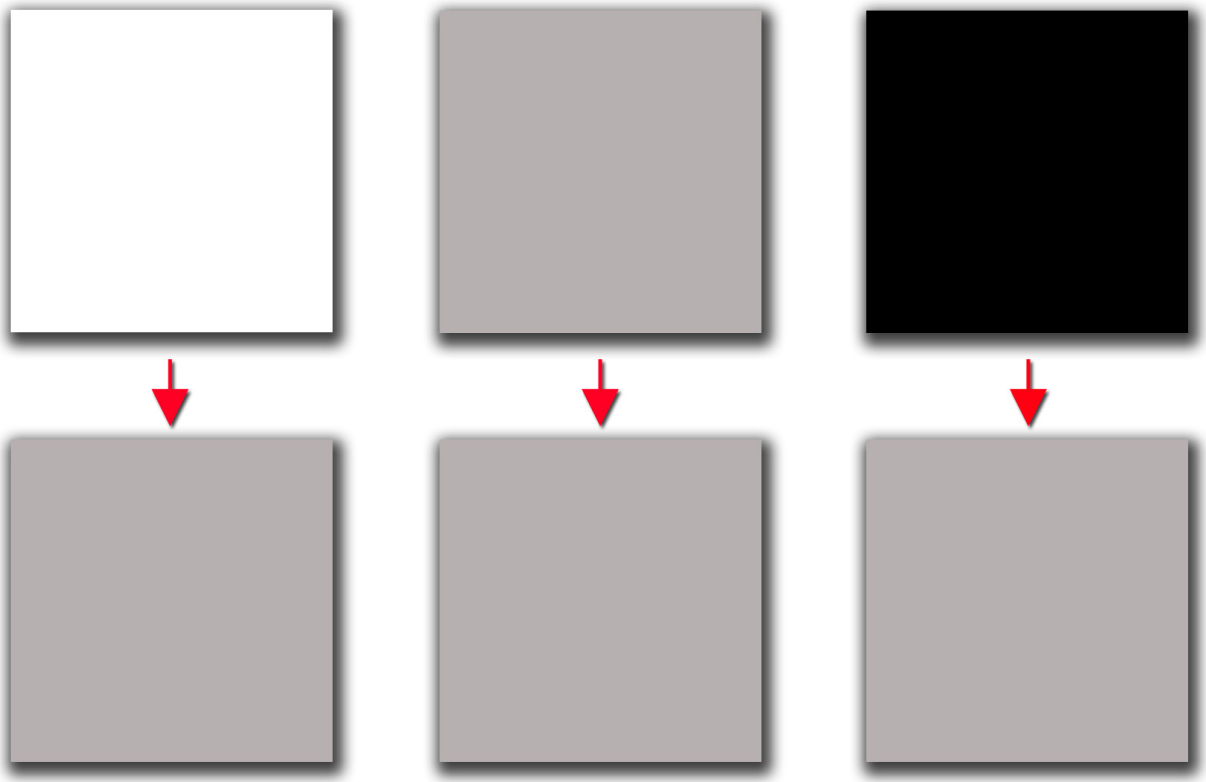
➤ Since holding down the shutter button can be tiring and introduce camera shake, some remote cable releases let you lock the shutter open until you unlock it.

➤ Bulb is great for time exposures such as those needed to capture fireworks. When left open long enough you can even capture multiple bursts in the same image.

3.18 How Your Exposure System Works—Middle Gray

Animation

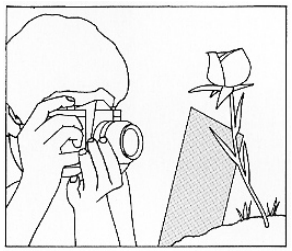
One of the most important things to understand in photography is that exposure systems are designed to measure the light reflecting from part or all of the scene, average it, and set the exposure to record that brightness as *middle gray*. This works because most scenes average out to middle gray, a tone that reflects 18% of the light falling on it.



➧ Because of the way your exposure system works, if you photograph a white card, a gray card, and a black card, the exposure system sets the camera to capture each as middle gray.



➧ Your exposure system sees a scene as if it were looking at it through frosted glass. It doesn't see details, just averages. It's this average that it exposes for middle gray.





➧ When you fill the viewfinder with a gray card and press the shutter button halfway down, your camera will indicate the best exposure regardless of how light or dark the scene is.



Click to visit the companion Web site

3.19 When Automatic Exposure Works Well

Automatic exposure works well in most situations, especially those in diffuse light or open shade.



▲ This portrait, taken under a cloudy bright sky is perfectly exposed with autoexposure.



▲ This landscape of Canyon de Chelly was taken on an overcast morning using autoexposure.



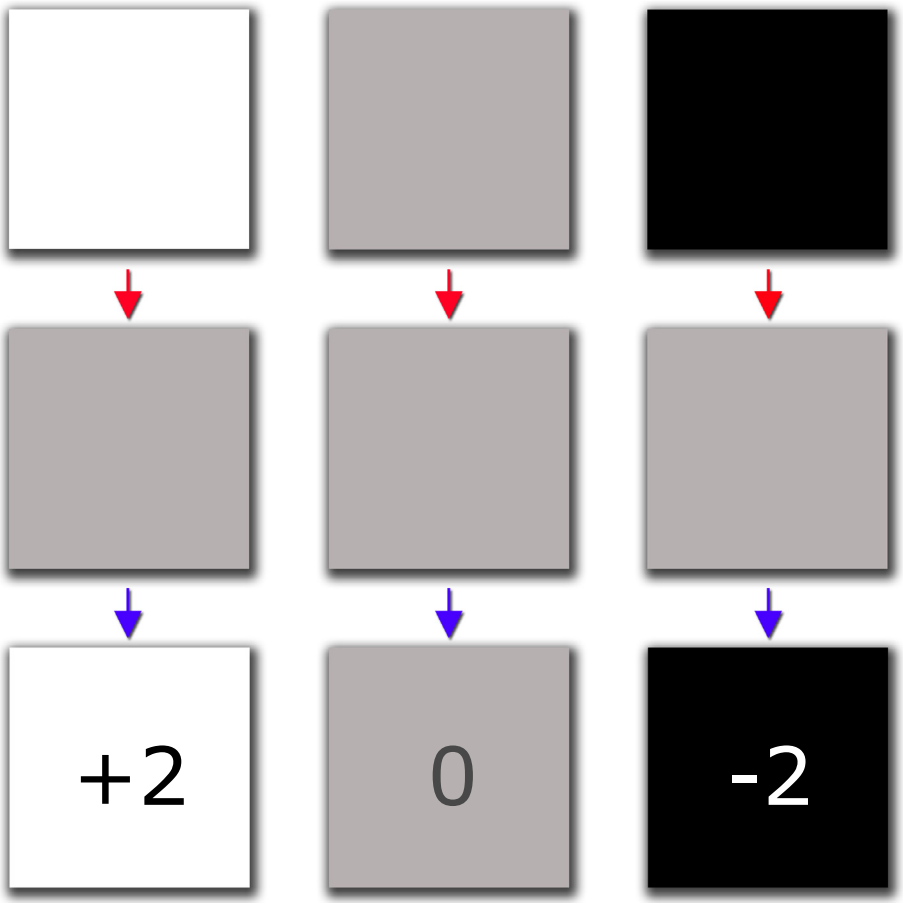
◀ Front lit scenes photograph well on auto if the background isn't too light or dark.



◀ Landscapes under blue skies photograph well on auto as long as they aren't backlit.

3.20 Why Autoexposure Doesn't Always Work

Since the camera's exposure system exposes every image as if the scene were middle gray, and since most scenes are, exposure is usually correct. However, there can be problems when a scene is lighter or darker than middle gray.



1. Here are three cards that you photograph with each filling the viewfinder at the time you take the picture.

2. The camera's exposure system makes all three cards appear gray in the photographs. Only the middle gray card in the center is exposed correctly.

3. Increasing the exposure for the white card and decreasing it for the black card captures them as they really appear. Only the middle gray card in the center doesn't need the exposure adjusted manually.



▲ If you meter a gray card instead of the scene, the exposure should be perfect. This is because the gray card is the same gray the camera sets the exposure for. Using it prevents the brightness of the scene from throwing off the exposure.



Click to visit the companion Web site

3.21 When to Increase Exposure—Light Scenes

When scenes or subjects are lighter than middle gray, automatic exposure darkens them unless you increase the exposure. You'll encounter such scenes when photographing light subjects or in bright light on sandy beaches and snow covered fields.



➧ Pure white subjects, such as this mission on Rt 66, will usually be too dark unless you increase the exposure to lighten them.





➤ In this snow scene the important tones are at the lighter end of the gray scale. For a good exposure you have to increase the exposure (top right). If you didn't do so, the snow in the scene would appear too gray (bottom right).

3.22 When to Increase Exposure—Light Backgrounds

A subject in front of a light background will be underexposed and too dark because the camera is fooled by the background. This is always a problem when a subject is backlit so the side facing you is in shadow. Unless you or the camera increases the exposure, the subject will be silhouetted against a brighter background.



➤ A light background, such as the sky, causes the foreground subject to be too dark in the photo unless you increase the exposure to lighten it.



➤ Backlit subjects will be dark but if you increase the exposure the background may be too light. Use the effect creatively or use flash to lighten the foreground subject.



➤ A dark subject against a light background will usually be too dark unless you increase the exposure to lighten it.

3.23 When to Increase Exposure—Foggy and Misty Scenes

Photographing in mist or fog is the same as photographing a light subject. Unless you increase the exposure the image will be darker than it should be.



▲ Fog and mist will be a dingy gray unless you increase the exposure to make them a more natural white.



▲ Scenes in fog or mist are brighter than normal scenes and you have to increase the exposure to capture this quality.

3.24 When to Decrease Exposure—Dark Scenes

When you photograph a scene or subject that is darker than middle gray the camera increases the exposure to lighten it. To capture the scene more realistically you have to reduce the exposure to darken the image.



➤ This scene of a tide pool and dark seaweed would have been too light and less moody if photographed at the settings suggested by the autoexposure system.



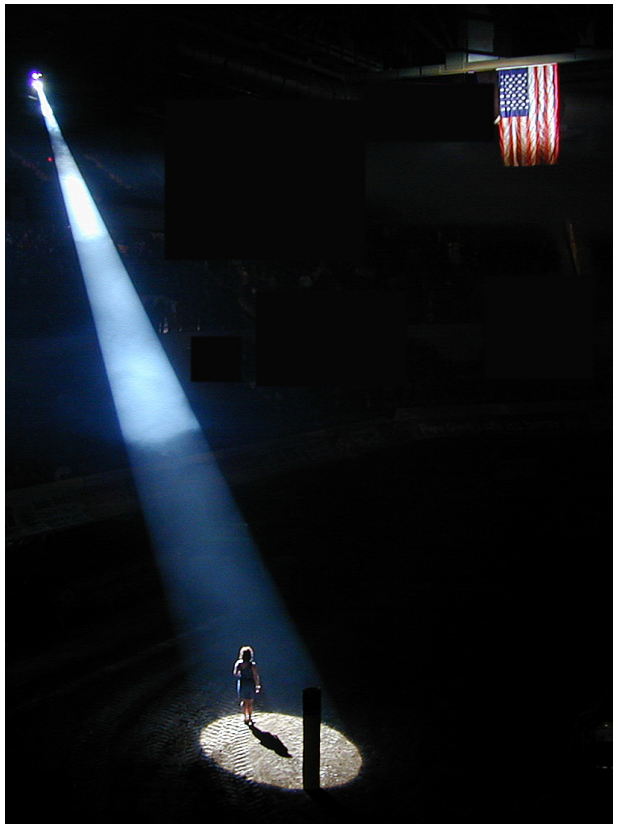
➤ This part of the black granite Vietnam War Memorial would have been too light had the exposure not been decreased to darken it.



➤ Exposure was decreased or the wall would be too light.

3.25 When to Decrease Exposure—Dark Backgrounds

When a light subject is in front of a background that is darker than middle gray, the entire image will be too light unless you decrease the exposure.



➤ Decreasing the exposure darkened the background and spotlit areas.



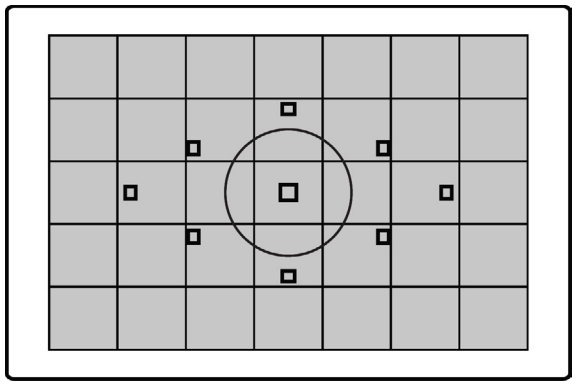
➤ Decreasing the exposure darkened the background so the white tops of the train cars and the brightly lit rails are emphasized.



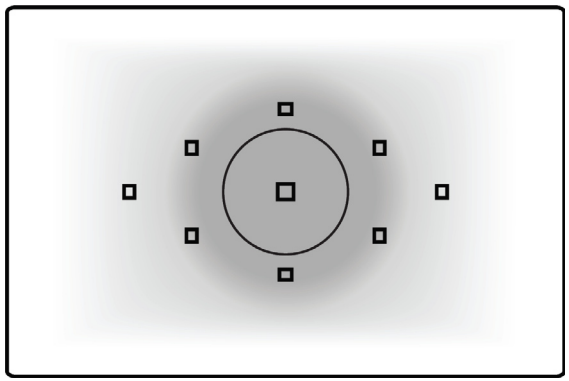
➤ Photographing the return of life to a lava flow required decreasing the exposure so the dark volcanic rock would not be too light.

3.26 Metering a Scene

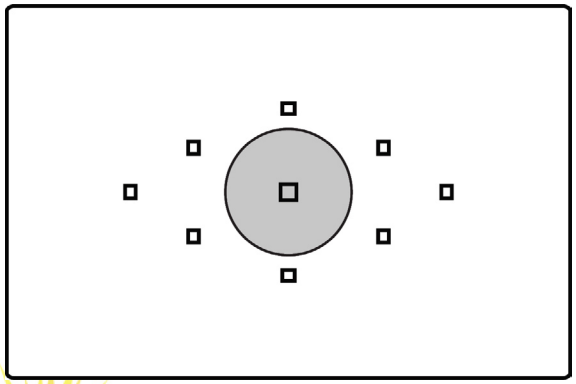
Your exposure often depends on which part of the scene your camera is metering so many cameras give you a choice.



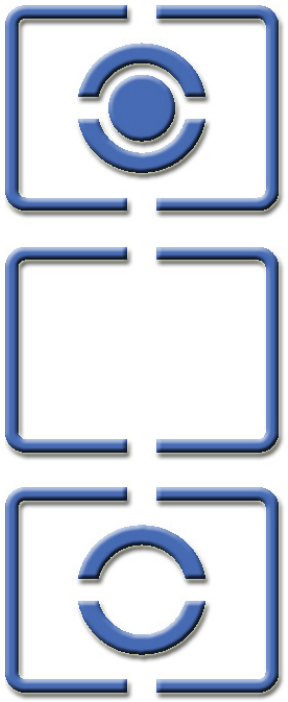
➤ Evaluative/matrix metering divides the scene into a grid and measures each section. The camera then analyzes the results and sets the best exposure. Some systems even recognize backlit subjects so the main subject isn't underexposed.



➤ Center-weighted metering measures the entire scene but emphasizes the center. This is an ideal metering method for portraits, or any scene where the main subject is centered.



➤ Spot metering measures a very small area of the scene. Some cameras measure a slightly larger area and refer to it as partial metering. Some cameras let you move the spot being metered along with, or independent of the spot being used to set focus so you can meter off-center areas.



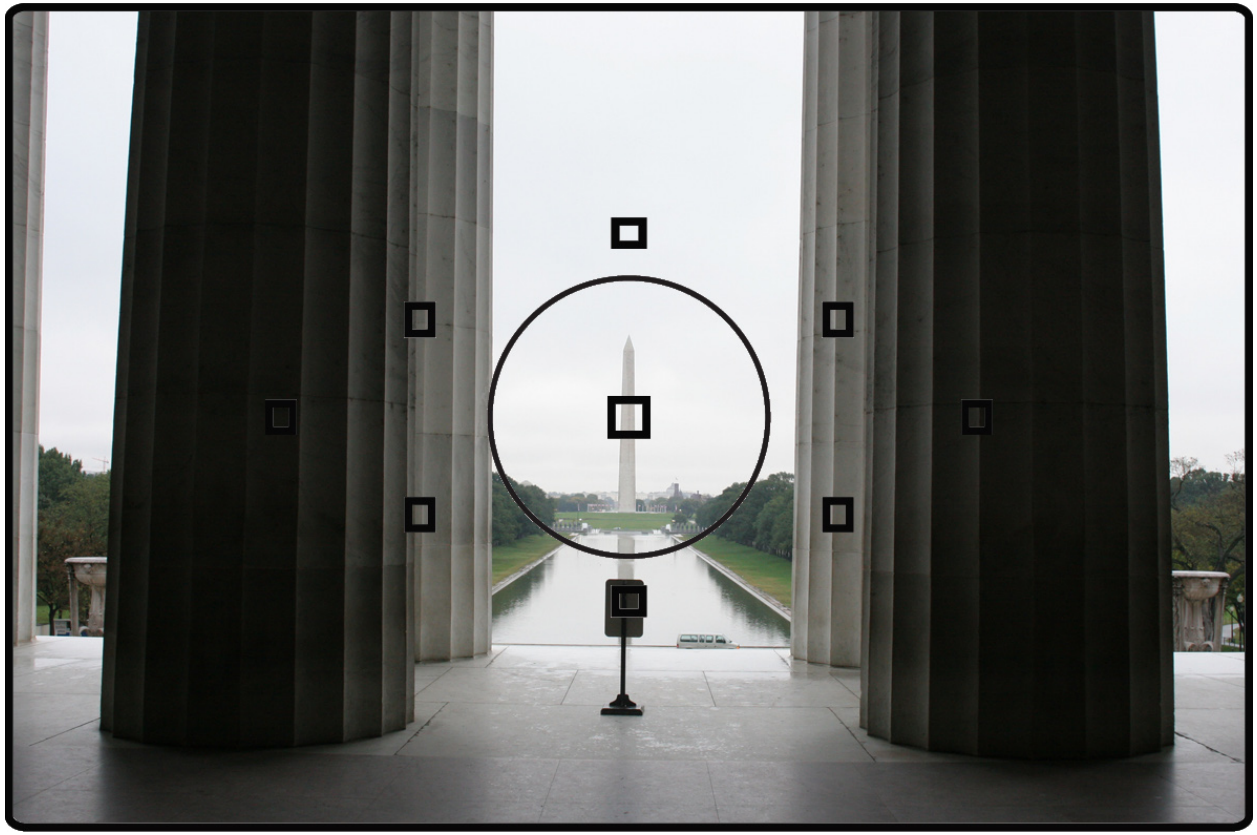
➤ Canon icons for evaluative, center-weighted and partial (spot) metering.



➤ Nikon icons for matrix, center, and spot metering.

3.27 Metering a Scene, con't.

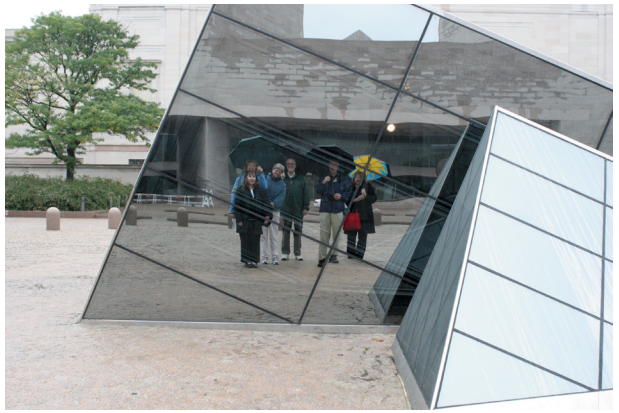
Evaluative or matrix metering has become so sophisticated, it can select the correct exposure for the vast majority of situations, although you may still need to use exposure compensation. However, there are times when you might want to switch to spot or partial metering. These metering modes let you base your exposure on a small area of the scene. This is most useful when you have a light subject against a dark background or vice versa.



▲ The monument and sky were spot metered, then exposure compensation was used to lighten them.



▲ The brightly lit part of the boat was spot metered and then exposure compensation was used to lighten it.



▲ The reflection was partial metered so it was exposed correctly causing the light areas to be slightly overexposed.

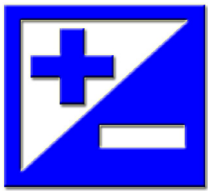


Click to visit the companion Web site

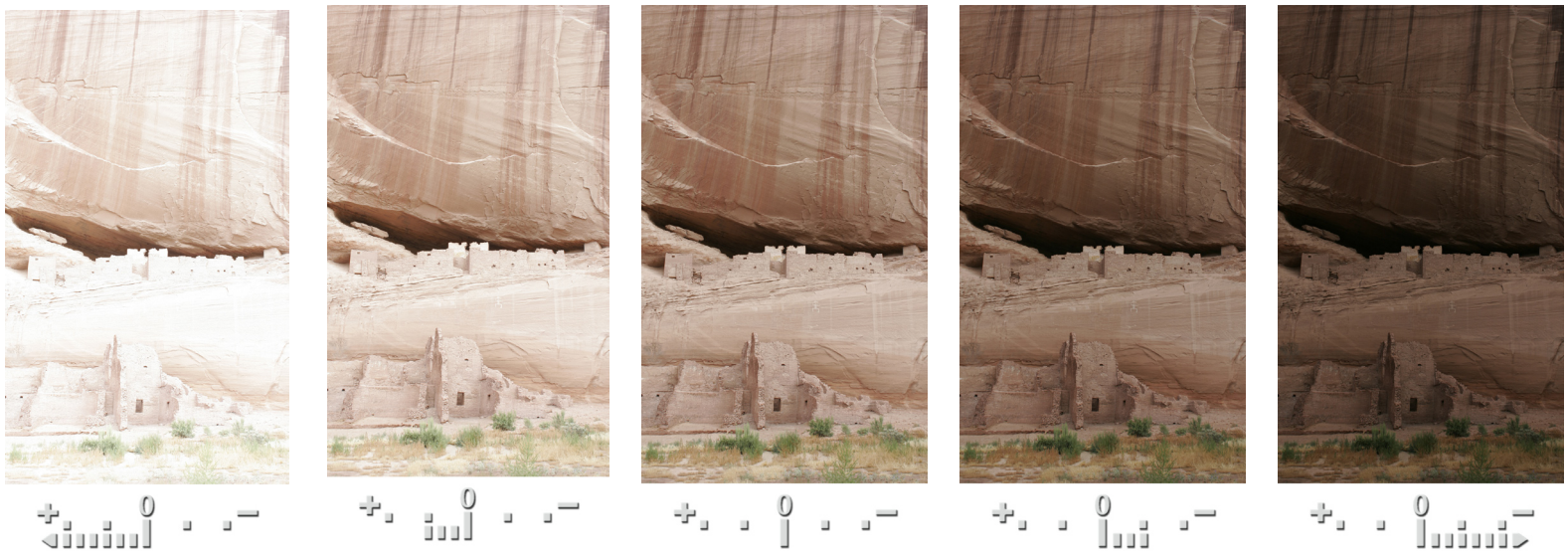
3.28 Adjusting Exposure—Exposure Compensation

Animation

Once you understand why and when you have to override automatic exposure to make a photo lighter or darker, all you need to know is how to do it. One of the popular ways is exposure compensation, a feature available on many cameras. When you use this mode, an exposure compensation scale is usually displayed and you press buttons or turn a dial to change the setting.



➤ The universally recognized icon for exposure compensation.



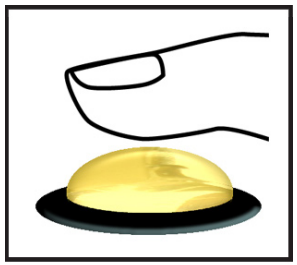
➤ When you adjust exposure compensation you can do so in full stops and even finer increments—usually one-third (shown here) or one-half stops. On most cameras you will see a scale displayed when you use this command. The "0" indicates the exposure suggested by the camera. As you adjust the exposure toward the plus (+) side of the scale the image gets lighter. As you adjust it toward the minus (-) side it gets darker. Here you see the results as it's adjusted from +2 (left) to -2 (right). The effect of the changes on the image are dramatic.

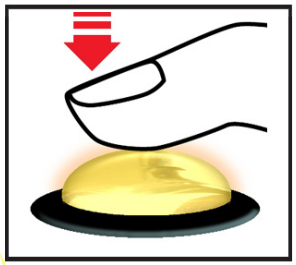


Click to visit the companion Web site

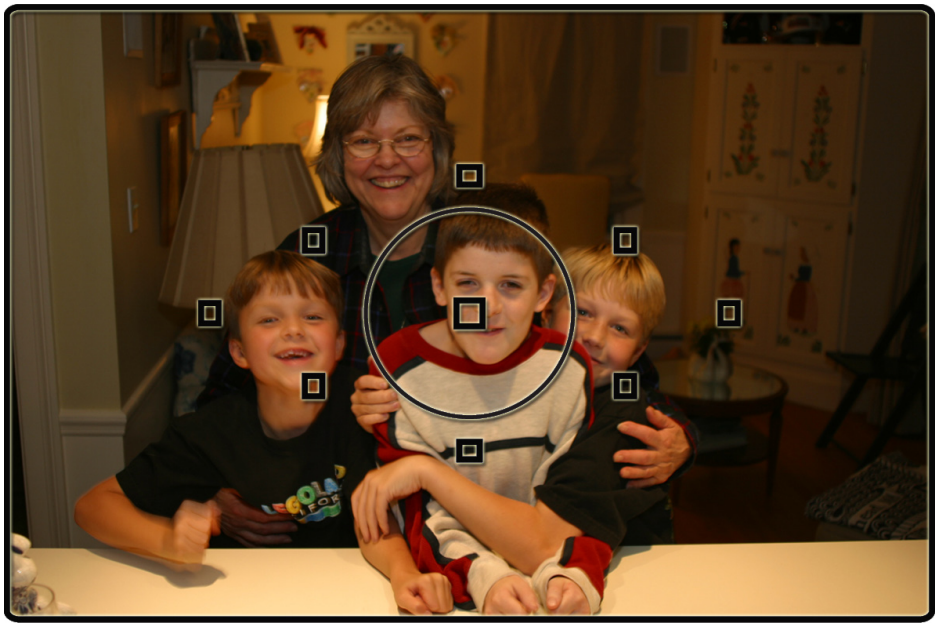
3.29 Adjusting Exposure—Exposure Lock

You can also adjust exposures with a procedure called *exposure or focus lock*. You point the camera so the part of the scene you want to base the exposure on is metered and press the shutter button halfway down to calculate the exposure and focus and lock them in. While continuing to hold down the shutter button, you recompose and shoot the picture using the locked in settings. Some cameras also have an AE Lock function that lets you lock exposure independently of focus. The only real difference is that you lock exposure by pressing the AE Lock button instead of the shutter button and it remains locked until you take the picture. Focus is then determined when you take the picture, even if you have changed your position.





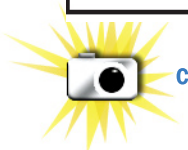
➤ Most shutter buttons have two stages. When you press them halfway down, the camera sets and locks focus and exposure. Usually indicators tell you when these are locked.



➤ Exposure lock works best when used with spot metering because you can precisely control which area is metered.



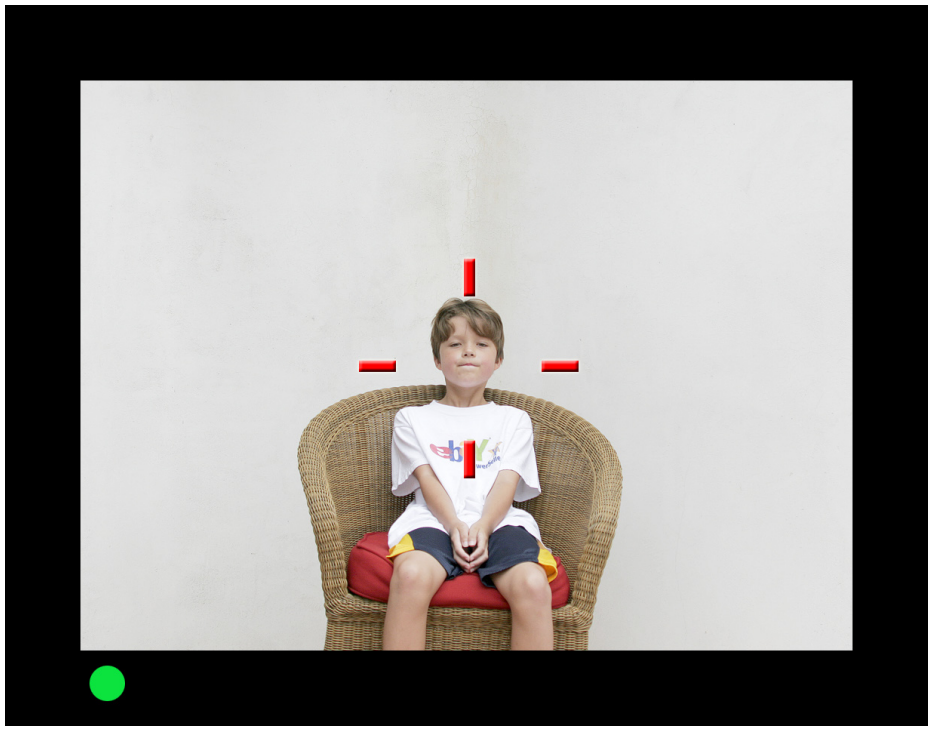
➤ A frequently used AE lock icon on cameras that have a separate button to lock exposure.



3.30 Adjusting Exposure—Exposure Lock, con't.

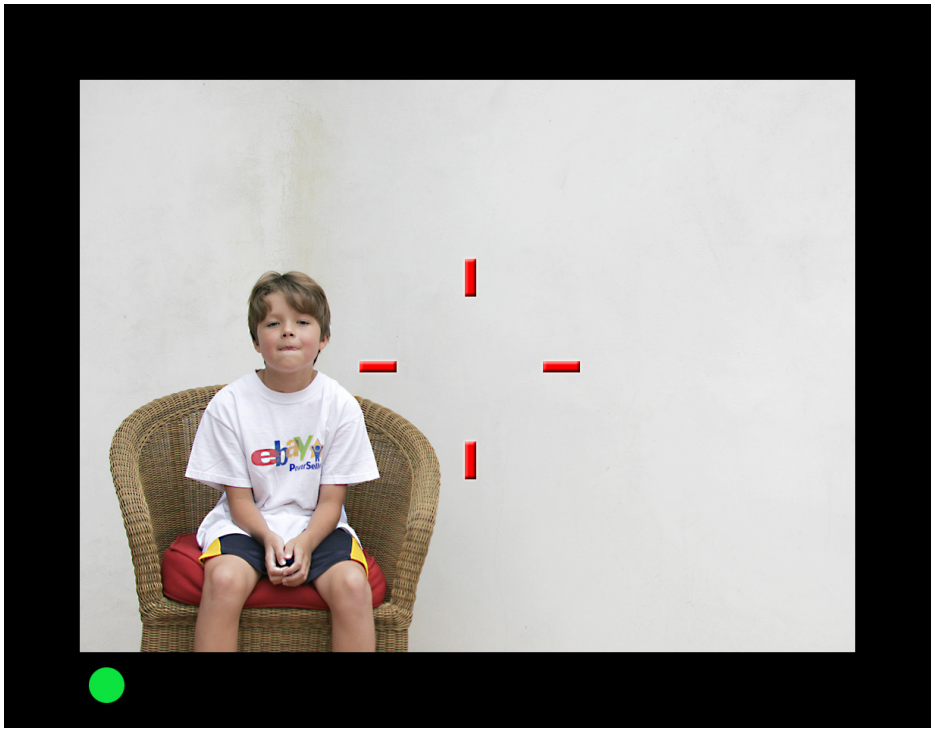
Animation

Using exposure and focus lock to set exposure is a simple two-step process—lock exposure then compose and shoot the photo.





1. Point the camera so you are metering the area on which you want to base the exposure. Press the shutter button halfway down to lock exposure (and focus).





2. Without releasing the shutter button, compose the image the way you want it and press the shutter button the rest of the way down to take the photo.



➤ If you took the picture without first locking exposure, the image will be too dark because the background has influenced the exposure.



Click to visit the companion Web site

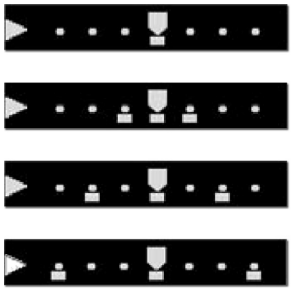
3.31 Adjusting Exposure—Auto Exposure Bracketing (AEB)

Animation

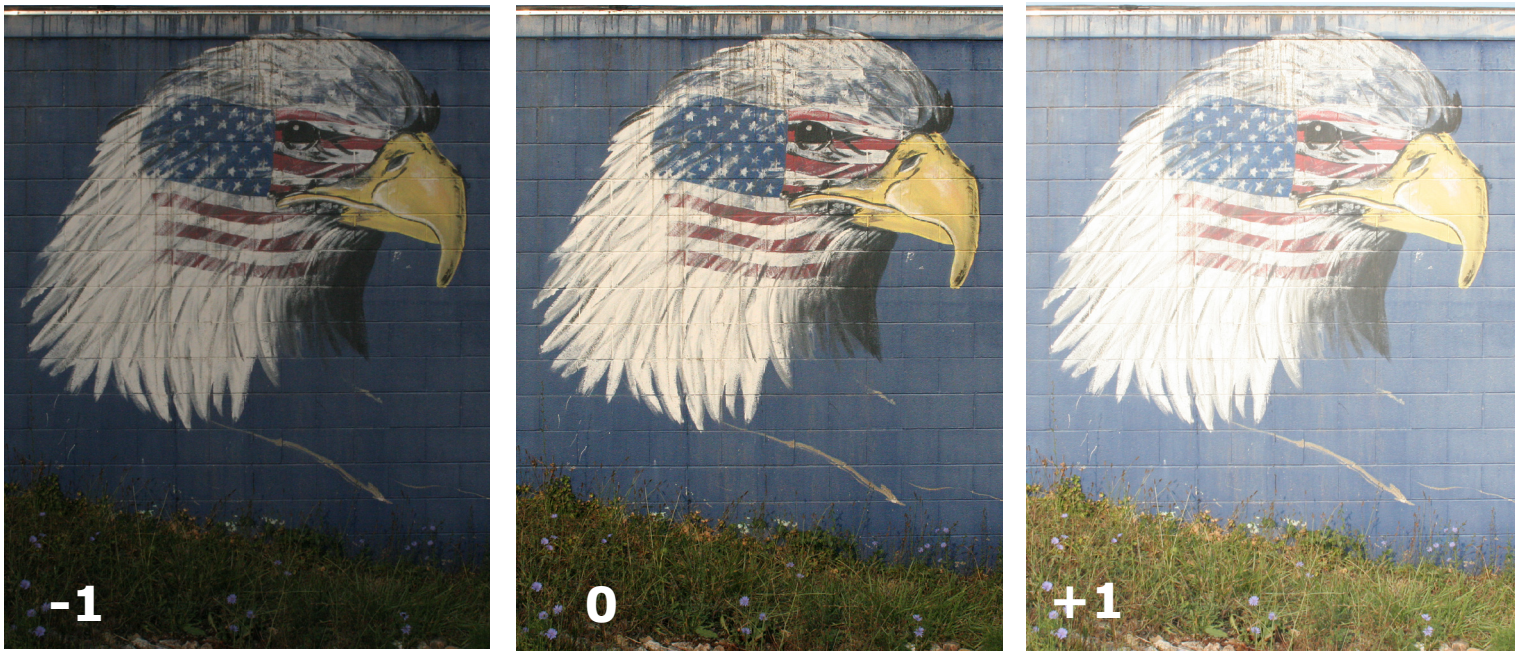
When you want to be absolutely certain you have the best exposure, autoexposure bracketing (AEB) mode takes a series of photos—each at a slightly different exposure. Some cameras take all of the pictures, usually 3 or 5 of them, with a single press of the shutter button. With others you have to press it once for each picture.



➤ The standard icon for auto exposure bracketing.



➤ Some cameras let you select the number of shots and the exposure increment between each. Here the scale has no bracketing (top) followed by settings for one, two, and three stops difference between exposures.



➤ Here AEB was used to take three photos of the same subject—one at the recommended setting (0), one underexposed one stop (-1) and one overexposed one stop (+1). You can select the best exposure for display or printing and delete the rest.

3.32 Expanding Your Exposure Range

You can't always get the shutter speed or aperture you want because the light is too bright or there isn't enough light. When this happens, there are solutions using filters that reduce the light or flash that increases it.



When you can't get a slow enough shutter speed or a large enough aperture (perhaps to reduce depth of field), you can use a neutral density filter or even a circular polarizing filter. Both reduce the light entering the camera so you need a slower shutter speed or larger aperture.



When you can't get a fast enough shutter speed (perhaps to freeze action) or a small enough aperture (perhaps to increase depth of field), you can increase the ISO so less light is needed, or use flash so there is more light on the subject.





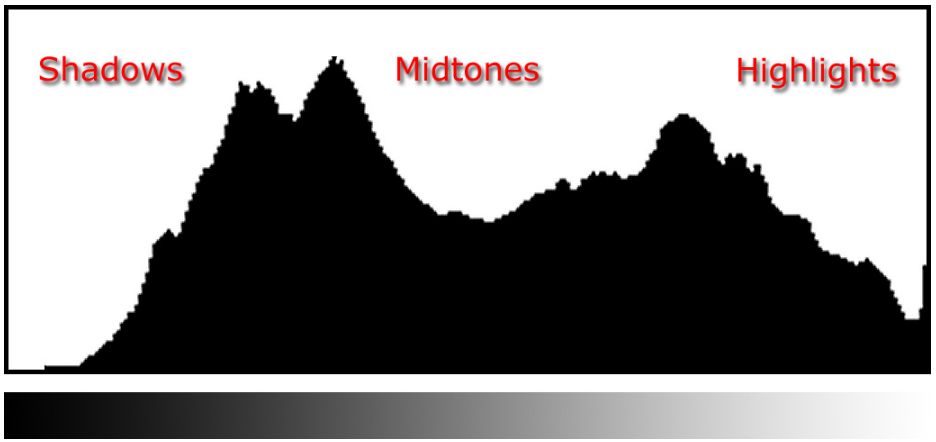
You may need a neutral density filter when you want to use a large aperture for shallow depth of field, especially in bright sun on light surfaces such as snow or sand.

3.33 Evaluating Your Exposures—Histograms

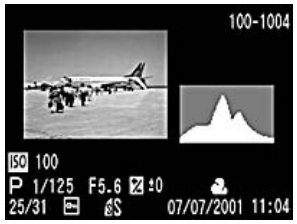
Animations

Serious photo-editing programs and some digital cameras display an image's *histogram* so you can better evaluate your exposures. Each pixel in an image can be one of 256 levels of brightness from pure black (0) to pure white (255) and the histogram for the image is a bar graph that shows how these levels of brightness are distributed.

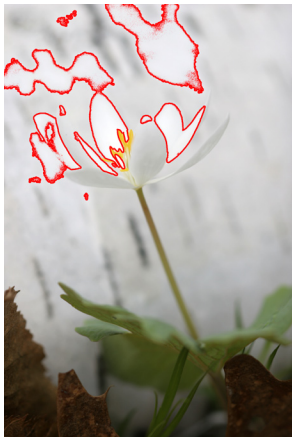
➤ The vertical axis represents the number of pixels that have each of the 256 brightness values. The taller the line, the more pixels there are at that level of brightness.



➤ The horizontal axis represents the range of brightness from 0 (shadows) on the left to 255 (highlights) on the right. Think of it as a line with 256 spaces on which to stack pixels of the same brightness. Since these are the only values that can be captured by the camera, the horizontal line also represents the camera's maximum potential tonal range.



➤ The best way to be sure you got the best exposure is to check the image's histogram on the camera's monitor. This way you can be sure while still in a position to reshoot the image if necessary.



➤ Some cameras highlight areas of an image that have been so overexposed they lack any detail. To get details into those areas, you have to reduce the exposure using exposure compensation. You can't add it later.

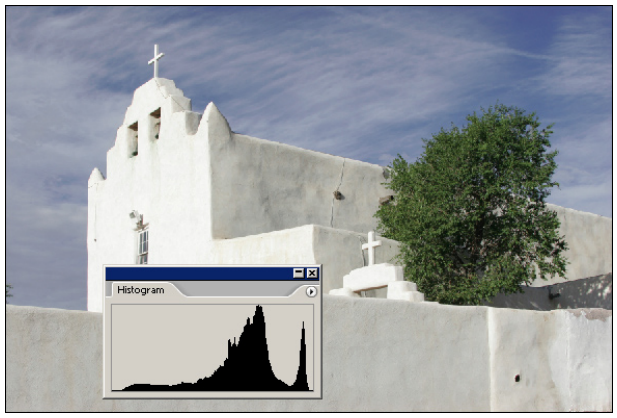
3.34 Evaluating Your Exposures—Histograms When Shooting

When checking a histogram, here are some things to consider:

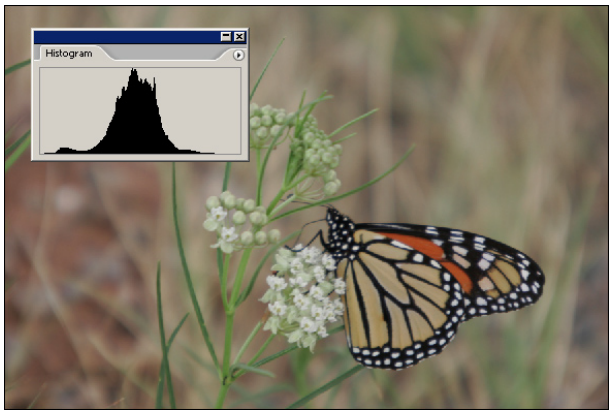
• Many photos look best when they use the entire tonal range and there are some pixels at every position.

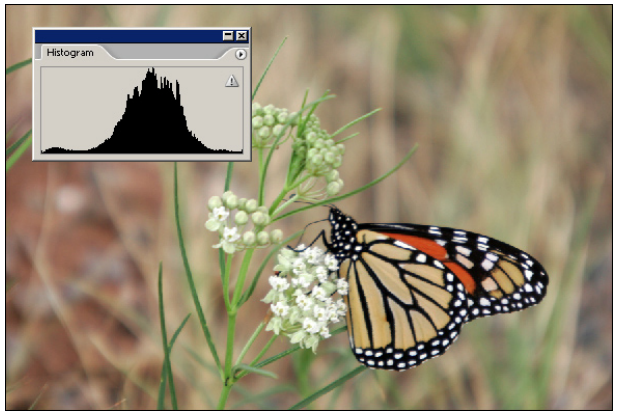
• In most images, pixels occupy only a part of the available tonal range. These images lack contrast because the difference between the brightest and darkest areas (the contrast) isn't as great as it could be. This can be fixed with Photoshop's Levels or Curves commands that spread the pixels out to cover the entire available tonal range. The only pixels that can't be fixed in this way are those that have been "clipped" to pure white or black.



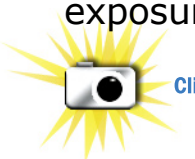


➧ When a histogram shows pixels at the extreme ends of the range, in the 0 and 255 positions, it means details in those tones are being lost or "clipped" in your image. In the image on the left you can tell from the histogram that some of the highlight pixels are pure white and hence clipped. There is nothing you can do later to display details in the area of these pixels. However, if you reshoot it at a different exposure you can avoid the clipping (right).





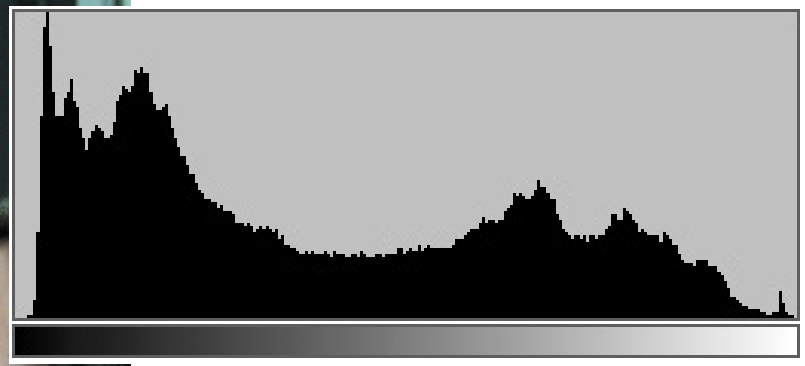
➧ The original image (top) is flat and its histogram indicates only part of the tonal range is used. Photoshop's Levels command was then used to expand the tonal range (bottom). You can see the change in both the image and in the histogram.



Click to visit the companion Web site

3.35 Histograms—Normal and Good

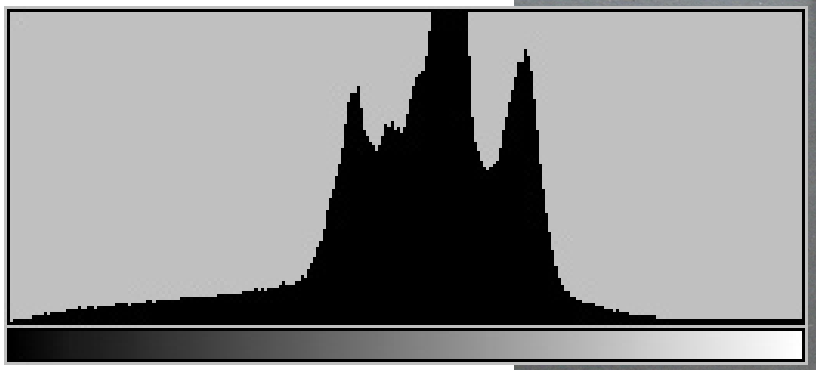


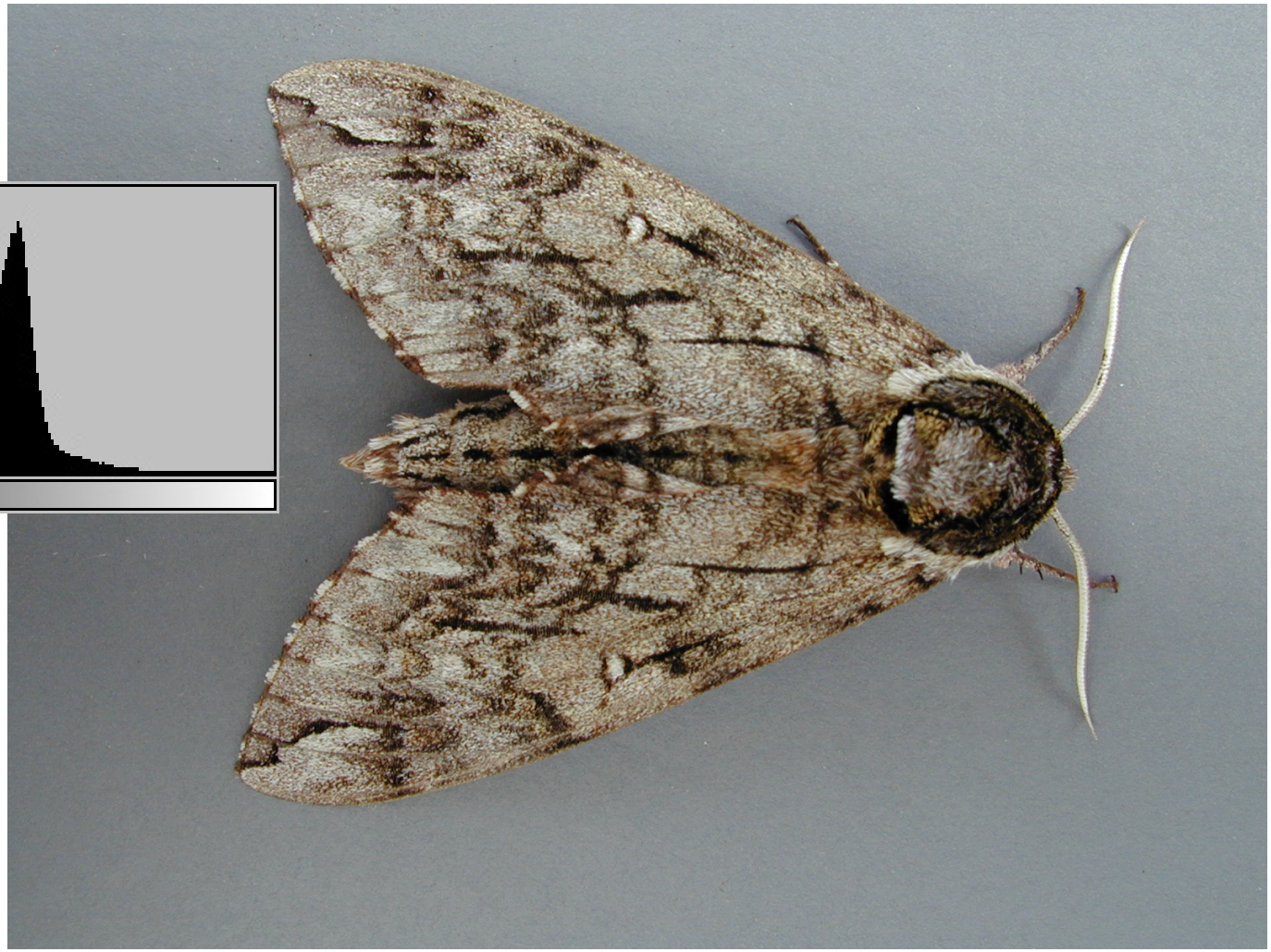


▲ In this well exposed portrait there is a fairly even distribution of values in both the shadow and highlight areas of the image. There are no pure blacks as shown by the gap at the far left end of the histogram.



3.36 Histograms—Middle Gray

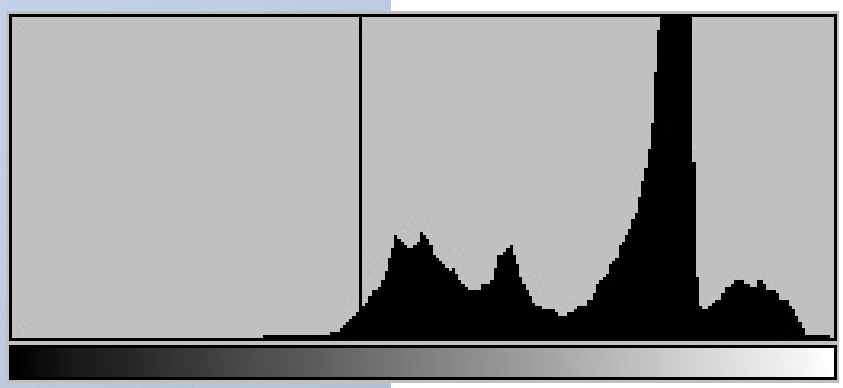




▲ This brown moth on a gray card has most of its values in the midrange but uses the entire available tonal range. That's why there are a number of high vertical lines grouped in the middle of the horizontal axis.

3.37 Histograms—High Key





▲ The distinct vertical line to the left of middle gray shows how many pixels there are in the uniformly gray frame border added in Photoshop.

▲ This high-key fog scene has most of its values toward the highlight end of the scale. There are no really dark values in the image. The image uses only a little more than half the available tonal range.

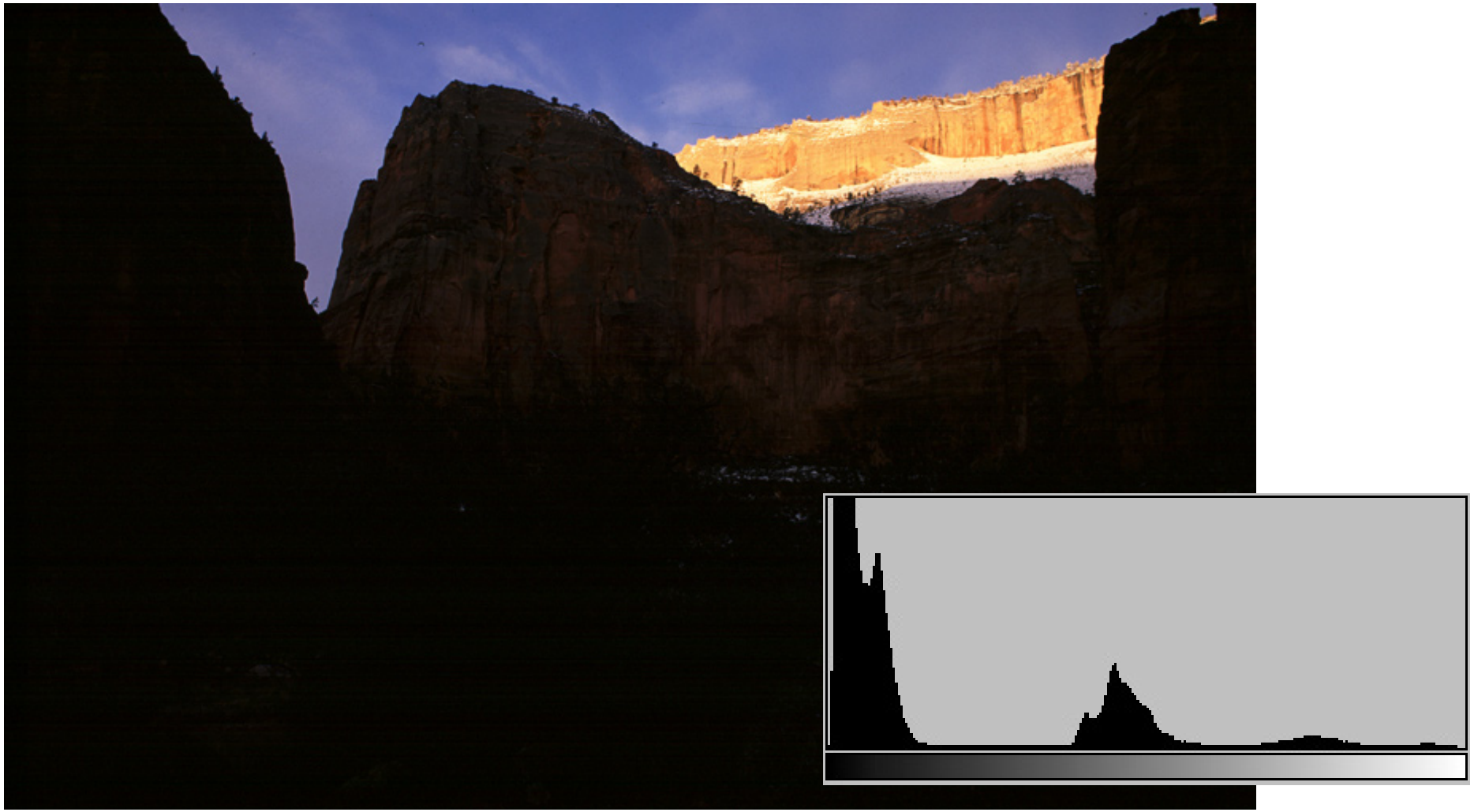
Click to visit the companion Web site

3.38 Histograms—Night Scene



➤ This night scene with flash has a lot of dark pixels, many of which are clipped, but then there are other values fairly evenly distributed across the entire range.

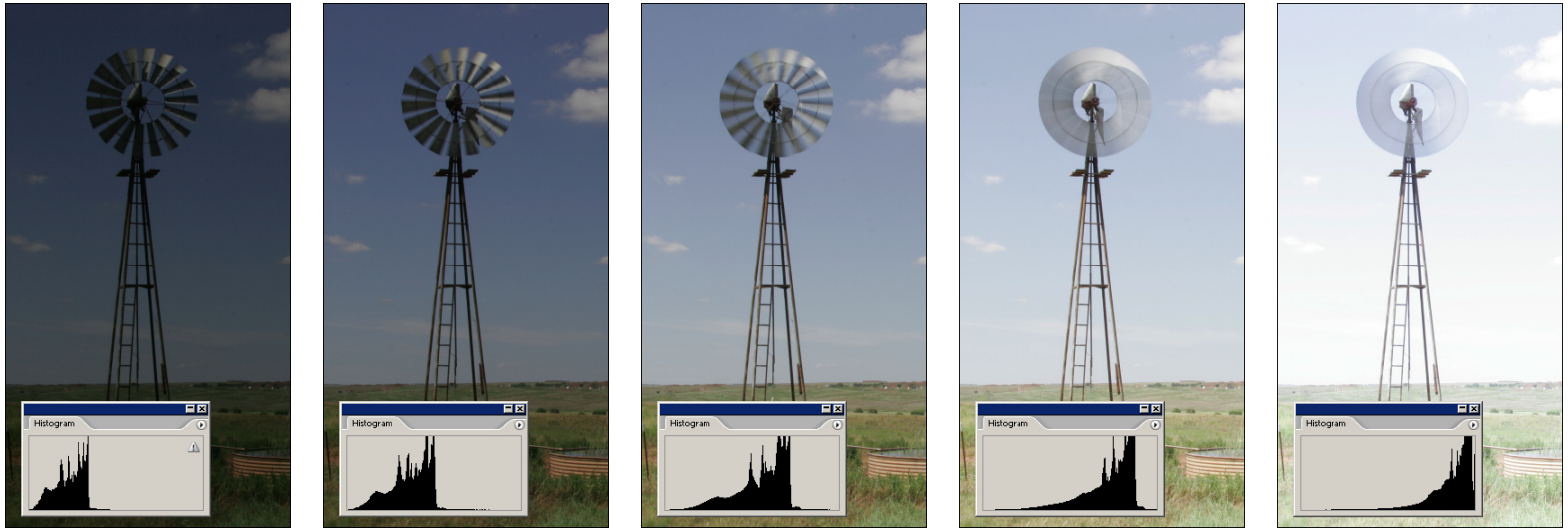
3.39 Histograms—Low Key



▲ This low-key scene has the majority of its values in the shadow area with another large grouping around middle gray. Note there are numerous brightness levels that have only a few pixels and that no tones at the shadow end are clipped.

3.40 Histograms & Exposure

As you learn to evaluate your own histograms, you'll notice that increasing exposure shifts pixels to the highlight, or right end of the histogram. Decreasing exposure shifts them the other way. Unless you are deliberately trying to get pure whites or pure blacks, you should shift the pixels if any are being clipped. This then gives you a chance to correct the image in Photoshop.



▲ This series of photos was taken one stop apart using exposure compensation. You can tell from the way the fan blades blur that the shutter speed was changed to change the exposure. At fast shutter speeds (left), the image gets darker and the blades more frozen. At slower speeds (right) the image gets lighter and the blades more blurred.



Photo COURSE

Controlling Sharpness

Chapter 4

4.1 Eliminating Camera Movement

The majority of your photos will probably look best if they are sharp, or at least free of blur caused by camera or subject movement. One of the major causes of unsharp pictures is camera movement during the exposure.





➧ The camera was steady in the left picture and moved in the right one. You can tell the camera moves because everything in the image is blurred as if it were painted onto the moving image sensor.

➤ When subject movement causes blur, those parts of the scene that aren't moving will be sharp in the photo.





➧ Just before taking a shot, inhale deeply, then exhale and hold your breath while smoothly pressing the shutter button down.

4.2 Eliminating Camera Movement—Holding the Camera

Holding the camera correctly, bracing it, and breathing correctly can reduce blur in your images. Use the optical viewfinder to take photos because you can brace the camera against your face instead of holding it out at shaky arms' length as you do when using the monitor.





▲ When using the viewfinder for both horizontal and vertical photographs use your right finger to press the shutter button and your left hand to support the camera.



◀ When using the monitor, hold the camera with both hands. If possible, brace your elbows to your sides or find something to support the camera.



▲ If your monitor swings and tilts, you can steady the camera on the ground and even shoot up at flowers and other small subjects.



▲ There are many situations in which you can get some additional support from the environment around you. Lean against a wall or tree and brace yourself with your elbows tight to your body. You can also find a branch, railing, table or other surface to rest the camera on.

4.3 Eliminating Camera Movement—Tripods and Monopods

What we normally think of as a tripod, is actually three parts—the leg set, the head, and a quick release system. The *leg set* includes the three legs that are usually in sections that you can collapse and extend as necessary.

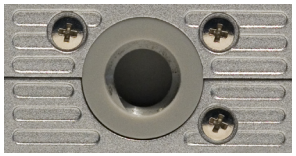


▲ Leg sets vary in stability, ease of use, weight and height. The lightest, and most expensive are made from carbon fiber.

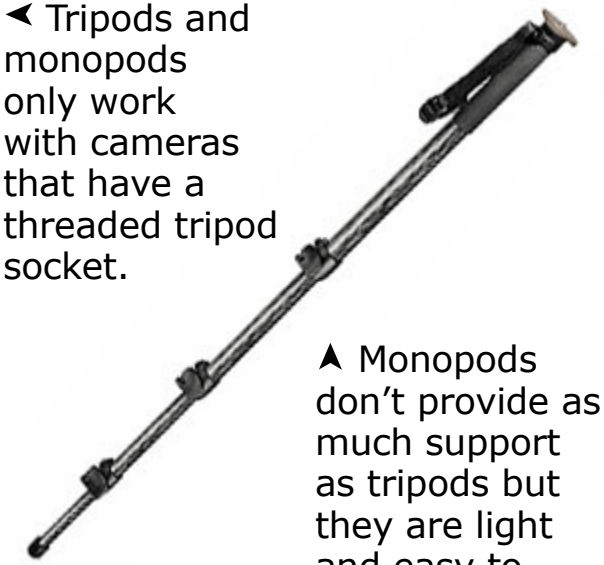


▲ Tabletop tripods, like this classic by Leica are small enough to sit on a table.

➤ A pivoting center column lets you cantilever the camera out to shoot straight down.



➤ Tripods and monopods only work with cameras that have a threaded tripod socket.



▲ Monopods don't provide as much support as tripods but they are light and easy to carry.



4.4 Eliminating Camera Movement—Tripod Heads

Tripods usually have a *center shaft* that raises or lowers the camera. This center shaft ends at a flat platform through which projects a threaded screw. It's on this platform that you mount a *head*. There are two basic kinds of tripod heads—the traditional 3-way pan tilt head and the ball head.





➤ The classic 3-way pan/tilt head can rotate (pan), tip forward and back, and tilt side to side. Movement on each axis is separately controlled so it's ideal for architecture and other work where placement of horizontal and vertical elements is critical. To move and lock it in each of these three axis, you use a separate twist handle. These protruding handles cause problems when hiking and take time to set when photographing.

Gitzo photo courtesy of Bogen Photo at www.bogenphoto.com.



➤ Many photographers prefer a ball head because you can compose an image with one motion and lock the camera with a single control. This makes a ball head ideal for nature photography. It's also easier to carry and backpack a tripod with a ball head because it doesn't weigh as much or have the protruding handles that a pan-tilt head has.

Photo courtesy of Markins at www.markins.com.

➤ Nature photographers using large, heavy lenses like the Wimberly mount because it makes the lens seem weightless and lets you move it in any direction to follow the action.

Photo courtesy of Wimberly at www.tripodhead.com.

4.5 Eliminating Camera Movement—Tripod Quick Release Systems

To mount and unmount a camera quickly and easily, you use a two-part *quick release system*. A clamp screws onto the tripod head and a plate screws into the camera. To mount the camera, you slip its plate into the tripod's clamp and lock it in place. To remove the camera, you unlock the clamp and pull the camera out. It's fast and secure.



➤ The Arca-Swiss quick release system uses a tripod-mounted channel with "jaws" that can be closed and tightened with the turn of a screw. The channel accepts plates mounted on a camera or lens that slide into the jaws to be locked in place.



➤ The plates used in a quick release system must be designed for specific cameras. Courtesy of Acratech at www.acratech.net.





➤ Most ball heads have a 90 degree slot that you use when positioning the camera in a vertical position. The problem is that this doesn't keep the weight of the camera centered over the tripod. However, with an "L" bracket mounted on the camera, you actually have two plates—one for horizontal shots and one for verticals. To change between landscape and portrait orientations, just remove the current plate from the clamp, turn the camera 90 degrees and insert the other plate.



➤ With heavier lenses that have lens collars, you attach a plate to the lens and mount it to the tripod for better balance. The collar lets you rotate the camera into any position.

Click to visit the companion Web site

4.6 Eliminating Camera Movement—Shutter Release

Most digital cameras have a self-timer and a few have a remote control or cable release socket. Any of these will let you take a picture without moving or vibrating the camera and hence reduce the possibility of blur. Just place the camera on a secure surface, compose the image, and use the timer, remote, or cable release to take the picture.



➤ Self-timers usually take a photo 10 seconds after you press the shutter button although some have an optional shorter mode. This is the universally accepted icon for self-timers.



➤ Cable releases let you trigger the shutter without moving the camera and some also lock open the shutter for time exposures.



➤ Wireless remote controls can be used to trigger a camera from a distance. Many, like this one from Olympus operate on infrared light.



➤ SLR cameras have a mirror that swings up out of the way when you take a picture. Since this can introduce vibrations many cameras let you lock it up first and then take the picture after any vibrations have died out.

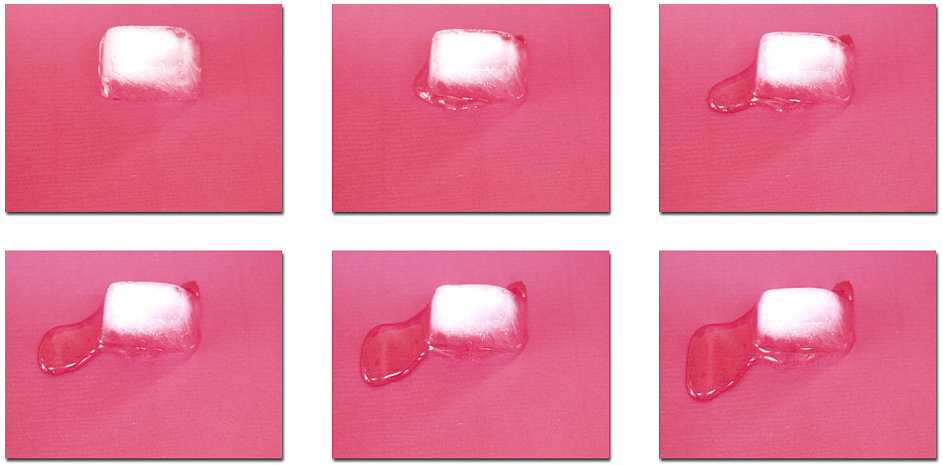


➤ When using a remote, cover the eyepiece of an SLR to prevent light from entering and affecting the exposure.

4.7 Eliminating Camera Movement—Shutter Release, con't

Animation

One of the interesting things you can do with a camera is have it take pictures while you are doing something else.



An intervolemeter setting (also called interval shooting or time-lapse) lets you take pictures at specified intervals—perhaps every few minutes to show a flower blossom opening. Some cameras have these built in and others supply them as software. Here I've recorded a melting ice cube.



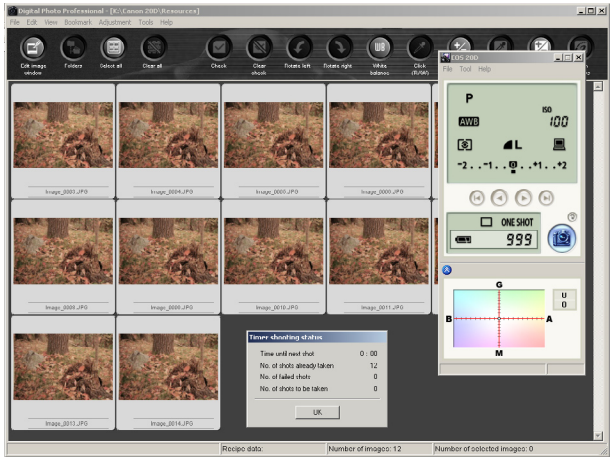
The Time Machine can take pictures at specified intervals or when sensors detect sounds or motion.

Courtesy of www.bmumford.com.

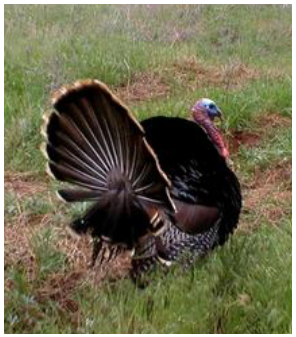


Tracking cameras use a motion detector to photograph anything that passes in front of them. Some use infrared flash so the animals aren't startled.

Courtesy of www.snapshotsniper.com.



Canon's EOS Capture program lets you automatically capture images from a cable-connected camera at specified intervals.



A wild turkey caught by the camera.

Courtesy of www.snapshotsniper.com.

Click to visit the companion Web site

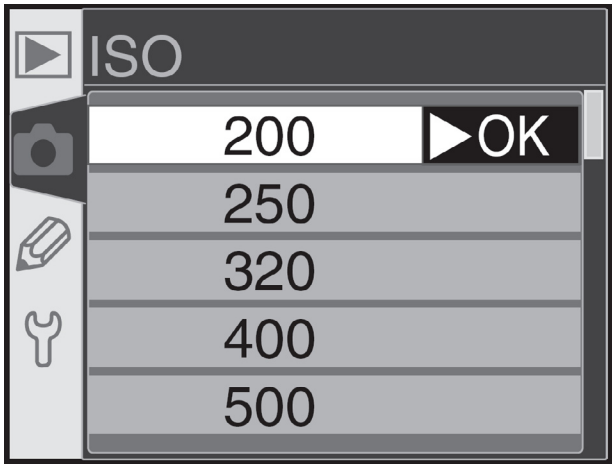
4.8 Eliminating Camera Movement—The ISO Setting

Animation

ISO (International Standards Organization) is the rating for a film or image sensor's speed. When you used film you changed the ISO by changing film. With a digital camera you use a menu, button, or dial to change it. Higher ISOs let you use faster shutter speeds to reduce camera blur, but the higher the ISO the more *noise* you get in your images.



▲ Noise appears in images as random color pixels especially when you use long shutter speeds.



◄ Digital cameras change the ISO by amplifying the signals captured by the photosites on the sensor. Dim light can be made brighter this way but unfortunately, amplifying the image also amplifies noise.



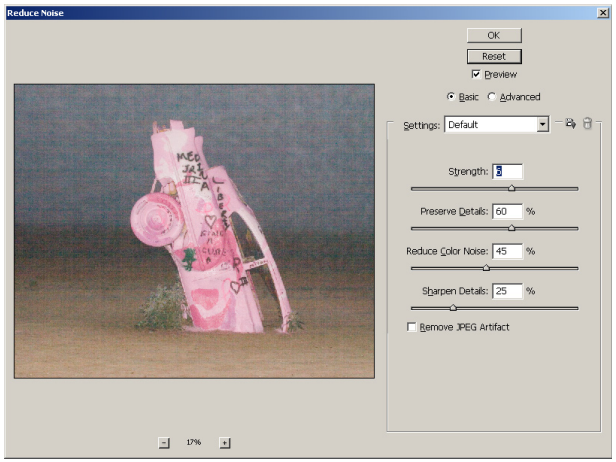
◄ Film is sold in a variety of ISO ratings such as these ISO 100 and 800 films from Samsung.

Click to visit the companion Web site

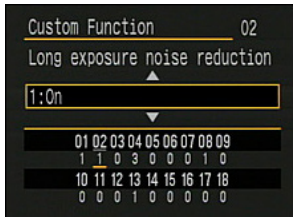
4.9 Eliminating Camera Movement—ISO and Noise

Animation

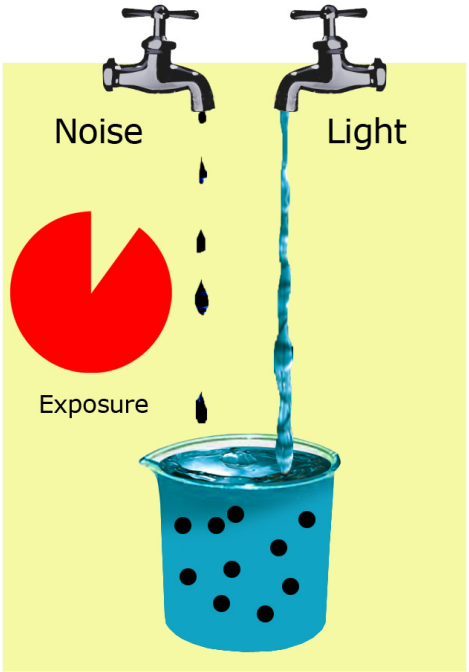
One kind of noise accumulates at a steady pace. During normal exposures there isn't enough time for it to accumulate enough to affect the image. At longer exposures, where it takes much longer for the exposure to be completed, the noise has enough time to build up and become noticable.



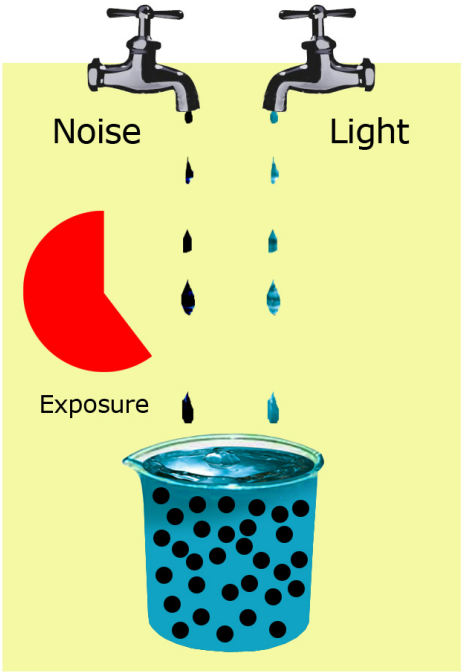
Most cameras and photo-editing programs have noise reduction settings or commands. Here is the Photoshop Reduce Noise filter dialog box.



Some cameras have a noise reduction feature that records a dark frame with the shutter closed after you take a picture. It then uses this frame to locate and remove noise from the photo.



During a normal exposure the drip, drip, drip of noise is overwhelmed by the strong light from the scene. There isn't time for noise to build up in the image.



During a long exposure the noise and the light from the scene are more equal and before the image is fully exposed, noise has time to accumulate.

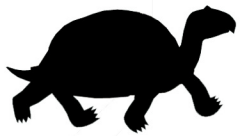


Click to visit the companion Web site

4.10 How to Photograph Motion Sharply

Animation

The sharpness of a moving subject is determined by how far the subject moves on the image sensor while the shutter is open. This is affected not only by the speed of the subject but by its direction and its distance and the focal length of the lens you are using.

	Faster	Slower
Shutter Speed Needed		
Speed of Subject		
Direction of Movement		
Focal Length of Lens and distance to subject		



On this speeding train, the part closest to the camera looks the most blurred while the farthest part looks sharper. Since all parts of the train are moving at the same speed, this shows how distance affects blur.

To visualize the effects of distance on blur, look out the side window of a moving car (but not when you're driving). The objects in the foreground seem to fly by while those on the horizon don't seem to move at all.



Click to visit the companion Web site

4.11 Shutter Speed and Sharpness

Animation

Your primary control over how motion is portrayed is the shutter speed you select.



▲ An Osprey is caught in mid-air as it lands on a nest it's building in Myakka State Park in Florida.



▲ One butterfly is frozen while the one flying away is slightly blurred.

➤ Here a slow shutter speed was used to take a photo off the back deck of an Alaskan Railroad car. The slow shutter speed blurred the image.



➤ Here the image was made much sharper by selecting a faster shutter speed.



Click to visit the companion Web site

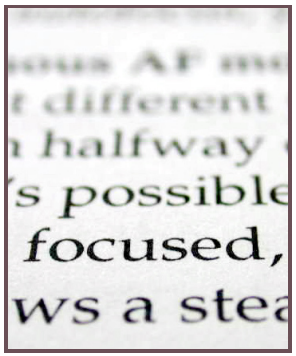
4.12 Focus

Animation

A camera can only bring one narrow part of a scene parallel to the image sensor into the sharpest possible focus. This part, called the *plane of critical focus*, falls at the point on which you focus.

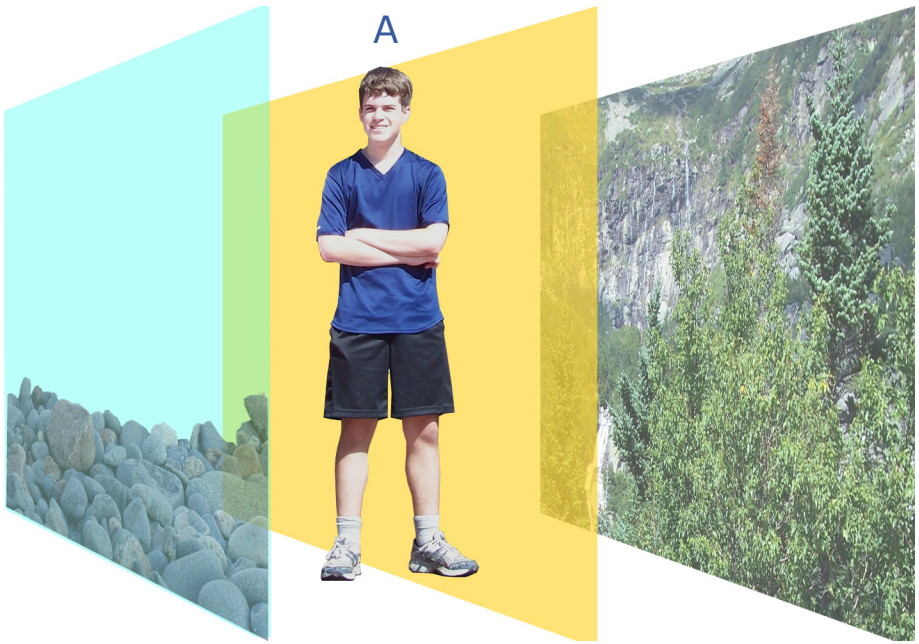


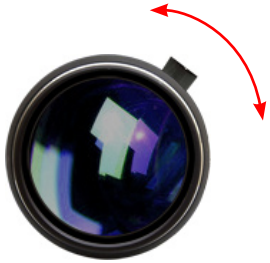
➤ Lenses often have a scale that indicates how far it is to the plane of critical focus.



➤ With the camera very close to the page and focused on the line that reads focused, you can see where the plane of critical focus falls.







➤ You move the plane of critical focus (A) by turning the focus ring in manual mode, or pointing the camera and pressing the shutter button halfway down in autofocus mode.

Click to visit the companion Web site

4.13 Types of Focus

There are three ways cameras focus—fixed focus, autofocus, and manual focus.



➧ Fixed Focus is found on the least expensive cameras and almost all camera phones and one-time-use cameras. It is sometimes called focus-free for marketing purposes, a euphemism one reviewer suggests they change to unfocusable.

➤ Manual focus found on SLRs and some expensive fixed lens cameras lets you focus by turning a ring on the lens. On point and shoot cameras you have to use buttons or dials—a slow and awkward process at best.



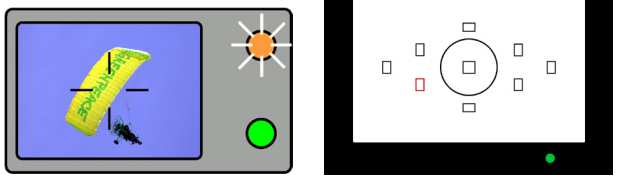
➧ Autofocus is available on all but the very cheapest cameras. In fact, on many low-end cameras it's the only kind of focus. When you press the shutter button halfway down, the camera automatically focuses on the center of the scene or some other designated focus point.



4.14 Autofocus Facts

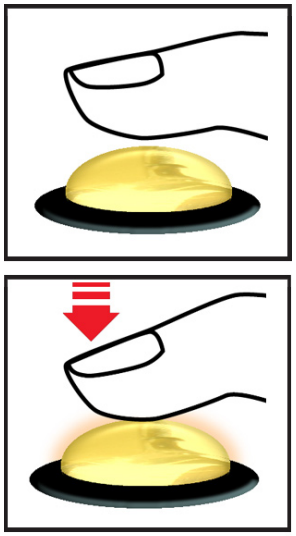
Most cameras automatically focus the camera when you press the shutter button halfway down. Autofocus often has problems with scenes that:

- Are taken through glass or chain link fences
- Are low in contrast or poorly illuminated
- Are very bright or have reflections
- Include both near and distant objects
- Move rapidly

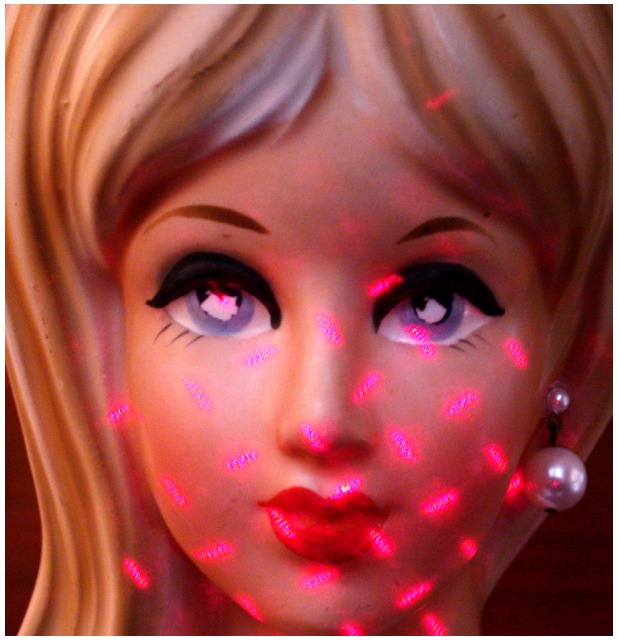


▲ When focus is achieved a beep may sound and an indicator light in or next to the viewfinder comes on or changes color (left). In some cameras, one of the focusing area indicators in the viewfinder lights to indicate where the camera is focusing (right). Usually the beep won't sound and the indicators blink if the camera is having trouble focusing.

You can't tell what is in focus in an optical viewfinder, but you can in the viewfinder of an SLR and the monitor on fixed lens cameras. The plane of critical focus will be sharp compared to the rest of the scene.



▲ Shutter buttons have two stages. When pressed halfway down, the camera sets and locks focus (and often exposure).



▲ Many cameras (and some flash units) have a focus assist lamp that projects a beam of light on the subject to help the camera focus in dim light. Sony's hologram AF system uses a low power laser to project a pattern of light on a subject. The range of these assist lamps is fairly short and depends on how the lens is zoomed.



4.15 Autofocus—Types Of

Animation

Since focusing is so important, many cameras have more than one autofocus mode. The most common are single AF and servo AF (although the names vary).





▲ Servo AF adjusts focus continuously as long as you hold the shutter button halfway down. If the subject moves, the camera keeps it in focus as long as it's covered by one of the focus areas. In this focus mode, focus doesn't lock.

A variant of servo AF is predictive AF which tracks a moving subject moving towards or away from you and predicts where it will be when the shutter opens.

Some cameras have a continuous autofocus setting that has the camera continually focus when you aren't pressing the shutter button halfway down. When this is on you'll often hear the camera hunting for a focus point as you walk with the camera turned on.

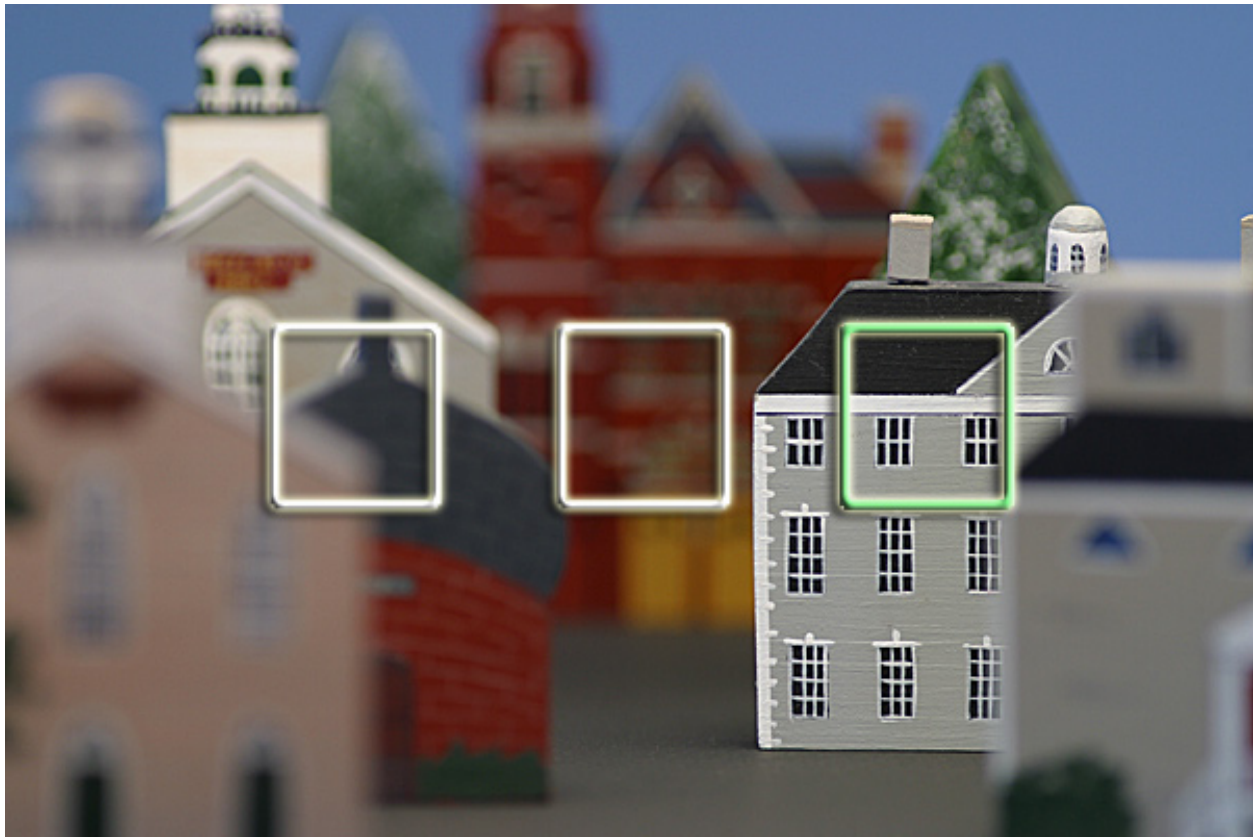


▲ Single AF, best when subjects are not moving toward or away from you, focuses only when you press the shutter button halfway down.

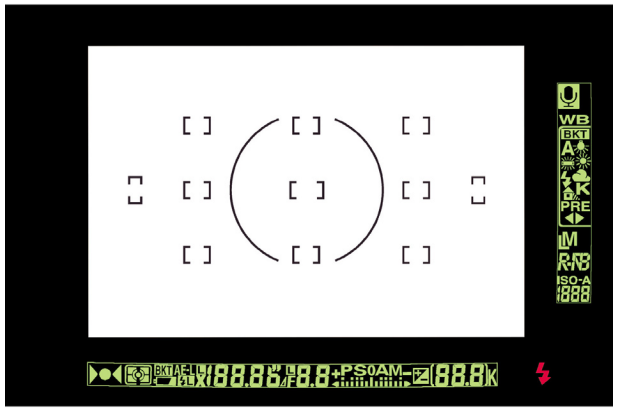
4.16 Autofocus—Focus Points

Animation

Some cameras put more than one focus point, area or zone in the viewfinder or let you move the focus area over any point in the scene. This is a great way to focus on off-center subjects.



▲ Here three areas are indicated with the active one used to set focus shown in green. The camera normally chooses the focus point that covers the closest part of the scene but you can also select the point manually.



▲ It seems the more expensive the camera, the more focusing points you get to choose from. These are from a Nikon SLR.



▲ Some cameras let you move the focus point around the screen. You may also be able to link spot metering to the focus area.

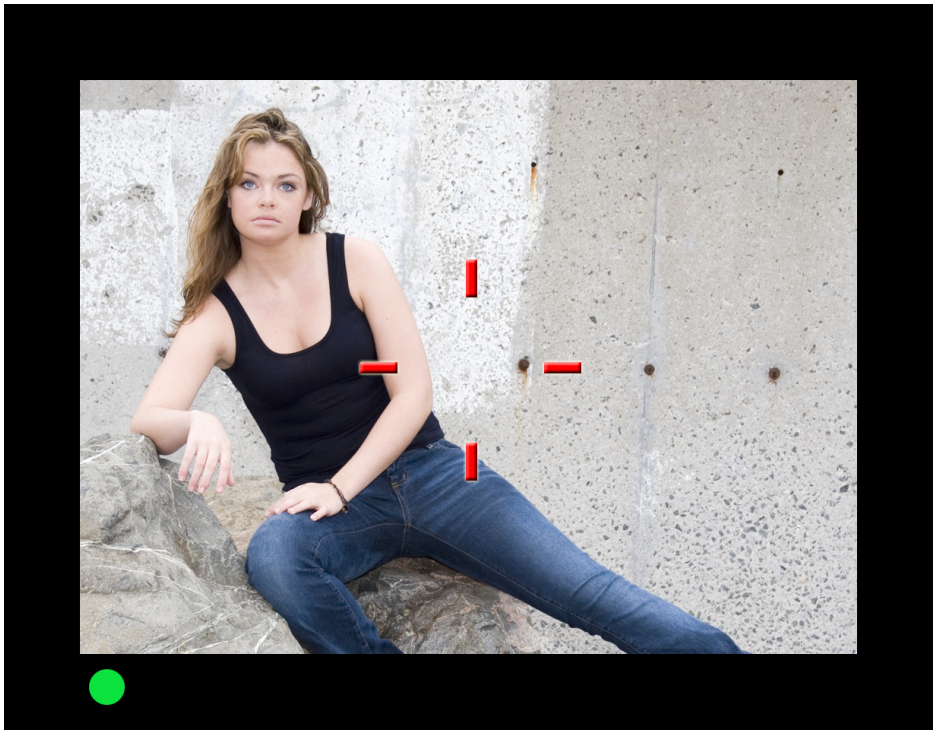
4.17 Focus—Focus Lock

Animation

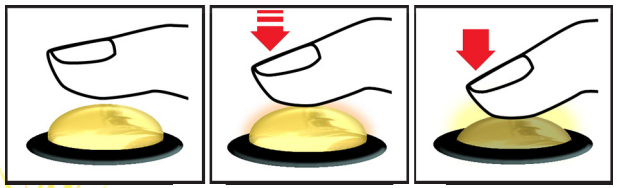
When photographing an off-center subject, or when the camera is having trouble autofocusing, you can use *focus lock*.



1. When photographing an off-center subject, you position the focus area, in this case the center of the viewfinder, over the subject and press the shutter button halfway down to lock focus.



2. Without releasing the shutter button, compose the image the way you want it and press the shutter button the rest of the way down to capture it. If this hadn't been done here the camera would have focused on the wall.



➤ Almost every modern camera works the same way. Press the shutter button halfway down to lock focus and often exposure, and the rest of the way down to take the picture.

Click to visit the companion Web site

4.18 Manual Focus—Ways it's Done

Manual focus gives you control over the placement of the plane of critical focus and let's you focus in situations where autofocus is having problems.



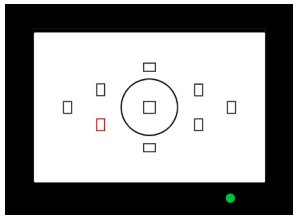
➤ Almost all SLR lenses can be focused by turning a focus ring on the lens. On some you have to set a switch to manual focus first.



➤ Some fixed lens cameras have a focus ring on the lens so you can focus manually. Photo courtesy of Sony at www.sony.com.



➤ Some fixed lens cameras without a focus ring can be focused using a scale displayed on the monitor.



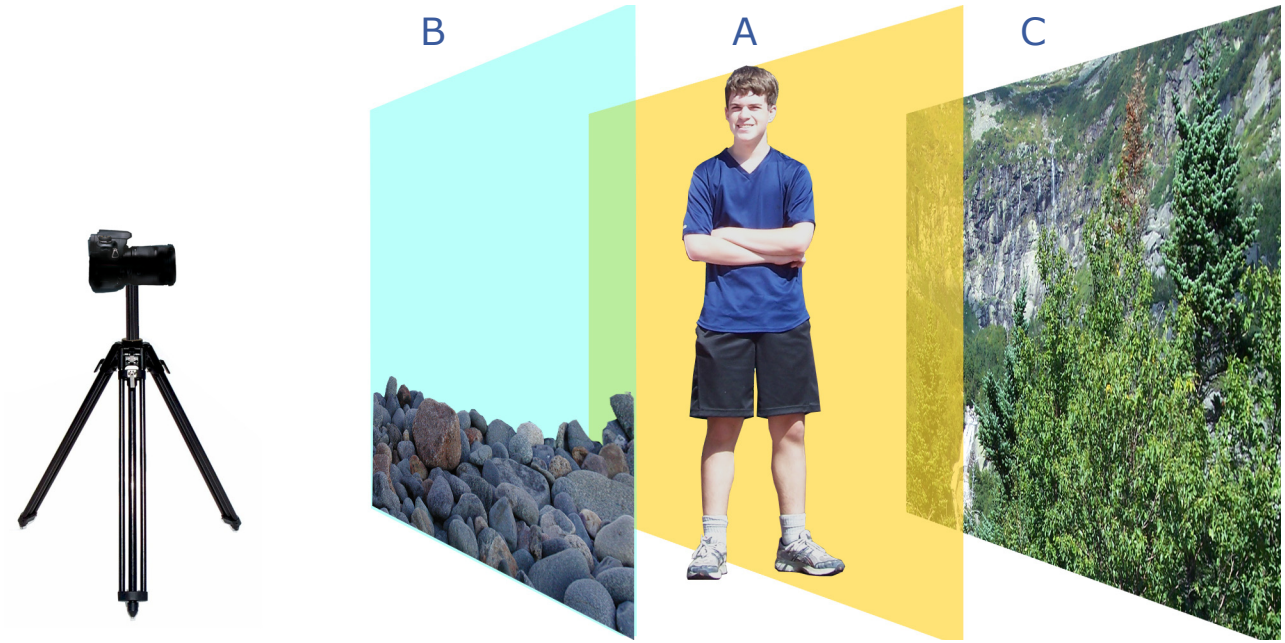
➤ When you manually focus while holding the shutter button halfway down some cameras light up the focus point when the area it covers comes into focus.



4.19 Depth of Field

Animation

After placing the plane of critical focus, you control how much of the area in front and behind that plane is in focus by adjusting the aperture. The near and far limits of depth of field are usually not visible as exactly defined boundaries and you usually can't find the plane of critical focus by looking at a picture. Instead, sharp areas imperceptibly merge into unsharp ones.



▲ The near and far limits of depth of field are shown here as two planes of near and far focus (B and C), parallel to the plane of critical focus (A). At normal shooting distances, about one-third of the depth of field is in front of the plane of critical focus (toward the camera), and two-thirds is behind it (away from the camera). When the camera is focused very close to an object, the depth of field becomes more evenly divided.



▲ In both of these images the plane of critical focus has been placed on the middle face. In the top image a large aperture was used to give shallow depth of field. In the bottom image a small aperture was use to give great depth of field.



Click to visit the companion Web site

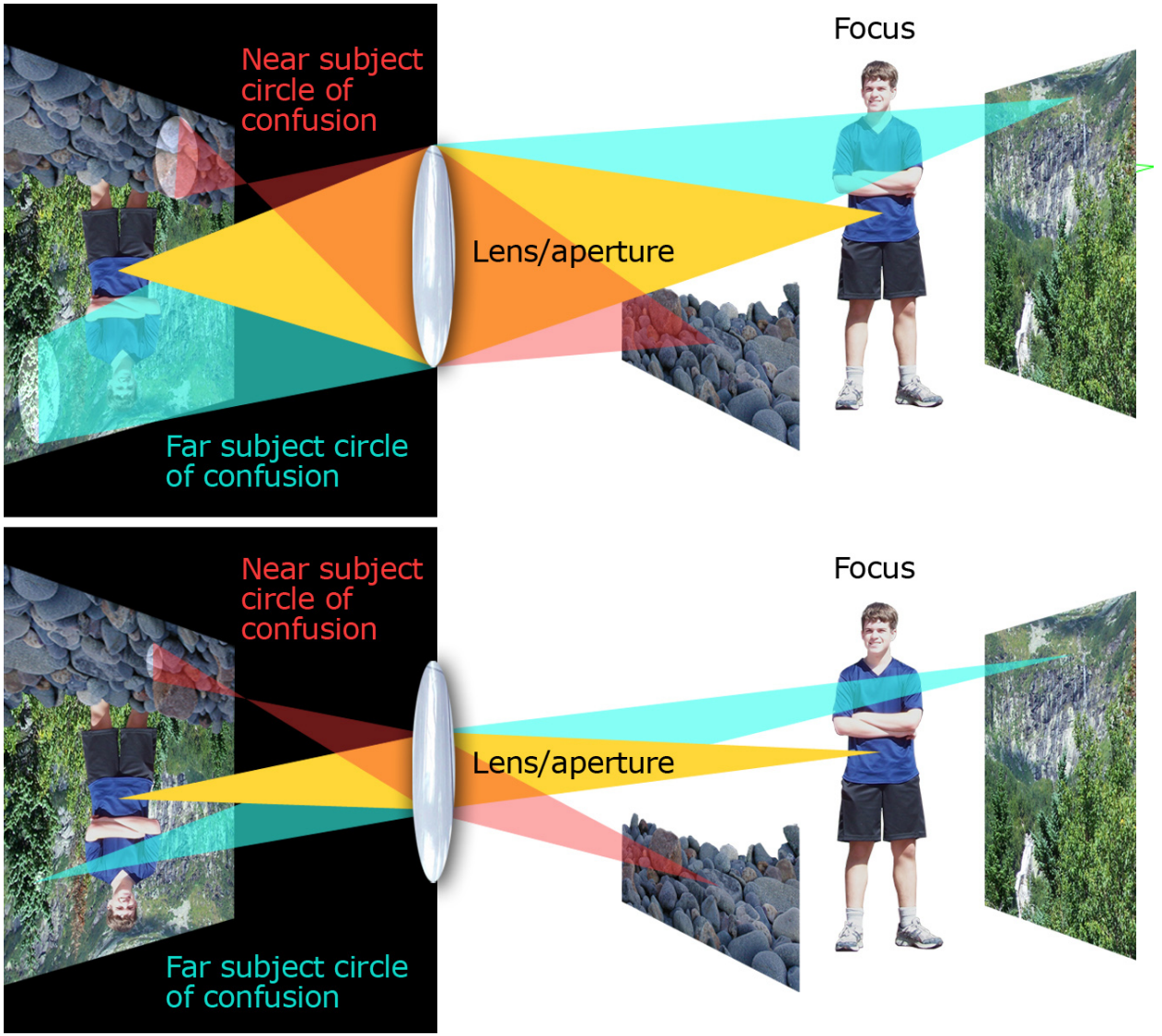


4.20 Depth of Field—The Reasons Why

Depth of field is a result of different parts of a scene coming into sharp focus at different points inside the camera.

- Points in the scene that fall on the plane of critical focus are projected as points onto the sensor.

- Since the light forming these points is cone shaped, any point in the scene in front of or behind the plane of critical focus is projected onto the sensor as a circle, not a point. Called *circles of confusion*, these circles increase in size the farther they are from the plane of critical focus. The point at which they grow too large to look like points defines the planes of near and far focus and depth of field.



When a large aperture is used (top), the cone of light is wide and circles of confusion get larger quickly. Smaller apertures (bottom) have narrower cones of light so the circles get larger more slowly.



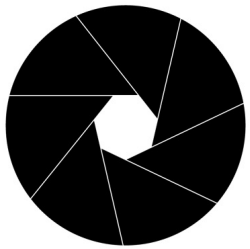
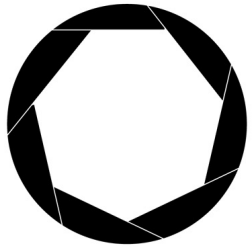
Click to visit the companion Web site



4.21 Controlling Depth of Field—The Influences

To control depth of field, you have three factors to work with.

- *Aperture size*. The smaller the size of the lens aperture (the larger the f-number), the greater the depth of field. The larger the aperture, the shallower the depth of field.
- *Camera-to-subject distance*. As you move father from the subject you are focused on, you increase depth of field. As you move closer, you decrease it.
- *Lens focal length*. Shorter focal length lenses increase depth of field and longer ones decrease it. On many cameras you get a shorter focal length by zooming out and a longer one by zooming in.

Effect on Depth of Field	Deeper	Shallower
Aperture Size		
Camera to Subject Distance		
Focal Length of Lens		



Click to visit the companion Web site

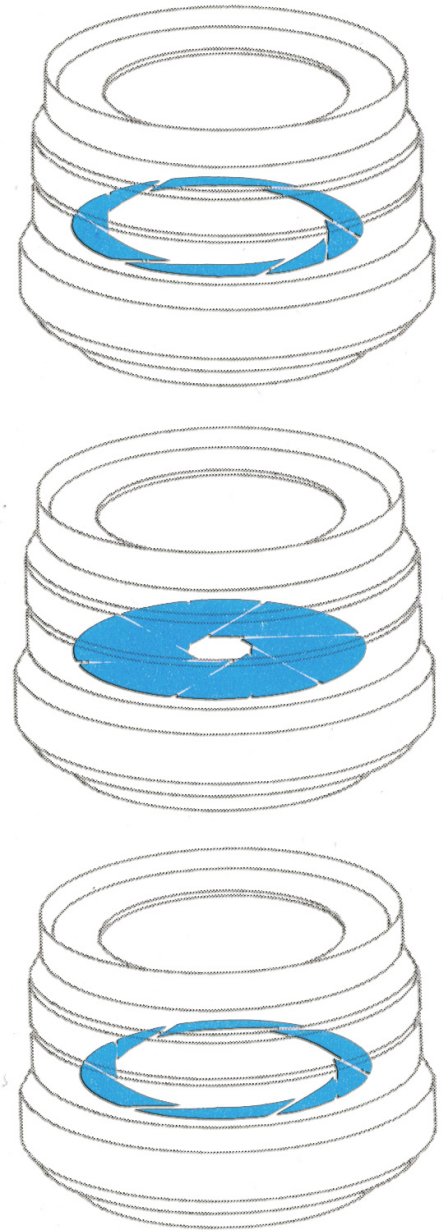


4.22 Controlling Depth of Field—Checking

When you compose an image on an SLR, the aperture is wide open so the viewfinder image is bright. To check the depth of field, you press a depth of field preview button that stops down the aperture to the one that will be used to take the photo. On point and shoot digital cameras, the best way to check depth of field is to take a trial picture and then play it back on the monitor where most cameras will let you zoom it and then scroll around it to examine details.



➤ The depth of field preview button is usually located near the lens mount. Just be sure not to confuse it with the lens release lever that's usually in the same location.



➤ When you hold down the depth of field preview button, the aperture in the lens closes to the selected aperture (middle). If the aperture is small, the image in the viewfinder is dark. When you release it again, the aperture opens all the back to its maximum aperture.



4.23 Controlling Depth of Field—Shallow

Shallow depth of field, sometimes called *selective focus*, is a great way to isolate a subject from a distracting background.



➤ If you can't get a large enough aperture, use a neutral density filter or even a polarizing filter.

➤ Shallow depth of field isn't always a choice—it's forced on you. Here a very long lens was used to photograph a Carolina Wren. A large aperture was needed so depth of field is very shallow—maybe an inch or two. You can see the effects best on the door the bird stands on.





➤ The most common use of shallow depth of field is to set a subject off from the background. When both are sharp the main subject doesn't jump out at you as it does when the background is soft and out of focus.



Click to visit the companion Web site



4.24 Controlling Depth of Field—Shallow, con't.

Placing the plane of critical focus is a creative decision because it determines the sharpest part of the picture. Here are two examples of how focusing was used to move the plane from one part of the scene to another. Notice how your eye is drawn to the sharpest part of the scene.





▲ Here the plane shifts from the flowers in the foreground to the building in the background.





▲ Here the plane shifts from the head to the hand.

4.25 Controlling Depth of Field—Shallow, con't.

Selective focus draws attention to the most important part of the image and sets up a relationship between one part of an image and another.



➤ Here attention is drawn to the sharp monarch butterfly caterpillar and the boy's face is soft and less distracting, but sharp enough that you can see the expression.



➤ Only the bubble gum blower is sharp while figures in the foreground and background aren't.

4.26 Controlling Depth of Field—Deep

Great depth of field is often desirable in landscapes and other scenes with great depth.



➤ Here a small aperture was used to keep everything sharp from the lupine in the near foreground to the distant mountains in Glacier National Park.



➤ Here a middle aperture was used to keep the red call box in the foreground sharp while letting the background go a little soft.



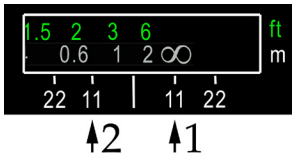
➤ A small aperture makes everything sharp from the roll of hay in the foreground to the farmhouse in the background.



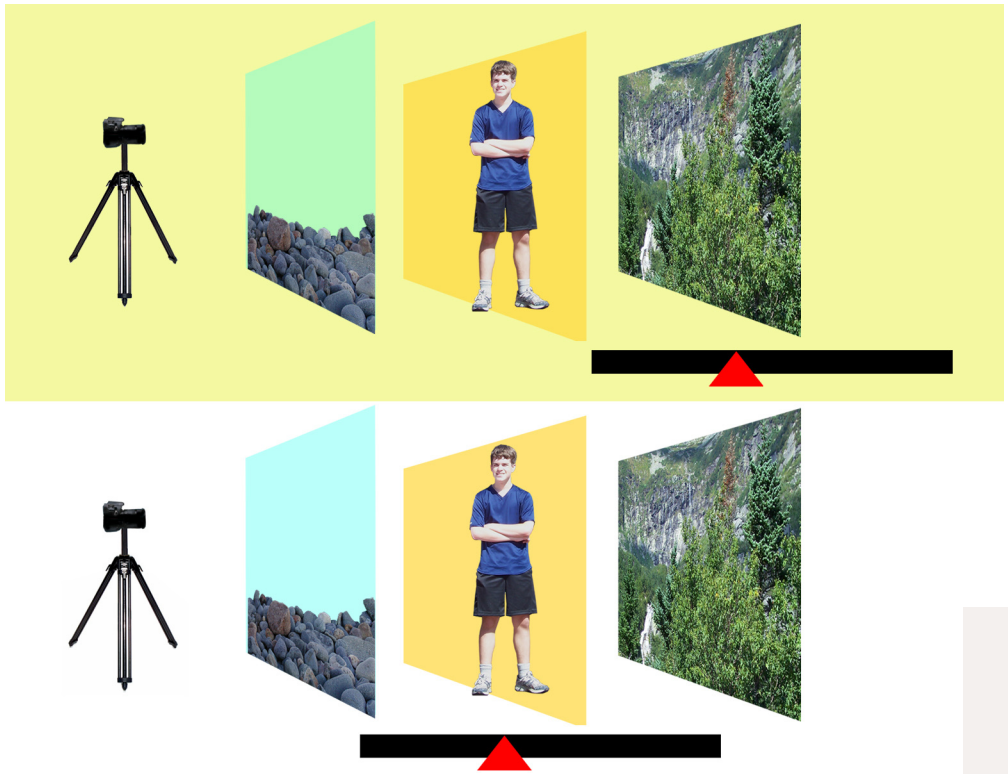
Click to visit the companion Web site

4.27 Controlling Depth of Field—Hyperfocal Distance

When you want the maximum depth of field you need to focus on a point in the scene called the *hyperfocal distance*. This is the point closest to the camera on which you can focus while still keeping in focus the most distant part of the scene. When you focus on this point depth of field extends from half the hyperfocal distance to infinity. Think of it as a way to shift the entire range of depth of field toward the camera.



➤ Many older lenses have a depth of field scale used to set the hyperfocal distance. Here the infinity symbol on the distance scale has been aligned with f/11 (the selected aperture) on the right side of the scale. On the left side of the scale, read up from f/11 to see that everything from about 2.5 feet (0.7m) to infinity is in focus.



➤ Here the camera is focused on the most distant part of the scene—the mountains. All available depth of field to the right of that point is wasted. As a result, the middle and foreground are not sharp because they don't fall within the range of available depth of field.

➤ By focusing on the hyperfocal distance, the most distant part of the scene remains in focus but the near point of depth of field moves closer to the camera. The entire scene is sharp.

The hyperfocal distance varies with lens focal length and aperture. To learn more, Google "hyperfocal distance calculator" or just apply the principle without worrying about exact distances.

4.28 Sharpness Isn't Everything—Using the Shutter Speed

Although sharpness is a laudable goal, it isn't the only one. The creative use of blur can lead to some interesting photos—especially when conveying the feeling of motion. The shutter speed can be selected to blur some or all of an image. Many times you don't do anything but benefit from a happy accident. Anything that moves day or night is a candidate for creative blurring. Your only limitation is getting a slow enough shutter speed in bright light.



➤ Here a fast shutter speed froze everything but the ball.



➤ You can use a neutral density filter or even a circular polarizing filter to get a slower shutter speed in bright light.



➤ One of the classic uses of a slow shutter speed is to blur flowing water, especially that of waterfalls.



➤ Moving lights at night are easy to blur but a very long shutter speed and a tripod help you get dramatic effects.

4.29 Sharpness Isn't Everything—Using the Aperture

Changing the aperture let's you change depth of field. For selective focus it helps if you not only use a large aperture but you also get close and use a longer focal length lens.





▲ In bright sun it's hard to get an aperture large enough to give you shallow depth of field. However, even a little of the effect is noticable in an image. Here the background of the image on the right is slightly softer than the one on the left because a wider aperture was used to take it.



▲ When you get close enough, even a small aperture gives you a fairly soft background.

4.30 Panning the Camera

Panning the camera in the same direction as a moving subject produces an image where the subject is relatively sharp against a blurred background. Your movement should be smooth and controlled to get a good pan, so begin to pan the camera before the subject enters your viewfinder. Smoothly depress the shutter button as you follow the motion of the subject, keeping it in the same position in the viewfinder. Follow through as you would in golf, baseball or tennis. Panning takes practice so take as many images as you can and delete those that don't work. Results are quite unpredictable here because your body motion adds yet another variable to the final picture.



➤ Panning with this barred owl blurred the background and created an impressionistic image.



➤ Panning the camera as this young great blue heron took off blurred the background.



Photo COURSE

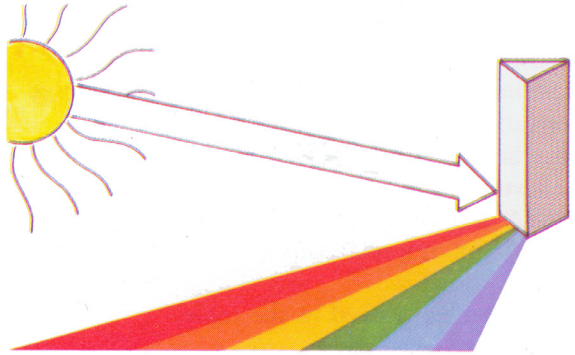
Capturing Light & Color

Chapter 5

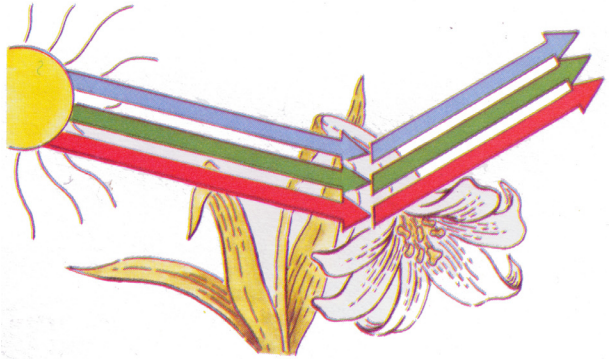
5.1 The Color of Subjects

Animation

All of the colors we see around us and capture in our photographs come from reflected light. What makes each of millions of colors we can see different from one another is which colors a subject absorbs or reflects. For example, a green subject reflects only the green wavelengths of light and absorbs all others. A subject appears white if it reflects most of the wavelengths that strike it, and appears black if it reflects almost none. Inks in color prints also selectively absorb and reflect certain wavelengths of light and so reproduce the colors captured from the scene.

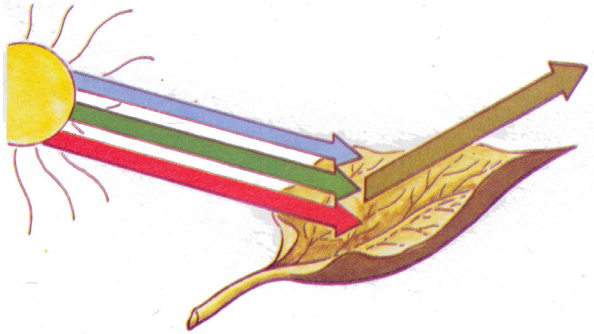


➤ Although light from the sun appears colorless or "white," it actually contains a range of colors similar to a rainbow. You can see these colors using a prism to separate them out.



➤ White objects reflect most of the wavelengths of light that strike them. Black objects reflect almost none of them.





➤ A green object reflects only those wavelengths that create the visual effect of green. The object absorbs the other wavelengths in the light.

Click to visit the companion Web site

5.2 The Color of Sources

The colors reflected from a subject are affected by the color of the light source illuminating it. Although light from the sun at different times of the day and from different kinds of light bulbs look much the same to us, they actually contain different mixtures of colors that affect the color of any scene they illuminate. For example, a white building will take on a red cast when illuminated by a red sunset. The color of the light is specified by its *color temperature* in degrees Kelvin.



➤ To find out exactly what the color temperature of a light source is, you use a color meter like this one from Gossen.

Color Temperature	Type of Light
12,000 K and higher	Clear skylight in open shade, snow
10,000 K	Hazy skylight in open shade
7000 K	Overcast sky
6600 K	
5900-6000 K	Electronic flash
5500 K	Midday
4100 K	
3750 K	
3600 K	
3500 K	Photolamp
3400 K	
3200 K	Sunset, sunrise
3100 K	
3000 K	
2900 K	100 watt tungsten bulb
2800 K	
1900 K	Candlelight, firelight

➤ As color temperature increases it moves through the colors red, orange, yellow, white, and blue white in that order.



➤ To ensure that the colors in your images don't have a color cast, include a gray card in at least one of the shots. You can then remove color casts from this card in Photoshop and all of the other colors in the image will adjust accordingly. You can then apply the same changes to all other photographs shot under the same light.

Click to visit the companion Web site

5.3 White Balance

Your camera's white balance system removes color casts that would otherwise be created by the color of the light source. It's purpose is to capture images with colors that look like they were shot at midday. For example, the fluorescent setting removes the greenish cast created by fluorescent lamps and the tungsten setting removes the warmer, more reddish cast created by tungsten lights. The choices usually include the following:

- *Auto* works in a wide variety of lighting conditions and is the default setting. On less expensive cameras, it may be the only setting available.

- *Manual* lets you set white balance while aiming the camera at a piece of white paper or gray card, under the same light you'll be using to take the picture. This is often the best setting to use when other settings don't give you the results you expect.

- *Artificial light settings* normally include Flash, Fluorescent, and Incandescent or Tungsten.

- *Natural light settings* include Cloudy, Shade, and Daylight.



➤ One way to eliminate white balance problems is to use flash since it has the same color temperature as daylight.



➤ In film photography, color casts were removed by your choice of film or filters placed over the lens.



➤ Typical white balance icons (clockwise from top) are auto (AWB), manual, flash, fluorescent, tungsten, cloudy, shade, and daylight.



Click to visit the companion Web site

5.4 White Balance, con't.

Animation

White balance settings can have a dramatic effect on the colors in your images. In most cases you select a setting to capture more accurate colors, but you can also use them creatively.



▲ These three photos were all taken under the same light but with the white balance setting changed from Tungsten (left), to Fluorescent (middle), and then to Auto (right).

Click to visit the companion Web site

5.5 White Balance, con't.



This subject was illuminated with tungsten light but white balance was set to Daylight. This gives the subject a warm look. Many people like the warm tone in photos taken indoors, and this is one way to capture it.



Under the same tungsten lighting the Auto or Tungsten white balance setting removes the warm cast and captures the colors as if they were shot at midday.





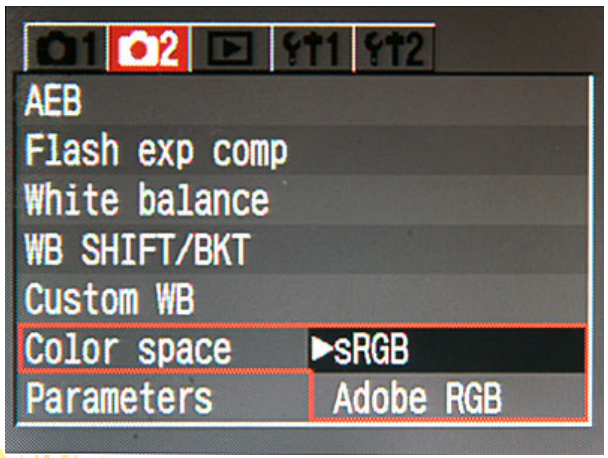
These two photos are of the same subject under the same light using auto white balance on two different cameras. Both the gray background and yellow colors differ significantly. This shows that you can't always count on auto white balance.



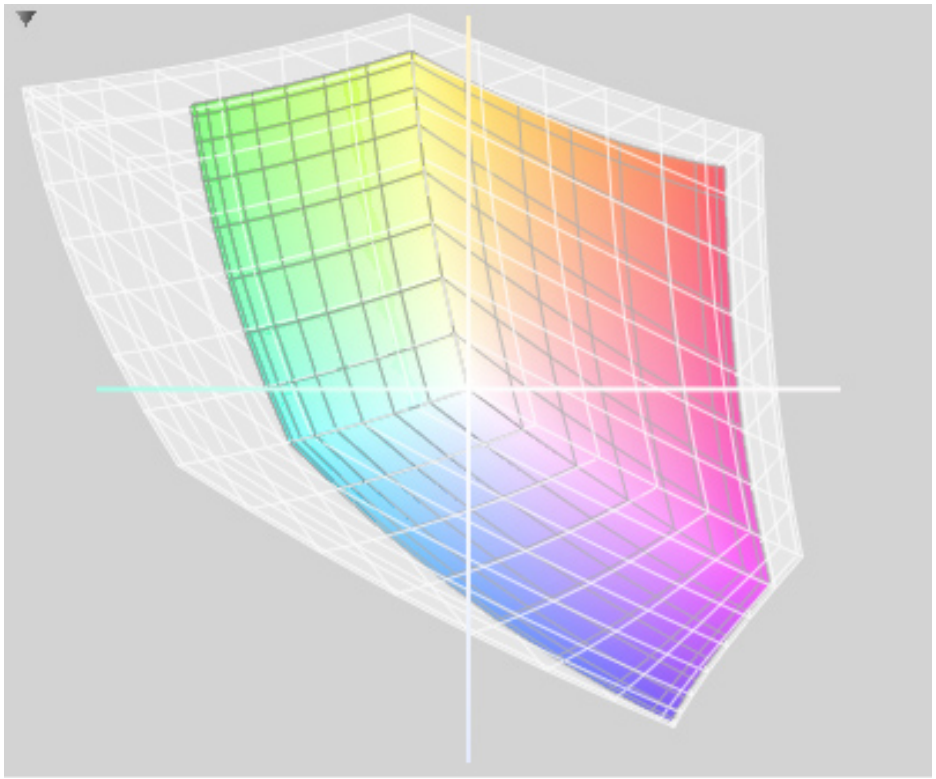
5.6 Color Management—Color Spaces

Animation

White balance determines how colors are distributed in an image but some cameras also let you change the *color space* and that affects the number of colors you can capture. On most cameras the default space is sRGB which is suitable for images that will be displayed on a monitor. However, if you plan on editing your images and making high-quality prints, the alternative Adobe RGB color space is a better choice. It captures a much wider range of colors—called a *color gamut*. The only drawback of Adobe RGB images is that when displayed on a monitor that hasn't been calibrated for it, colors are subdued. However, you can use a program such as Photoshop to convert images from Adobe RGB to sRGB without any loss in quality. Or better yet, you can calibrate your monitor.



➤ Some cameras let you change the color space used for the pictures you are going to be taking.



➤ One reason colors change when moved between devices is because the devices use different color spaces. For example, the sRGB color space used by most cameras and shown here in color has a much smaller gamut than the Adobe RGB color space shown here in white.

Click to visit the companion Web site

5.7 White Balance and Time of Day

One thing photography does is make you aware of the ever-changing quality of light. This heightened awareness is one of the great joys of photography—even when not carrying a camera.



▲ Just before dawn and at dusk, colors often appear muted or monochromatic. During these hours, when the light is relatively dim, you may have to use a long exposure time.



▲ Here the same beach setting was photographed on an early morning with an overcast sky (top) and then again in the late afternoon with bright sun (bottom). The differences are dramatic.



Click to visit the companion Web site

5.8 Sunsets and Sunrises as the Subject

Sunsets and sunrises are relatively easy to photograph because the exposure is not as critical as it is with some other scenes. Underexposure just darkens the scene and overexposure just lightens it. This is a good place to use autoexposure bracketing.



▲ Sunrises and sunsets by themselves aren't always interesting. It's objects in the foreground, such as a skyline, or unusual atmospheric effects such as this dark cloud, that give them some punch. Here the sun has already set, but this is a great time to photograph.



▲ A long-focal-length lens enlarges the disk of the sun so that it becomes a more important part of the picture. Foreground objects silhouetted against the bright sky, or backlit by the sun, can also add interest.

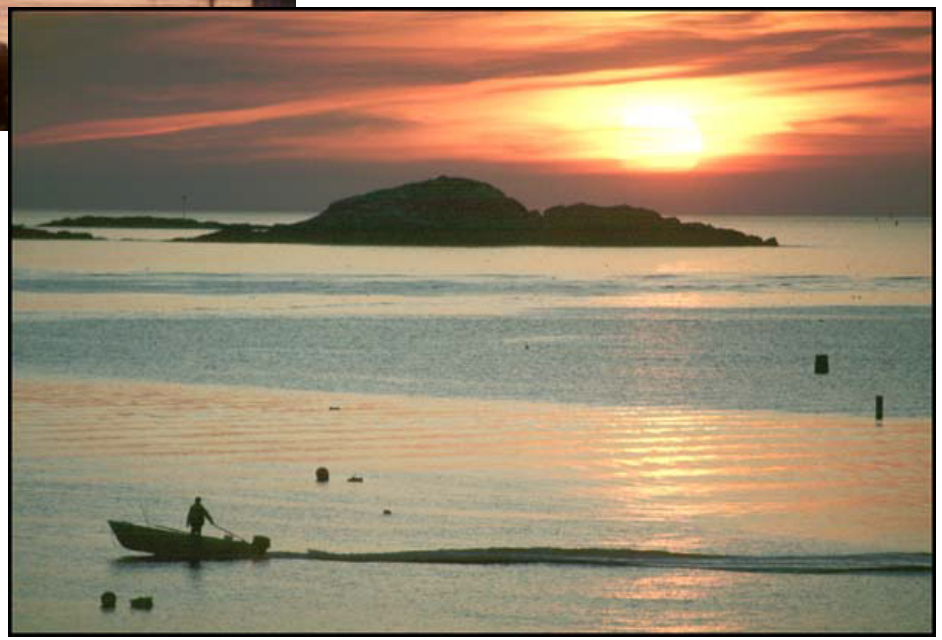
5.9 Sunsets and Sunrises—As the Subject



➤ The sun often takes on a flattened appearance as it rises above the horizon. When partially obscured and softened by haze, its warm, red glow illuminates the foreground.

Warning!

Never look at the bright sun through the viewfinder. You can seriously damage your eyes.



➤ With the bright disk of the sun included in a sunset or sunrise, your picture may be underexposed and too dark unless you increase exposure 1 or 2 stops.

Click to visit the companion Web site

5.10 Sunsets and Sunrises—As the Light Source

It's tempting to take all of your photos of a rising or setting sun, but it often pays to turn around. The rich, warm light changes the colors of everything it hits. This is a magic time to capture images that will really stand out. Colors take on a warm, soft glow that can't be found at any other time of the day.



➤ The rising sun strikes a windmill in Lamar, Kansas.



➤ The rising sun casts a warm glow over this South Carolina marsh.

Click to visit the companion Web site

5.11 Moonsets and Moonrises

Capturing the moon as it sets or rises makes it look larger because it's close to objects on the horizon that have a known scale. As with sunsets, it helps to show the moon in context.



▲ Here the moon sets behind Marblehead's Abbot Hall—the historic building where the famed "Spirit of '76" painting hangs. Light from the rising sun can be seen reflected in many of the town's windows.



▲ The moon makes any scene look better and it looks especially good with water in the foreground to reflect its light.



Click to visit the companion Web site

5.12 Weather—Snow

Snow makes almost every scene more attractive, or at least different. The secret to getting good photos in this, or any other weather, is to get out of the house. Another "secret" is to use exposure compensation to lighten the scene.



▲ This scene was photographed just after sunrise on the morning after a storm that kept almost everyone housebound.



▲ Snow covered scenes are not only beautiful to look at, they make great photographs.



▲ Photographing from a sheltered spot, in this case a car, lets you capture falling snow without getting it on the lens.



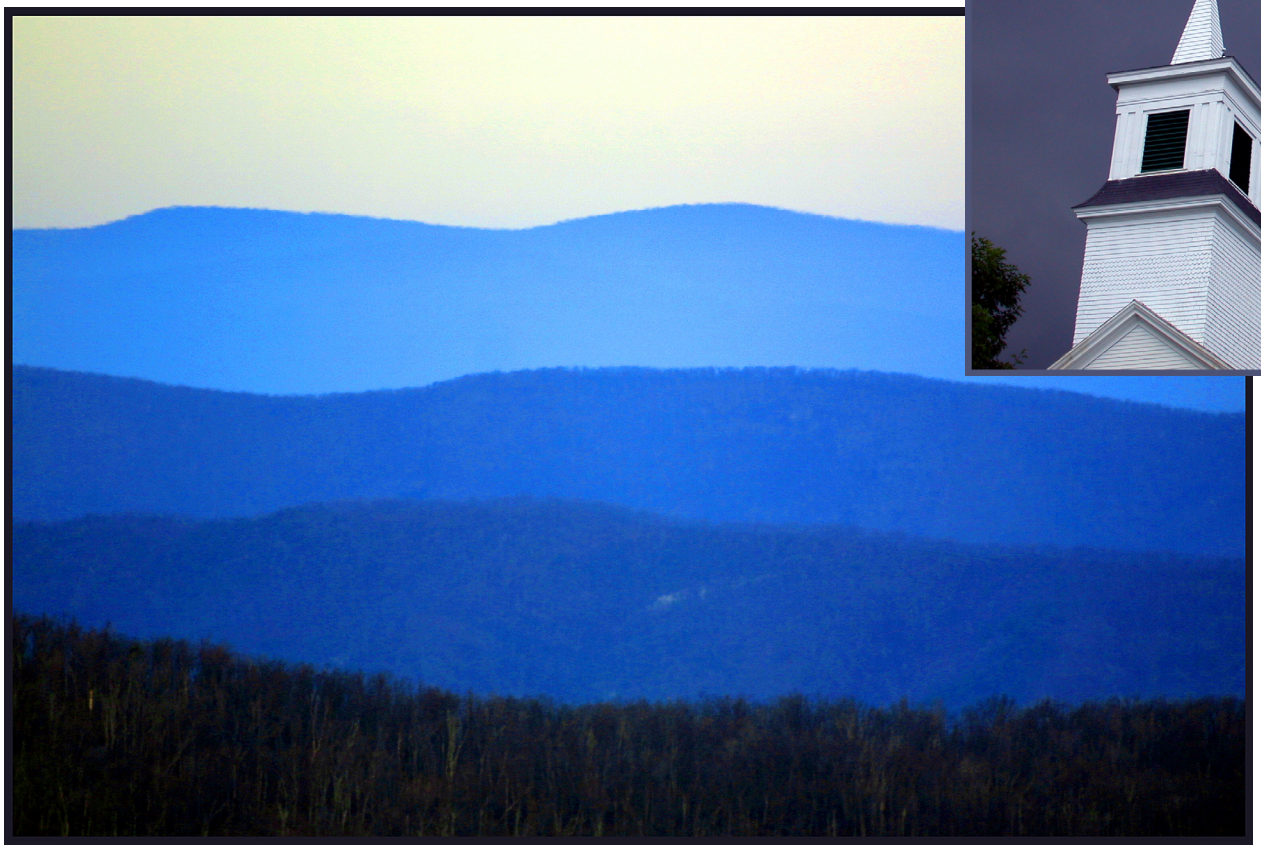
Click to visit the companion Web site

5.13 Weather—Haze, Mist and Clouds

Haze, mist and clouds all have one thing in common—they soften and change the light. There is almost no better time to be photographing then when these are around.

➤ As a storm moves in, a break in the dark clouds adds some interest to the scene.





▲ In light haze, distant subjects become increasingly more blue as in this scene in the Blue Ridge Mountains.



▲ A light fog subdues colors and softens objects in the background.

Click to visit the companion Web site

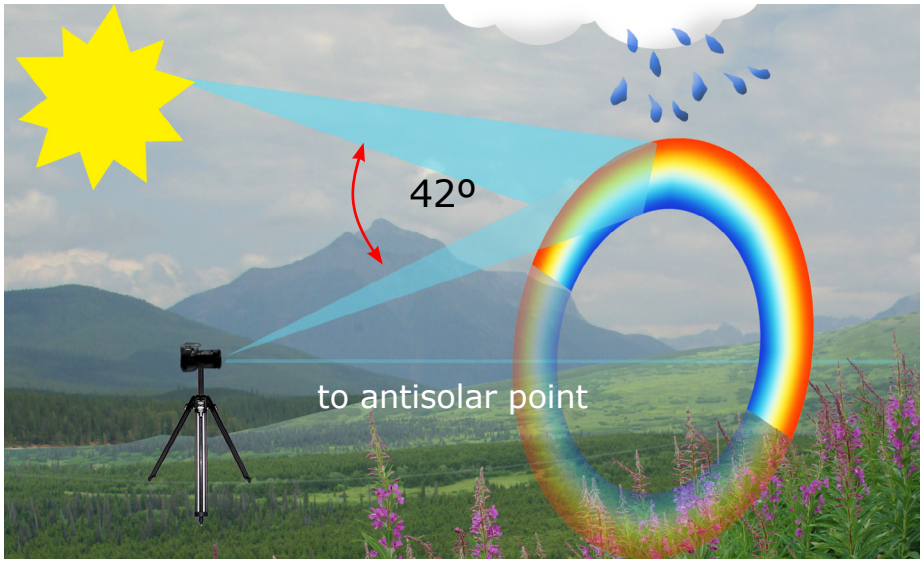
5.14 Weather—Rainbows

Rainbows can often be found as rainstorms clear. All it takes are raindrops in the air and the sun behind you.



Rainbows can be found anywhere there is bright sun and water droplets. Here one forms in an agricultural sprinkler system in Eastern Washington state. You often see the same effect with lawn sprinklers.

One of the things that makes professional cameras so expensive are the seals that protect them from rain and mist. They are less likely to be damaged by foul weather photography.



To photograph a rainbow, it helps to anticipate it. As a storm passes or clears, stand with your back to the sun and imagine a line from the sun passing through your eye, through the Earth, and out into space. (This is called the antisolar point.) A rainbow forms a complete circle around this imaginary line, although from ground level, part of it is below the horizon. A line drawn from your eye to the top of the rainbow forms a 42-degree angle with the imaginary line from the sun through your eye. (If there is a secondary rainbow, it forms an angle of 51 degrees.) Because these angles determine the position of the rainbow in the sky, it will sink as the sun rises and rise as the sun sinks. At midday, the entire rainbow, not just the bottom, will be below the horizon where you can't see it.

Click to visit the companion Web site

5.15 Weather—Rainbows



▲ Weather that creates rainbows often creates other dramatic lighting effects. Here the sky has darkened and taken on an orange glow.



▲ From a plane you can sometimes see all 360 degrees of a rainbow. Here you see a section of one photographed through an airliner window. To the right of the brighter primary rainbow is a dimmer secondary one.

5.16 White Balance and Mixed Lighting

There are times when perfect color balance can't be achieved in a photo. This is especially true when parts of the scene are illuminated by different light sources. White balance can be adjusted for one source but not for all.

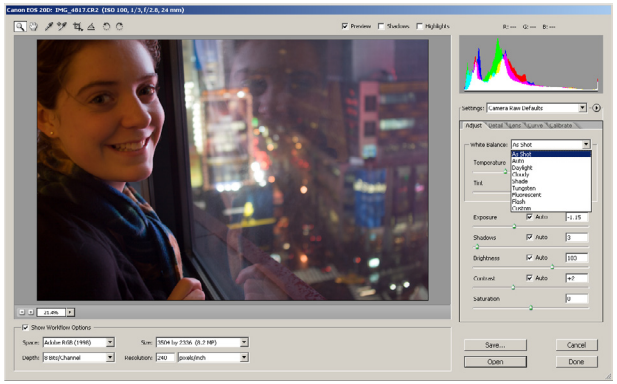


▲ This person is illuminated by the red flares he is lighting in Marblehead's annual July 4th harbor illumination.



▲ The white balance in this shot at Fenway Park in Boston is fine except where the faces are illuminated by a second source—light reflecting from the red seats.

➤ If you use the RAW format to capture images you can set white balance later and experiment with various settings.

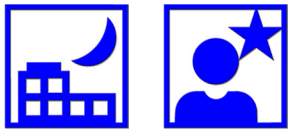


Click to visit the companion Web site

5.17 Photographing at Night

You can photograph many different things outdoors at night. Light sources (street lights, automobile lights, neon signs, or fires) or brightly lit areas (illuminated buildings or areas under street lights) will dominate pictures at night because they stand out strongly against darker backgrounds. Plan to use these bright areas as the dominant part of your picture. A tripod will support your camera during long exposures and prevent blur caused by camera motion during the time the shutter is open.





- Many cameras have night landscape and night portrait modes for taking photos at night.

- Urban areas are full of bright lights that can be used to illuminate nighttime scenes.



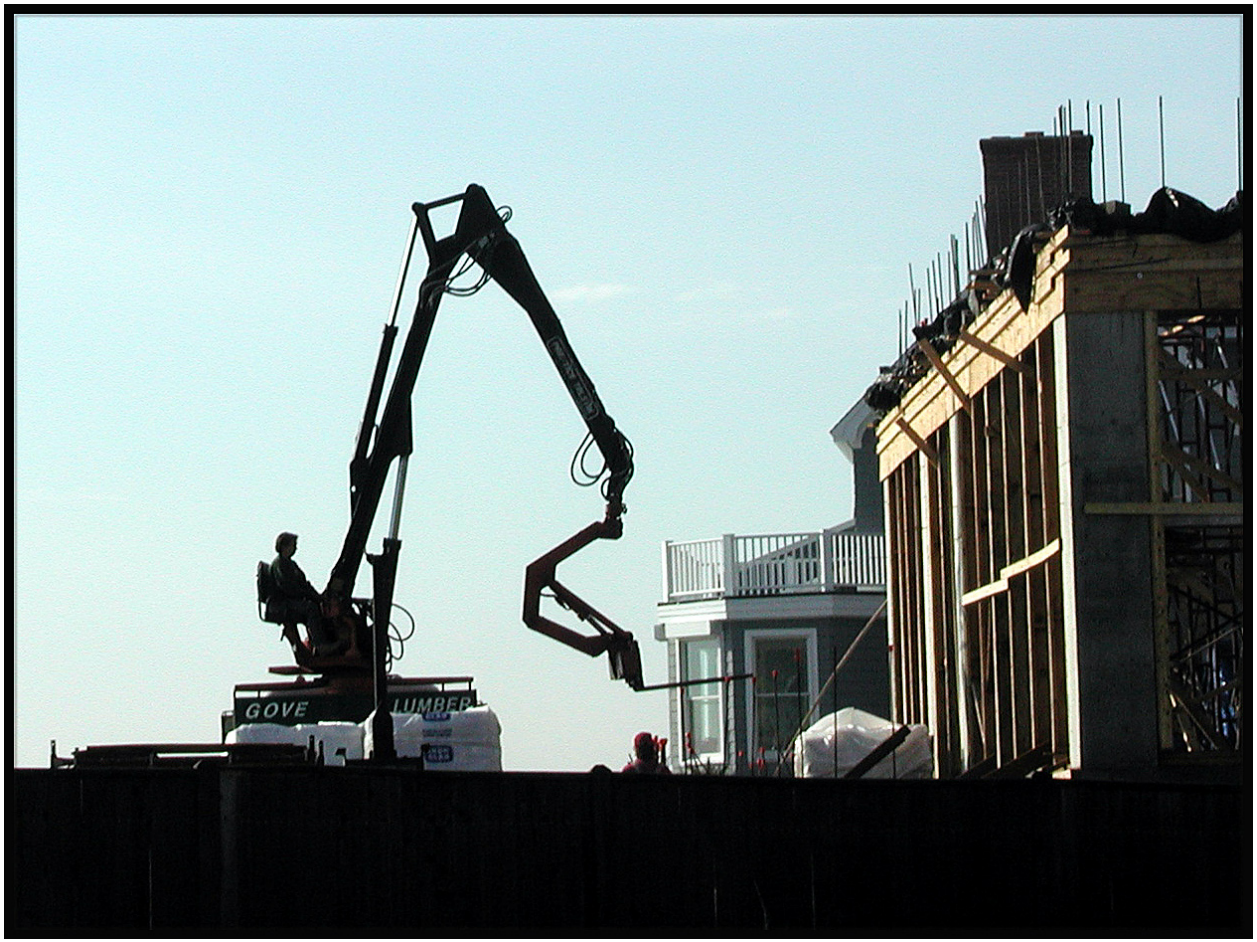
- Just after sunset or before sunrise there is a balance between natural and artificial light so the background doesn't go completely black.

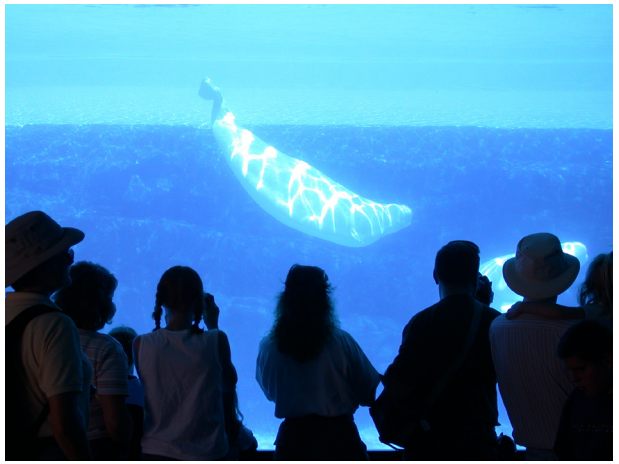


- A few cameras have an infrared mode that captures photos in complete darkness.

5.18 The Direction of Light—Backlighting

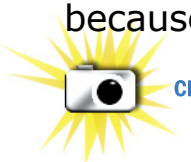
Backlighting puts the side of the subject facing the camera in shade. Automatic exposure tends to expose the background correctly, leaving the main foreground subject too dark. You can use this effect creatively or add exposure to lighten the subject.





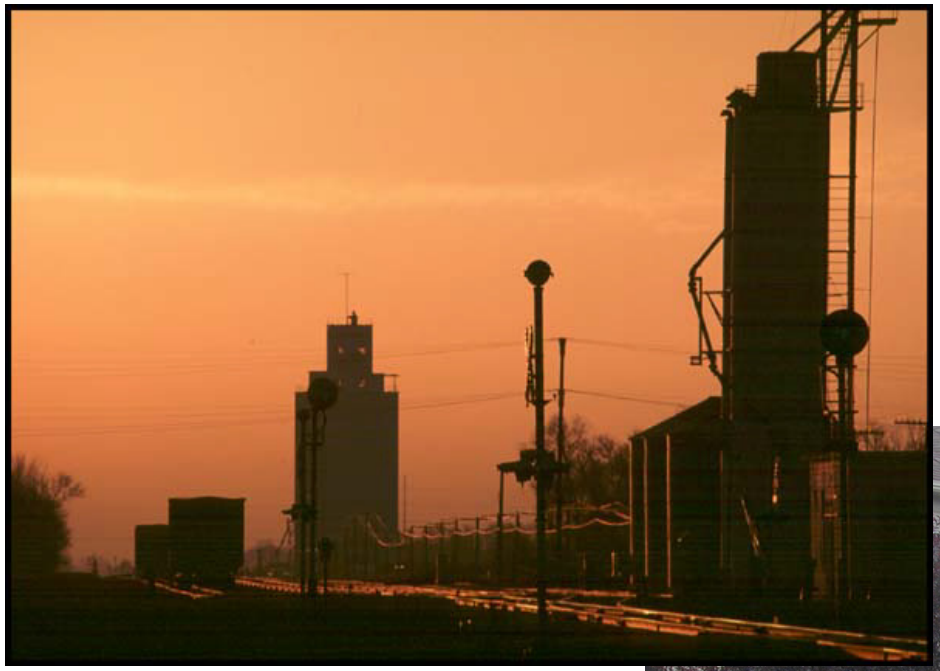


▲ All of these photos are classic backlit scenes although none actually contains the light source. Instead foreground subjects are black because the camera exposed for the brighter background.



Click to visit the companion Web site

5.19 The Direction of Light—Backlighting, con't.



➤ Here the bright morning sunrise was hidden behind a grain elevator so the image wouldn't be overexposed. The result is that the grain elevators are silhouetted against a colorful sky.



➤ Sometimes a backlit foreground subject creates an interesting void in a photo. Here a tilted basketball backboard creates a black hole in an otherwise well-exposed photo.

5.20 The Direction of Light—Backlighting, con't

The difference between frontlighting and backlighting can be dramatic and offer creative possibilities.



▼ These two photos were taken just a few feet apart in the Mojave Desert. They show the same palm tree and Cholla from different sides—one front lit (right) and one backlit (below).





▲ Cholla is covered with spines that become edge lit when the light is behind the plant. The same thing happens with hair.

5.21 Photographing Light Sources

Many light sources are too bright to photograph or just aren't interesting. One of the major exceptions is neon. Exposure can be a problem so this is a great place to bracket so you have choices later.



▲ When it's dark out, there is often too much contrast between the neon and the background. It's hard, if not impossible, to get the perfect exposure.

➤ Neon is often reflected in glass or on shiny surfaces. These may be more interesting than the subject itself.





▲ Photographing just after sunset captures more detail in the areas away from the neon.

5.22 The Quality of Light—Diffuse

Diffused light bounces onto the subject from several directions, lowering contrast. Contrast, in turn, affects the brilliance of colors, the amount of texture and detail, and other visual characteristics. In diffused light, colors tend to be softer and textures are also softened because shadow edges are indistinct.



▲ In diffuse light there are no burned out highlights or detailess shadows. The light is everywhere.





▲ Two photos taken on an overcast Florida beach one morning show how diffuse light is free of dark shadows. The colors are muted and contrast is softened.

Click to visit the companion Web site

5.23 The Quality of Light—Direct

Direct light comes from a point source, such as the sun on a clear day. Direct light produces relatively high contrast between bright highlights and dark shadows that crisply outline details. In direct light you may have to choose whether you want highlights or shadows to be correctly rendered because image sensors can accurately record only a limited range of contrast between light and dark areas.





▲ Direct light has a high contrast with areas facing the sun very light and those in the shadows very dark.

◀ Direct light casts hard shadows.

Click to visit the companion Web site



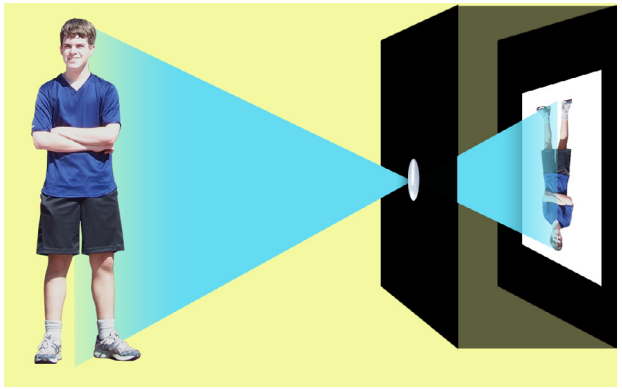
Photo COURSE

Using Lenses

Chapter 6

6.1 Lenses—Pinholes

Although this is a chapter about lenses, they are not actually needed to take a picture. You can make a camera out of a shoebox with a small hole in one end and film in the other. Known as a *pinhole camera*, this primitive device can focus an image and record it on film. In digital photography, the pinhole is placed in the body cap of a camera with a removable lens. The exposure is then made just like any other, except for a much longer time. Pinholes have extremely small apertures and extremely great depth of field.



In a pinhole camera the image inside the camera is upside down.



In digital photography, the pinhole is placed in the body cap of a camera with a removable lens, usually an SLR.

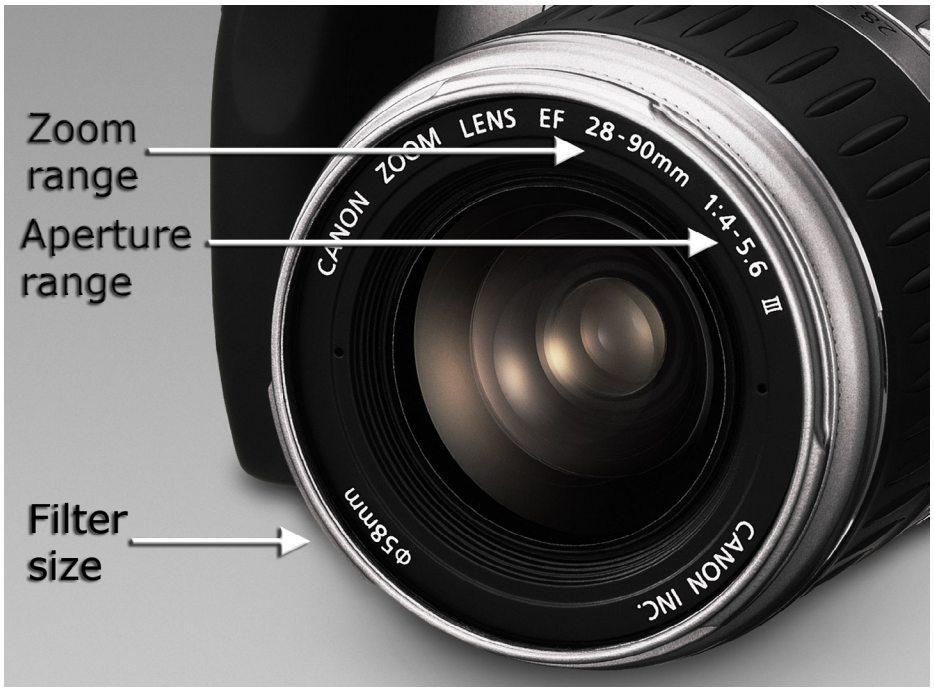


Pinhole cameras are usually made out of cheap paper boxes but if you want a high-quality version, they are widely available. Those from Kurt Mottweiler are functioning works of art.

Courtesy of www.mottweilerstudio.com

6.2 Lenses—Reading Lens Information

Many lenses display information that is useful in your photography. Be sure to take the time to read it and any information that came with the lens.



➤ Some lenses display the current focus distance and focal length. This lens also indicates if it is in auto or manual focus mode and that it has image stabilization.



➤ Information around the lens may include:

- The focal length of the lens or the zoom range in mm. Here it's 28–90mm.
- The aperture or aperture range on a zoom lens. Here it's listed as 1:4.5–5.6. This means the aperture is f/4.5 when the lens is zoomed all the way out and f/5.6 when zoomed all the way in.
- The size of filters or other accessories that can be screwed into the threads. Here it's 85mm.

The minimum focus distance of a lens determines how close you can get to a subject. If too close, the image will be blurry. Generally shorter focal length lenses let you get closer. For example, Canon's 14mm lens will get closer than a foot and their 600mm can't get closer than 18 feet. This information is usually found in the manual.

6.3 Lenses—Fixed or Interchangeable

Most digital cameras have a fixed zoom lens that can't be removed or replaced. One big advantage is that the camera is sealed so no dust can get on the image sensor. Digital SLR cameras almost always have removable lenses so you can change them when circumstances dictate.



➤ Point and shoot cameras often have 3x zoom lenses but they can range much higher. This camera from Canon is equipped with a 12x zoom.



➤ Panasonic's Lumix DMC-LC1 has a fixed Leica lens with a classic design—rings that zoom, focus, and set the aperture. Any Life magazine photographer from the 1950s would be familiar with the controls.



➤ On a fixed lens camera the only way to extend beyond the zoom range is with a lens adapter.



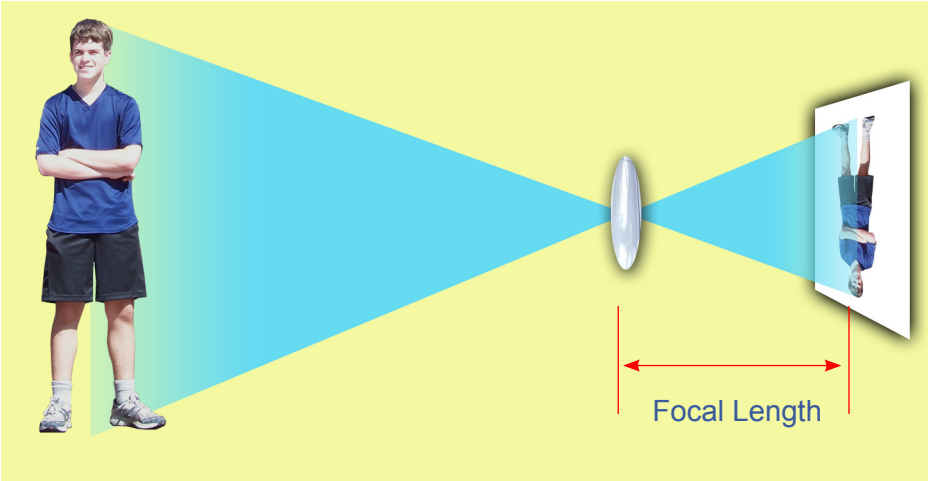
➤ SLR cameras from major camera companies let you choose from a wide array of lenses. Here are those offered by Canon.



➤ Digital SLR cameras use electrical connections to set the lens aperture and adjust focus. They also have a lens release button you press to unlock a lens so you can twist it to remove it.

6.4 Focal Length—Definition

Lenses on both fixed lens cameras and SLRs have specified *focal lengths* that determine the lens's angle of view and magnification.



▲ The focal length of a lens is the distance between the optical center of the lens and the point at which it focuses an image.



◀ Kodak introduced a camera with two lenses, one a zoom and one a fixed focal length wide-angle.



- Wide-angle, short focal length, and zoom out refer to the same thing.
- Telephoto, long focal length, and zoom in refer to the same thing.

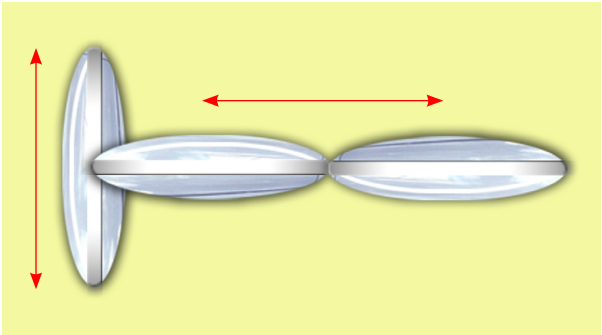
▲ Point and shoot cameras usually indicate the actual focal length of the lens, but the information isn't very useful unless you know the size of the sensor and do some math. To simplify things most companies give the equivalent focal length on a 35mm camera that would capture the same area in a scene. For example, a camera may list its lens as 7.5mm (equivalent to 50mm on 35mm camera). Zoom lenses will give you a range of focal lengths. For example, a lens may be listed as 7.1mm-23mm (35-105mm equivalent in 35mm photography).

6.5 Focal Length—And Aperture

Aperture numbers such as 2.8, 4.5, 5.6 and so on indicate the relationship between a lens' focal length and the physical size of the aperture. For example, an aperture of f/1 means the diameter of the aperture opening is equal to the focal length of the lens. An aperture of f/4 means that the diameter is only 1/4 the focal length. This has a number of effects:

- Long focal lengths lenses with large apertures need a large front element to accommodate the aperture. This is one reason why the front element on a f/2.8 lens is larger than one on a f/5.6 lens.

- The maximum aperture usually changes when you zoom a lens because as the focal length changes so does the size of the aperture to maintain the relationship.



▲ The aperture openings on a lens are fixed sizes. As you've seen, each let's in twice as much light as the next smaller and half as much as the next larger. The f number is related to the lens' focal length. As shown here an aperture of f/2 means the focal length is twice as long as the maximum aperture is wide.



▲ This f/2.8 400mm lens requires an aperture opening with a diameter that is large enough that only 2.8 of them would equal the 400 mm focal length. That is 143mm or 5.62 inches. That's why the front element of the lens is so big and why the lens is so expensive.

6.6 Focal Length—Angle of View & Magnification

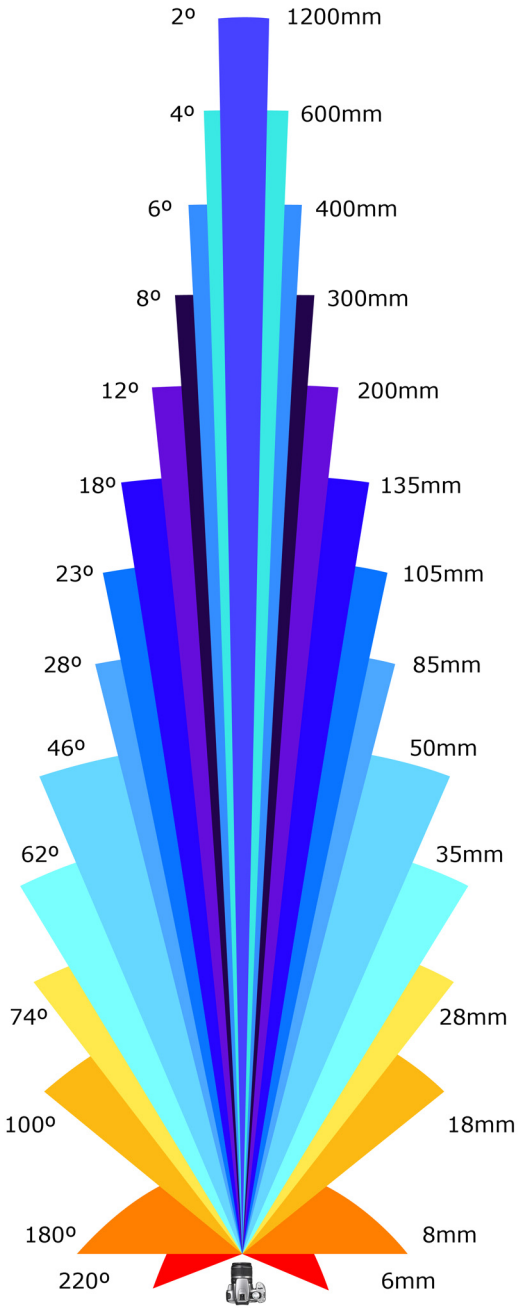
Animation

Angle of view refers to how much of a scene the lens covers. Short focal lengths capture a wide expanse of a scene. Long focal lengths have a narrow angle of view that lets you isolate small portions of the scene without moving closer to the subject.



➧ A lens' angle of view translates into its field of view at a given distance. A wide-angle lens (left) will have a larger field of view than a long focal length lens (right).

➤ The longer a lens' focal length, the narrower its angle of view.







➧ Magnification is related to angle of view. A wide angle of view (top) includes a wide sweep of the scene and all of the objects in the scene are reduced to fit into the image. A narrow angle of view (bottom) covers a much smaller area so objects in a scene appear larger.

Click to visit the companion Web site

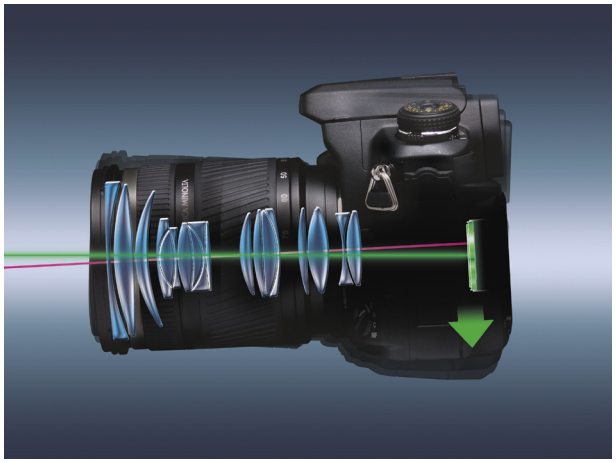
6.7 Focal Length—Image Stabilization

Animation

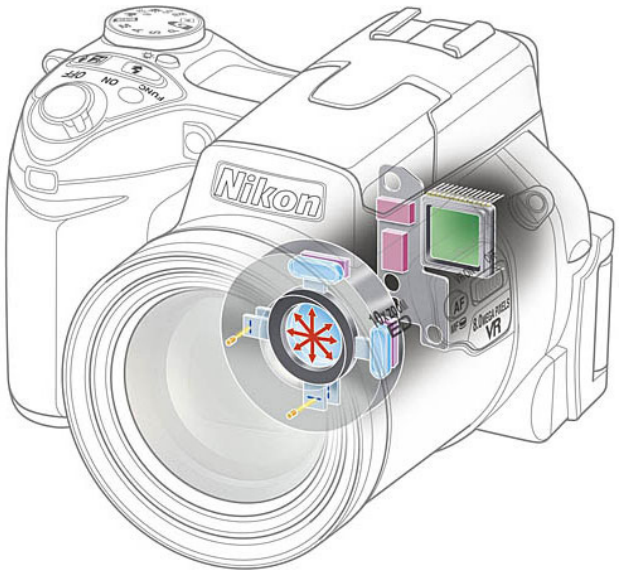
When you move the camera during an exposure, especially at slow shutter speeds, it causes blur in the image. To reduce this blur, camera companies have introduced *image stabilization* systems. These systems use a sensor to recognize camera movement and then compensate for it by shifting a lens group in the lens, or shifting the sensor in the camera. When the camera has a fixed lens, it doesn't matter which approach is used. However, on cameras with interchangeable lenses it does matter.

- If a lens group is shifted, the system must be built into every lens—a costly process.
- When the sensor is shifted, the system works with any lens attached to the camera.

In most cases these systems let you shoot at shutter speeds two or three stops slower than normal. This is particularly useful when doing macro or telephoto photography and in dim light where a tripod cannot be used. With the camera mounted on a tripod, some systems have to be turned off or they will add blur.



➤ Minolta's Anti-Shake system shifts the CCD to compensate for camera motion. Because the mechanism is in the camera's body, it works with most lenses.



➤ Nikon's image stabilization, called VR, for Vibration Reduction, and Canon's IS move a lens group to counteract camera motion.



➤ On Canon lenses a switch turns IS on (the vertical line) or off (the "o").



Click to visit the companion Web site

6.8 Focal Length–Effect of Sensor Sizes

Animation

Digital SLRs are often adapted from 35mm film cameras and use the same lenses. These lenses project an image circle onto the image sensor that is designed to cover a frame of 35mm film. When used on a digital camera, the angle of view captured in the image depends on the size of the image sensor.

- When the image sensor is the same size as a frame of 35mm film, called a *full-frame sensor*, then a lens' angle of view, and hence the focal length, is the same as it is on a film version of the camera.

- When the image sensor is smaller than a frame of film, as many are, it captures a smaller area, effectively increasing the lens' focal length by a factor of 1.5 x or so compared to the focal length indicated on the lens. Therefore, a lens that is 100mm on a film camera will be 150mm or 160mm on the digital version of the camera. This multiple works across the entire family of lenses that work with the camera, making wide-angle lens less so on a digital camera, and making telephoto lenses more so.



▲ A lens projects the image as a circle and the size of the film or image sensor determines how large an area of the circle is captured. Here the frames (from largest to smallest) show the areas captured by 35 mm film or a full-size sensor, an APS-H sensor, and a APS-C sensor.

Click to visit the companion Web site

6.9 Focal Length–Effect of Sensor Sizes, con't.

The most common sensors are either full frame or APS-C and both offer advantages and disadvantages. One advantage of a large sensor is that it allows for larger photo sites that capture less noise. The biggest advantage of the smaller sensor is a lower cost, but it also has a focal length advantage in some situations.



➧ An APS-C sensor gives you a bonus when used with longer focal length lenses and macro lenses because its sensor captures a smaller part of the image circle (the white outline) than a camera using a larger sensor so it has a longer effective focal length.



➧ A full frame sensor gives you a bonus when used with short focal length lenses because its larger image sensor captures a larger part of the image circle than a camera using a smaller sensor (the white outline).

6.10 Lenses—OEM or 3rd Party

Canon and Nikon, with their vast arrays of lenses, have a real advantage over other camera companies that make digital SLRs. Since developing a lens lineup is hugely expensive, there are only two ways companies can overcome this disadvantage:

- The easiest way is for the company to license the lens mount from one of the leaders so their lenses work with your camera. Fuji has done this with Nikon so you can buy a Fuji camera and use it with Nikon lenses.

- A more expensive way is to join with other companies to share the costs of development. Olympus (along with Kodak, Fuji Photo Film, Panasonic, Sanyo and Sigma) are doing this with the *Four Thirds System* and Konica Minolta and Sony with the Maxxum/Dynax lens mount.

There are also independent *third-party companies* that make lenses for cameras. To reduce costs, their lenses can be used with more than one camera make just by changing the mount, sometimes using an adapter.



➤ It's often possible to find less expensive lenses from third-party companies such as Tamron, Promaster, and others.

Courtesy of Tamron at www.tamron.com.



➤ Lenses from the same company that made your camera are called OEM lenses—Original Equipment Manufacturer. These lenses are generally of very high quality but can also be quite expensive.



Click to visit the companion Web site

6.11 Zoom Lenses—Introduction

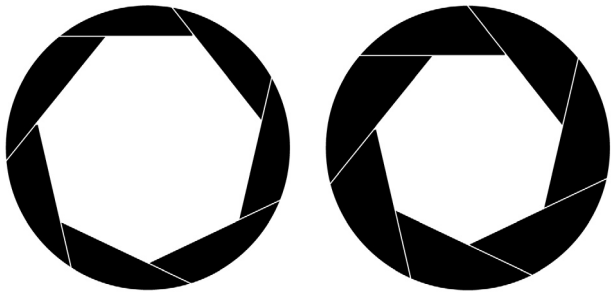
Some lenses have a fixed focal length, but zoom lenses give you a choice. Carrying one zoom lens is a lot more convenient that carrying a backpack full of fixed focal length lenses.







▲ Here, a lighthouse in Maine is photographed from the same spot with the lens zoomed to a short (left), normal (middle), and long (right) focal length. The zoom determines the angle of view and magnification.



◀ On most, but not all, zoom lenses the maximum aperture gets smaller as you zoom in on a subject. For example, a lens may have a maximum aperture of f/2 when zoomed all the way out (left) and f/4 when zoomed all the way in (right). This change forces the camera to compensate by changing the shutter speed to keep the exposure constant. (There are zoom lenses that maintain a fixed aperture through the entire zoom range.)

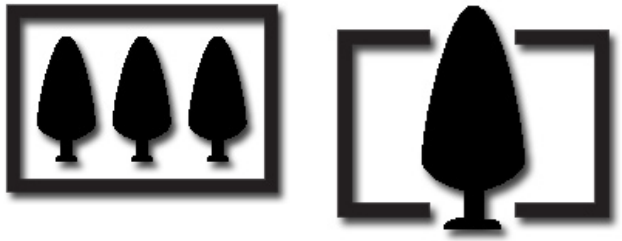
6.12 Zooming—Fixed Lens Cameras

Most point-and-shoot and other fixed lens cameras have a built-in zoom lens. The typical optical zoom range is 3x but some go as high as 12x. On a 35mm film camera the equivalent range of a 3x zoom would be about 35–100mm.



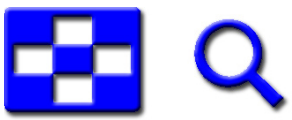
▲ Many fixed lens cameras have a zoom lever or buttons you press to zoom in and out. The direction of zoom is often indicated with icons.

➤ Common zoom icons indicate zooming out (left) and zooming in (right).





▲ Some fixed lens cameras display a scale on the monitor so you know how far you are zoomed.



◀ Zoom levers are also used in playback mode where they usually display a series of small thumbnails in what's called index view, or enlarge the image so you can examine details.

6.13 Zooming—SLRs

On SLRs, zoom lenses are very popular and come in all zoom ranges from ultra-wide to telephoto.



▲ You zoom an SLR lens by turning a ring on the lens.



▲ Zoom indicator on an SLR lens shows it set to 10mm.



◀ When your camera has a zoom ring on the lens, you can turn it during a slow exposure to streak lights.



◀ Although unusual, some fixed lens cameras, like this one from Sony, have a zoom ring on the lens.

Click to visit the companion Web site

6.14 Zoom Lenses—Optical and Digital

Animations

Zoom comes in two varieties; optical and digital.

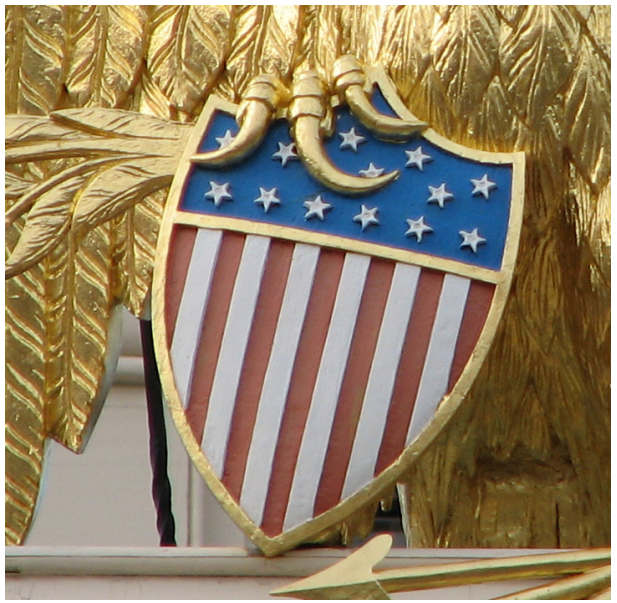
• *Optical zoom* actually changes the area of the scene falling on the image sensor. Every pixel in the image contains unique data so the final photo is sharp and clear.

• *Digital zoom* uses sleight of hand by taking a part of the image falling on the sensor and then enlarging that small area to fill the sensor. It does this by adding new pixels to the image using a process called *interpolation*. The interpolated image doesn't have as many unique pixels as one taken with an optical zoom so is inferior. In fact, you don't even need this zoom feature because you can get exactly the same effect, with better results, just by cropping a normal image in a photo-editing program and then enlarging it.



➤ Some fixed lens cameras have a zoom scale that shows when you have left optical zoom and entered digital zoom.

➤ These two photos were taken with the same camera. One was taken using optical zoom (top) and the other with digital zoom from farther away(bottom). The one taken with optical zoom is much sharper.





Be aware that some camera companies hide the fact that their zooms are digital by giving them deceptive names. Bell & Howell, for example, calls theirs "smart zoom."

6.15 Normal Lenses

A *normal lens* is generally considered to be one with a focal length between 50–85mm. On fixed lens cameras with zoom lenses, a normal focal length is slightly above the widest angle zoom. This focal length is ideal for portraits and other general purpose photography.



▲ Gene checks his haul of morel mushrooms after a spring walk in the woods.



▲ Emily works at drawing a crowd to the junior class yard sale.



Click to visit the companion Web site

6.16 Wide Angle Lenses

A *wide-angle lens* is often called a *short focal length lens*, or just a *short lens*. To get a short focal length on a zoom lens you zoom it out to a wider angle of view. Wide-angle lenses are great for landscape and interior photography.



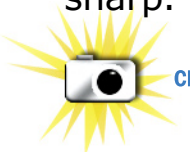
▲ A wide-angle lens captured this view of Marblehead's Civil War museum. The image shows a good view of the room and the lens' great depth of field kept both foreground and background objects sharp.



◀ On SLR digital cameras you can change to wide-angle by zooming out or changing to a shorter focal length lens.

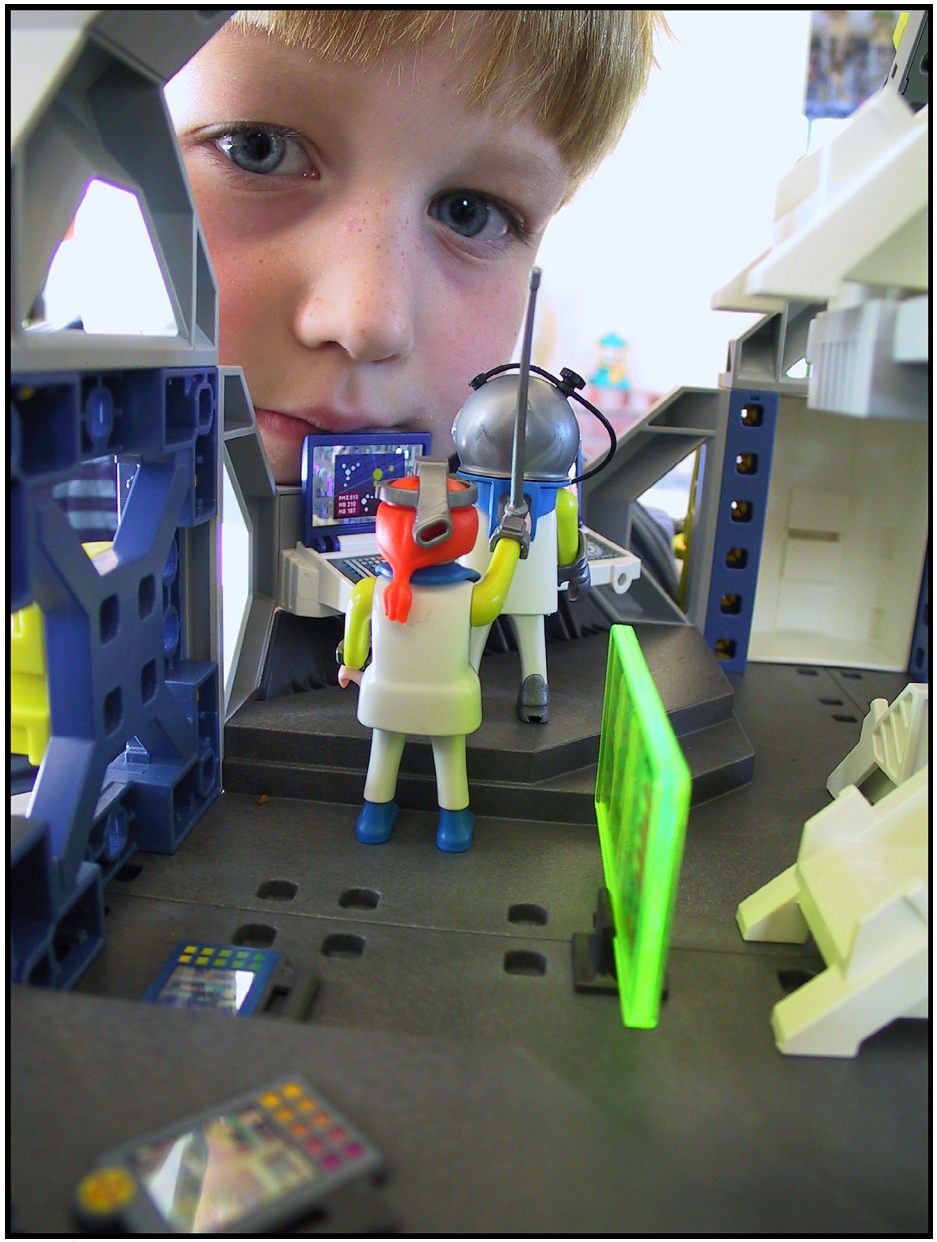


▲ On fixed lens cameras you can get an even wider angle by attaching a wide angle converter.



Click to visit the companion Web site

6.17 Wide Angle Lenses, con't.



➤ Wide-angle lenses have both great depth of field and close focusing distances that can be combined for unusual photos.



➤ Wide-angle lenses are great for capturing close-ups of flowers and natural subjects in context. Instead of using a macro lens to capture just the flower, a wide-angle lens let's you get close while still including some background. Because of the context, you can tell the flower grows on the forest floor—it's a wood anemone.

6.18 Wide Angle Lenses, con't.

Animation

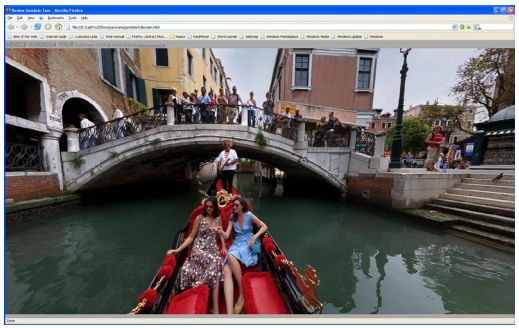
Fisheye lenses take wide-angle to its extreme—often 180 degrees. However, when used on a digital SLR without a full frame image sensor, the angle of view won't be as great. These lenses have dramatic barrel distortion so all straight lines, other than those in the center of the scene are curved in the image.



➤ The Canon 15mm fisheye lens fills the entire image area, instead of just a circle, so is considered to be a rectilinear fisheye.



➤ Many fisheye lenses capture images with a characteristic round look. This image of a performing arts center was taken with the 8mm Peleng made in Belarus.



To pan the panorama in the animation, drag with the mouse. Pressing Shift or Ctrl will zoom.

➤ You can take two or more shots and create interactive 360 degree panoramas, a process called VR Photography. This panorama, capturing a Gondola tour in Venice, was created by Hans Nyberg for VRWay.com. You can see more on Hans' work at www.panoramas.dk and www.arounder.com.



➤ The Olympus 8mm fisheye lens covers 180 degrees and is a true fisheye lens.

Click to visit the companion Web site

6.19 Distortion with Wide-Angle Lenses

Animation

Short focal length lenses are not good for portraits and close-ups of subjects where an accurate portrayal is needed because they distort at close range.





➤ The top photo, taken with a short focal length lens, makes the closest head appear much larger than the rest. The bottom photo, taken from farther away with a longer focal length lens shows the true relationship between head sizes.





➤ In the portrait on the left a short focal length lens has dramatically distorted the shape of the head. By shooting the portrait on the right from farther away with a longer focal length lens the head and face look normal.

6.20 Distortion with Wide-Angle Lenses, con't.



➤ When a vertical line is near the edge of the image created by a wide-angle lens, it may be curved due to barrel distortion. When the vertical line is in the center of the view (inset), the curvature doesn't show.



➤ In this photo the lines at the bottom are slightly curved by barrel distortion.

6.21 Long or Telephoto Lenses

A *telephoto lens,* often called a *long focal length lens* or just a *long lens,* has a narrow angle of view. To get a long focal length on a zoom lens you zoom in on a subject.



▲ A long focal length increases the size of the sun or moon dramatically in relation to foreground subjects.



▲ Long lenses with large maximum apertures, like this one from Olympus, are both expensive and heavy—$7,000US and 12 pounds or more in some cases.

➤ On digital SLRs you can use a teleconverter or telextender between the camera and lens to get an even longer focal length. Their magnification is given as 1.4x, 2x, or 3x. A 1.4x will increase a 100mm lens to 140mm.

➤ On fixed lens cameras you can add a teleconverter to get a longer focal length.





6.22 Long or Telephoto Lenses, con't.

A long focal length makes distant objects appear compressed.



➤ A long lens compresses this street scene in the Rocky Mountains.



➤ A long lineup of flag bearers at a military funeral is compressed when shot with a long lens.



➤ Many birding photographers connect digital cameras to field scopes in a field called digi-scoping. Since you may already have a scope, this is an inexpensive way to get a long focal length lens. To mate the camera and scope you need an adapter.

Courtesy of Nikon Imaging.



➤ To reach out even farther, you can use an adapter to attach a digital camera to an astronomical telescope.



Click to visit the companion Web site

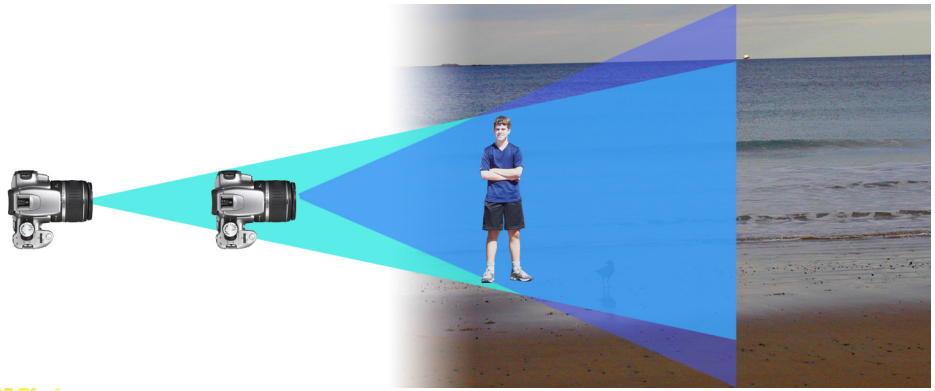
6.23 Perspective

Animation

The camera subject distance affects *perspective*. As you move farther way from the subject and increase focal lengths to keep the foreground subject the same size, the larger the background looms.







➤ As the photos above show, perspective changes as you change your distance from a subject while changing focal lengths to keep the foreground subject the same size. As the distance and focal length increases, the background increases in size relative to the foreground.

Click to visit the companion Web site

6.24 Macro Lenses and Macro Mode

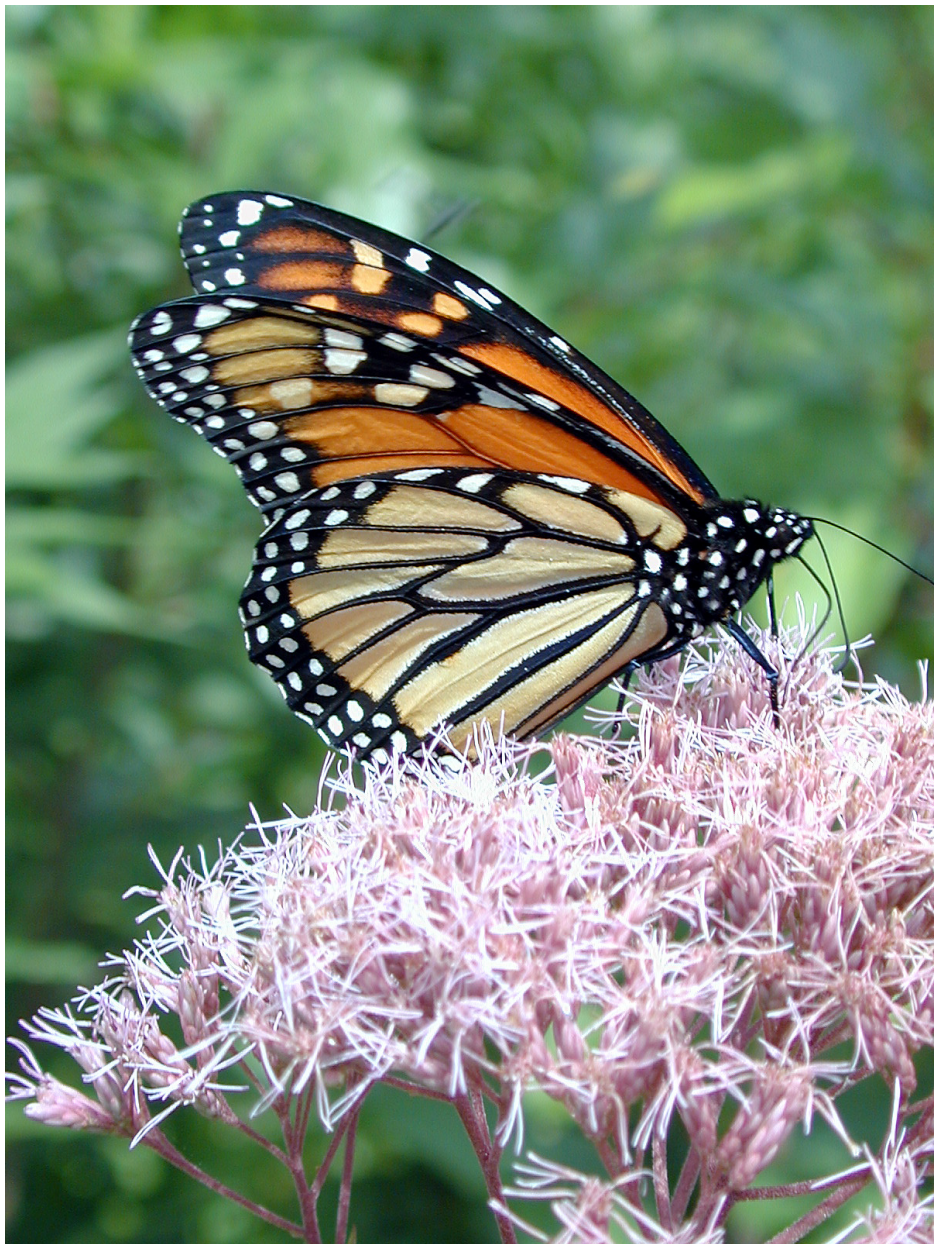
One of the great joys of photography is close-up or macro photography. There are a number of ways to do this:

- Point-and-shoot or other fixed lens cameras usually have a macro mode that lets you get close to a subject.
- SLRs have macro lenses and some normal lens have a macro mode that let's you get closer than normal.



➧ On digital SLRs you take close-up photos using a macro lens.

➧ On fixed lens cameras, you take close-up photos using macro mode.



➤ A monarch butterfly captured with a macro lens.



➧ An extension tube fits between an SLR camera and lens to increase magnification.



➧ Close-up lenses screw onto the front of the lens to increase magnification.

6.25 Macro Lenses and Macro Mode, con't.



▲ Macro lenses let you get very close to subjects but have very shallow depth of field. Here I focused on the eye so it was the sharpest part of the photo.



▲ With point and shoot cameras, use the monitor to compose a macro image to avoid parallax problems. Shooting at ground level means you have to lie down or use a camera with a tilting and swiveling monitor. When rotated just right you can squat and compose the image without having to lie down.

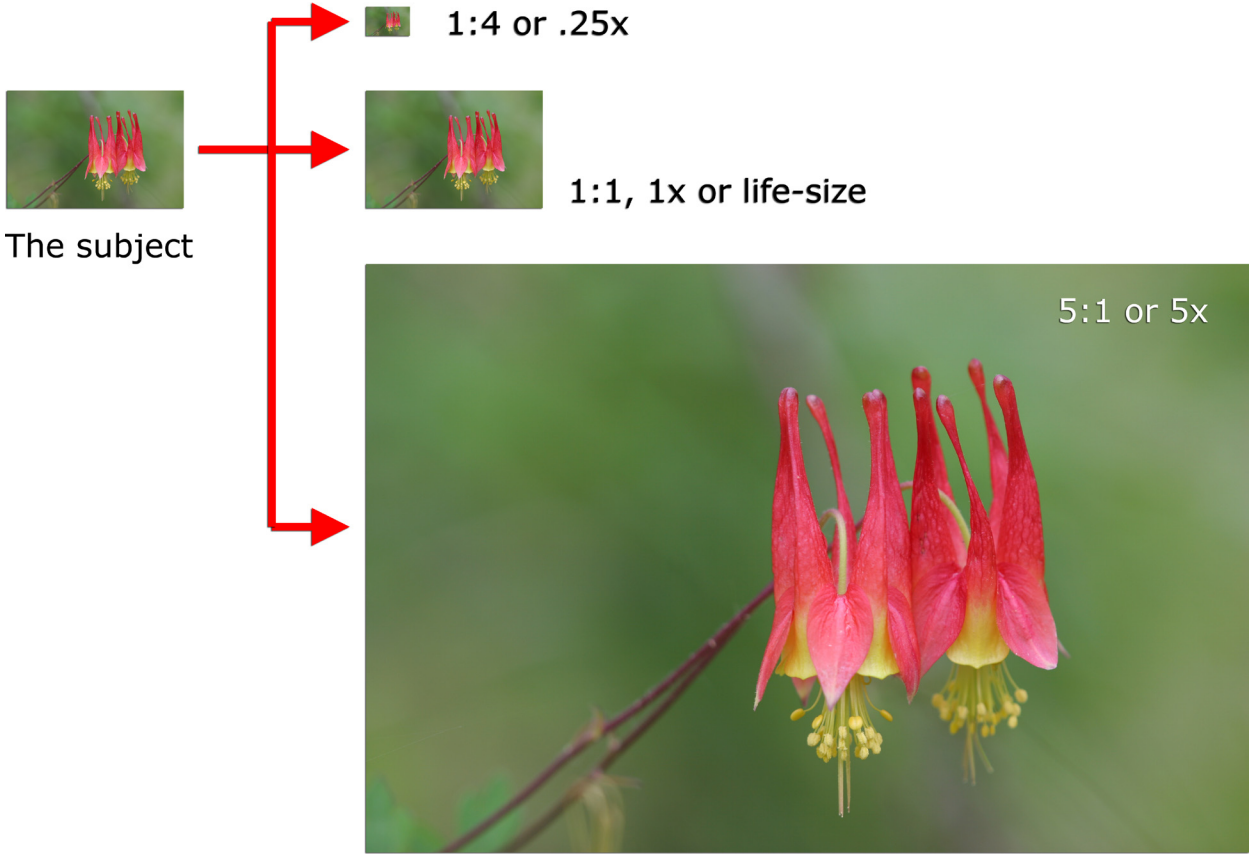
For maximum magnification, follow these three steps:

1. Zoom the lens to it's longest focal length.
2. Turn the focus ring to the minimum focus distance.
3. Look through the viewfinder or use the monitor as you focus the subject by moving the camera closer to and farther from the subject.

6.26 Macro Lenses and Macro Mode, con't.

Animation

Close-up magnifications are specified by the ratio between the size of the subject and it's size on the image sensor. Purists reserve the terms *macro lenses* or *macro photography* for lenses that can capture an image that is 1:1 or life size. This means the image on the sensor is the same size as the subject being photographed. These magnifications are expressed as ratios or proportions. For example, a lens that can capture an image 1/4 the size of the subject is referred to as being 1:4 or .25x.



▲ Here are the relative sizes of 1:4, 1:1 and 5:1 magnifications. Notice how 1:1 gives you an image the same size as the subject—or life size.



◀ Many zoom lenses are called macro zooms but they don't approach 1:1 magnifications. This Canon zoom can only get 0.19x (1/5th) magnifications but that can be increased to over 1:1 with the addition of an extension tube.



◀ On some cameras the position of the film plane is indicated on the camera body with this symbol.



Click to visit the companion Web site

6.27 Macro Lenses and Macro Mode, con't.

Macro photography has accessories that may come in useful when pushing the limits. They help you get closer or focus more accurately.



➧ A bellows lets you extend the lens far out for great magnifications.

Courtesy of Novoflex at www.novoflex.de/



➧ A reverse adapter lets you reverse a lens for macro work and still maintain electrical connections with the camera.

Courtesy of Novoflex at www.novoflex.de/

➧ A focusing rack lets you precisely focus a close-up image by moving the camera forward and back in very small increments.

Courtesy of Novoflex at www.novoflex.de/



6.28 Tilt-Shift Lenses

Tilt-shift, also called perspective control, lenses serve two very important purposes. The tilt controls depth of field so you can get great depth of field at wide apertures, and the shift controls the way vertical lines appear in the image. Until Canon developed these kinds of lenses, their effects could only be achieved on a large format camera. However, they are expensive and some of the same effects can now be achieved in programs such as Photoshop.





➤ This image was captured with the camera pointed up to capture the tall skyscrapers. Notice how vertical lines converge.

➤ Photoshop's Transform Perspective command was used to make the verticals appear vertical as if shot with a tilt-shift lens.

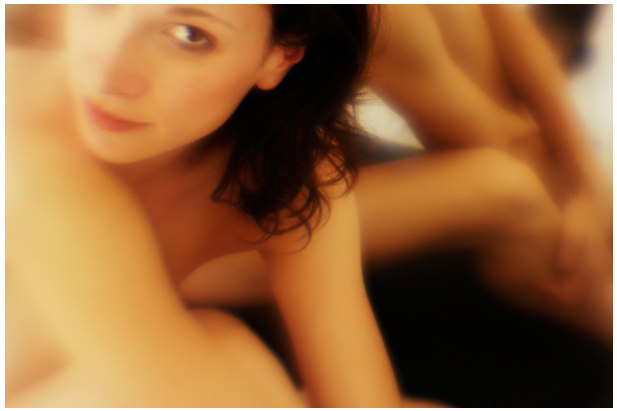


➤ A tilt-shift lens from Canon.



➤ Novoflex makes a tilt/swing bellows for digital SLRs.





➤ A popular lens is the inexpensive but funky Lensbaby. You focus the lens by moving the focusing collar in and out with your fingertips. You then move the "sweet spot" of focus around the picture by bending the lens left, right, up, & down, like a fluid tilt-shift lens.

Photo courtesy of Cherie Steinberg Cote at www.cheriefoto.com.

Click to visit the companion Web site

6.29 Lens Accessories

Lens accessories are available for both fixed and interchangeable lenses. Filters, other than UV, polarizing, and neutral density are not as popular as they once were. However, lens caps and cases for interchangeable lenses are essential and mounts for lens converters and filters on fixed lens cameras reminds one of the Victorian era when there were no standards and everything was handmade.



➧ Lens hoods help prevent lens flare when photographing toward bright lights but also protect the lens to some extent.



➧ Circular polarizing filters remove reflections from nonmetallic surfaces—one of the few corrections you can't do in Photoshop later.



➧ Lens caps snap on the front of the lens to protect it from dust and other damage. The size is indicated by a number on the lens such as Φ72mm.







➧ Lens cases protect lenses when in storage or transit.

➧ Adapter tubes let you add lens converters and filters to cameras that don't otherwise accept them.

Courtesy of Phoenix at www.pcaol.

➧ Neutral density filters cut the amount of light entering the camera so you can use larger apertures or slower shutter speeds in bright light. This is a great way to get shallower depth of field or blur subject movement.

6.30 Lens Accessories, con't.



➤ One way to reduce lens flare is to shade the lens with a hat or other object. You can often see the effect of this shading in the viewfinder as well as in the picture or on the monitor. Just be sure the hat doesn't appear in the image.



➤ Lens flare (left and above) takes different forms but lowers contrast and introduces colors into areas of an image.



➤ Lens accessories can cause vignetting at wide apertures. In some cases the darkening of the corners is subtle.



Click to visit the companion Web site



Photo COURSE

On-camera Flash Photography

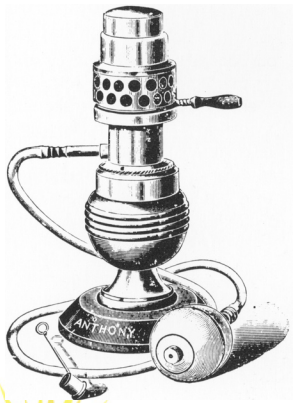
Chapter 7

7.1 Flash—The Beginnings

Flash photography's history goes back to the photos taken by Fox Talbot in 1851 using light from bright sparks.



➤ Club mosses were used by early photographers because their spores emit a bright flash when ignited.

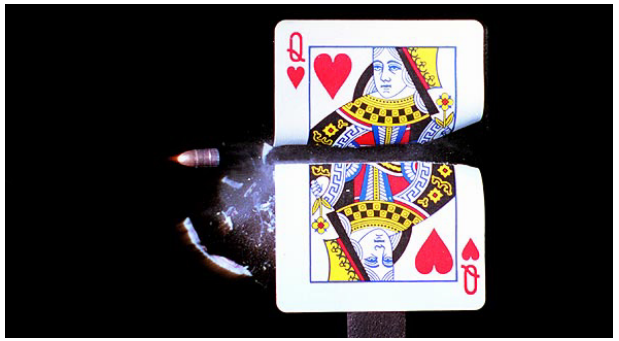


➤ An early flash device used a bulb to blow flammable dust into an open flame where it was ignited in a bright burst of light.



➤ Flash bulbs and reflectors were the source of artificial light for much of the past century.

Photo courtesy of Doug Hindmarsh.





➤ It was Dr. Harold Edgerton's invention of the electronic flash that brought us into the modern era of flash photography. The short duration of these flash units lets them freeze actions that couldn't be seen before.

Photos courtesy of Andrew Davidhazy at RIT at www.rit.edu/~andpph.



Click to visit the companion Web site

7.2 Built-in Flash

Almost all cameras have a built-in flash. Although convenient, these flashes emit a hard flat light that creates shadows on the subject, have a short range, and are prone to red-eye.



➤ Many point and shoot and SLR cameras have a pop-up flash that helps eliminate red-eye.



➤ Flash units built into camera phones are often LEDs that don't yet have the power for good flash photos.



➤ Point and shoot cameras often have a fixed flash built into the camera body.



➤ On-camera flash creates shadows behind subjects when they are too close to a wall. The solution is to move them farther from the wall or use an external flash that lets you bounce flash off a wall or ceiling.

7.3 External Flash

Animation

External flash units are always more powerful than built-in flash but some have other advantages as well; especially those that zoom, tilt, and swivel.



➤ The front and back of a full-featured external flash.



➤ External flash units zoom along with a lens so the entire scene is covered by the flash. If you can zoom your flash manually you might try zooming the lens to wide-angle and then zooming the flash to telephoto to highlight one area of a scene. Here a 24mm lens was used with the flash zoomed to 105mm. The photo of a white wall shows the flash falloff around the edges of the image.



➤ Bounce flash can evenly illuminate a scene that has depth because it spreads the light more evenly front to back.

Click to visit the companion Web site

7.4 External Flash, con't.



➤ The Metz 28 CS-2 digital flash attaches to a pocket camera's tripod socket and fires when the built-in flash fires.



➤ Handle mounted flash units are the most powerful because they have much larger batteries.

Metz flashes courtesy of Bogen.



➤ Many cameras have a hot shoe you use to mount an external flash, many of which have heads that tilt and swivel for bounce flash.



➤ Canon has an optional bracket and external flash for its small pocket cameras.

7.5 Ring and Twin Flash

One type of external flash is widely used by nature photographers and others doing close-ups—perhaps even your dentist. It's the ring flash and its new variant—the twin flash.



➤ A twin lite flash captured this white moth on a pink lady slipper with great depth of field and life-like colors.

➤ An LED ring flash illuminates small subjects with continuous light so you can capture macro videos.

Courtesy of SR Inc. at www.srelectronics.com.



➤ The ring flash fires a circle of light although the two sides can be fired independently or with different intensities.





➤ A new variant of the ring flash has two adjustable flash heads. It's almost like having a camera mounted studio. This one is Canon's Twin Lite.

7.6 Flash Accessories

When using an external flash, there is a variety of accessories that photographer's have found useful.



➧ Flash diffusers soften the light by spreading it out so it bounces off more surfaces.



➧ A flash reflector bounces the flash's light and softens it because its reflective surface is larger than the flash's.



➧ Kirk Photo's Flash X-Tender is used with long focal length lenses and increases the flash output by a minimum of 2 full stops.

Photo © Lesley Mattuchio.



➧ An extension cable connects a flash without mounting it in the camera's hot shoe. This lets you hand hold the flash some distance from the camera, or even mount it on a tripod for more interesting lighting effects.



➧ Lumiquest makes a diffuser for pop-up flashes.

➧ An external battery pack speeds recycle times and extends shooting sessions.



7.7 Autoflash

Autoflash fires whenever the camera determines that the light is too dim for a good exposure.

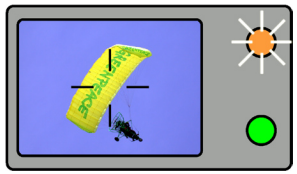


▲ To calculate flash exposure settings, the camera fires one or more low intensity preflashes before firing the much more powerful main flash. It's like your taking one or more images of individual fireworks to determine the exposure for the grand finale.



◀ Flash usually gives you very good exposures but if you block a sensor, you can get odd results like this gross overexposure.





▲ On SLRs when you press the shutter button halfway down a flash icon, usually a lightning bolt (left), is displayed in the viewfinder if the flash is going to fire. On point and shoot cameras an indicator next to the viewfinder lights (right).







▲ It takes time for the flash to recharge between shots—especially when photographing distant subjects in the dark. This recycle time determines how long you have to wait between shots. If you press the shutter button halfway down and the flash indicator blinks, it means the flash is recharging. Release the shutter button and wait a few moments before trying again. A dark or black frame usually means the flash had not recycled fully when you took the picture.



7.8 Flash and Shutter Speeds

Animation

When using flash with a focal plane shutter, you may not be able to select fast shutter speeds. This is because at high speeds, the image sensor is never completely uncovered by the shutter.



➧ A focal plane shutter opens a curtain to begin an exposure and closes a second curtain to end it. At shutter speeds faster than 1/200 or 1/250 or so the second curtain starts to end the exposure before the first curtain has fully opened so the two curtains form a slit traveling across the image sensor. Flash would only expose the area uncovered by the slit between the two rapidly moving curtains.

➤ Many point-and shoot cameras and a few SLRs use an electronic shutter to achieve higher flash sync speeds. On SLRs the focal plane shutter's role is to just get out of the way. It opens, the electronic shutter turns on and off to capture the image, then the focal plane shutter closes.





➤ Leaf shutters allow faster flash sync speeds because they don't use curtains. These shutters are usually found only on medium and large format cameras.

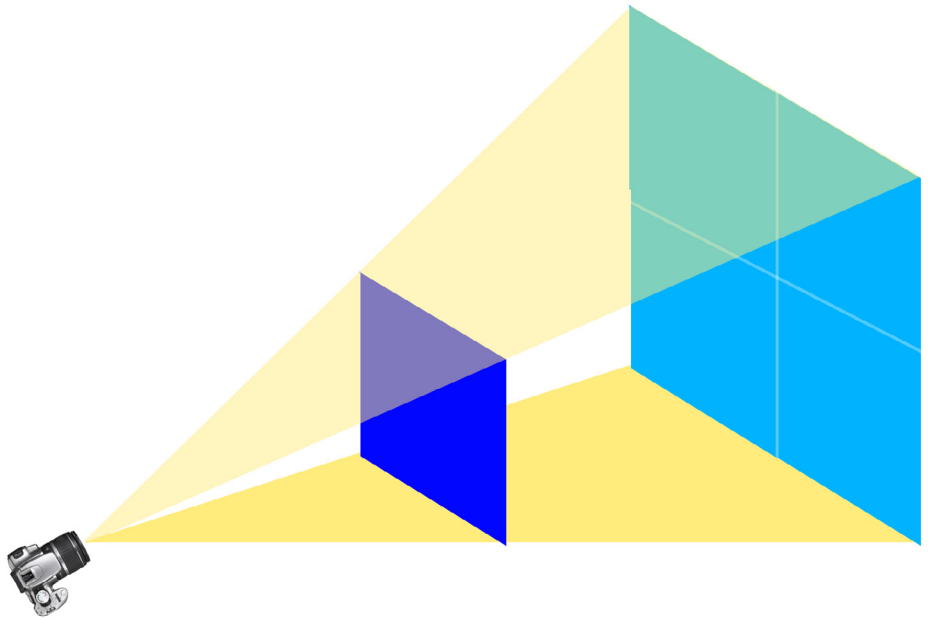
Click to visit the companion Web site

7.9 Flash and Distance

Animation

If you have ever seen someone using flash to photograph from 200 seats back at a rock concert or from the last row of seats in a sports stadium, you know you've found someone unfamiliar with the range of flash units. On point and shoot cameras, flash can often be effective up to 10 feet or so. To extend that range, you need to add a more powerful external flash unit.





➧ The light from a flash falls off with distance. When you double the distance, you get one-quarter as much light. This relationship is called the inverse square law.

➧ Since light from a flash becomes dimmer the farther it travels, objects near the flash will be lighter than objects farther away. You can use this to advantage; for example, at night you can isolate a subject against a dark background.



Click to visit the companion Web site

7.10 Red-eye Reduction

Animation

When the axis of the lens and flash are too close together, light can reflect back from inside the subject's eye and cause what is known as *red-eye*.



▲ A classic example of red-eye.



▲ Many point and shoot cameras have a red-eye reduction mode that fires the flash one or more times at low intensity or projects a red-eye lamp to close the subject's irises before the flash fires to take the picture.



▲ An extension cable lets you hold the camera to the side to avoid red-eye and also get side lighting.

➤ One way to avoid red-eye is to raise the flash so it isn't on the same axis as the lens.



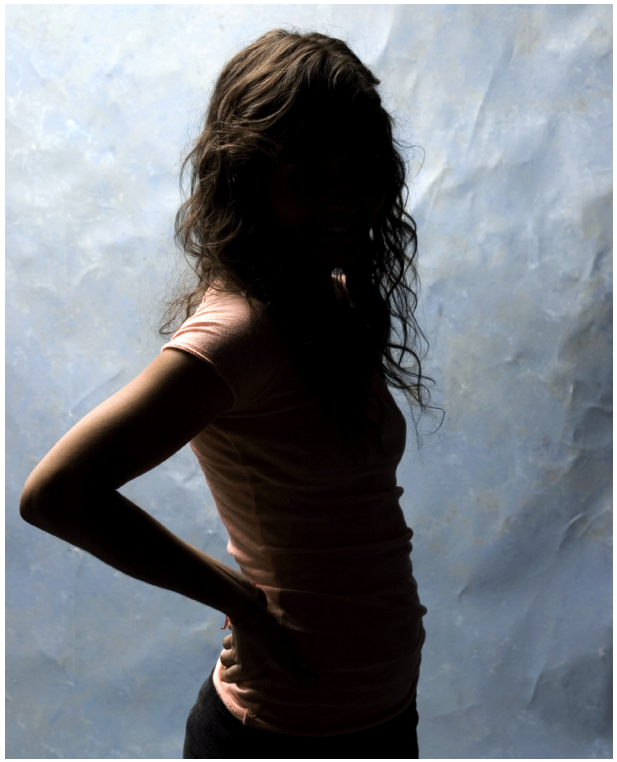
➤ People aren't the only ones to show red-eye as shown in this flash photo of an owl.



7.11 Fill Flash

Animation

Fill flash, sometimes called *daylight synchro* or *anytime flash*, is used to lighten shadows in back or sidelit subjects, or when a subject is in front of a bright background that throws off the exposure.



▲ With no fill flash the bright background has caused the main subject to be underexposed.

Photos courtesy of Tim Connor.



▲ Using fill flash gives the main subject the correct exposure.



▲ Fill flash makes these boys stand out from the background at Fenway Park in Boston.



◀ The almost universally accepted fill flash icon.

To use fill flash in daylight, especially when you want to use a large aperture for shallow depth of field, you need a high flash sync speed. High speed flash helps in some situations, especially those where you are close to the subject.



Click to visit the companion Web site

7.12 Fill Flash, con't.



➤ Many cameras now recognize backlit scenes and fire the flash automatically. That obviously didn't happen with this roadside mammoth in Oregon.



➤ Fill flash can freeze action.



➤ Fill flash can even out lighting and add a glow to a subject that helps it stand out from the background.



➤ One reason to use flash outdoors is to add catch lights to eyes—hot spots that make the eyes sparkle.

7.13 Flash Off

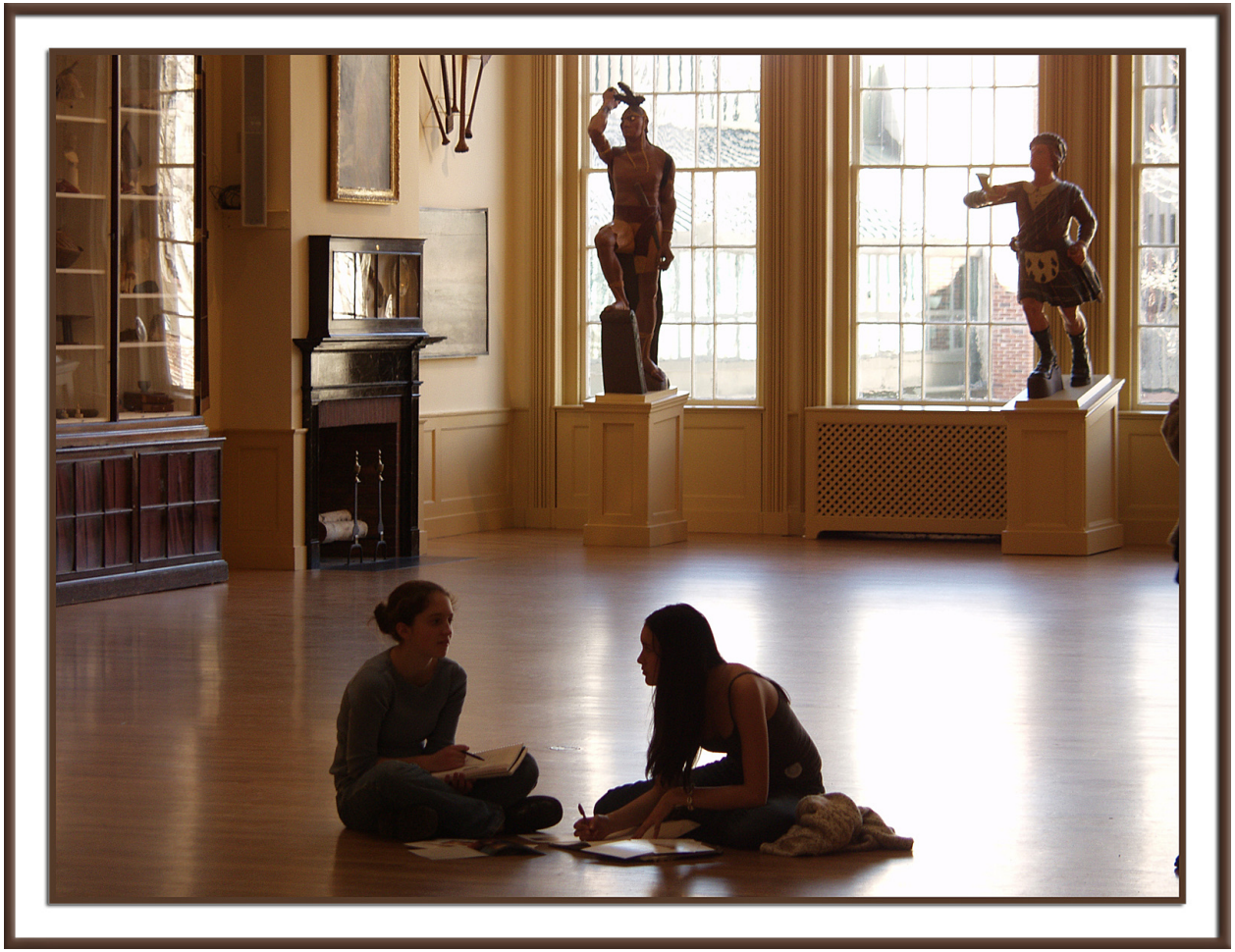
To prevent the flash from firing, you can turn it off. You do this where flash isn't allowed but also for creative reasons. There may be situations where the light is dim, but you want to capture the unique colors of the available light. The way you turn off the flash varies. On some cameras you just close the flash. On others you press a flash button to select the flash off mode, sometimes called flash cancel, or flash prohibited.



➤ The almost universally accepted icon for flash off.







▲ Here the flash was turned off in a museum and a photo taken using just the natural light streaming in the windows.

➤ To turn off some flash units you just close them. On this camera you press the flash down until it locks into a closed position.



Click to visit the companion Web site

7.14 Slow Sync Flash—Automatic Modes

Many point and shoot cameras have a night portrait or a night landscape mode that combines flash with a slow shutter speed to lighten the background. These *slow sync flash* modes use such slow shutter speeds your images combine blur from both subject and camera movement.



➤ A mode dial with night portrait in the lower left.





➤ Icons for night portrait (top) and night landscape (bottom).



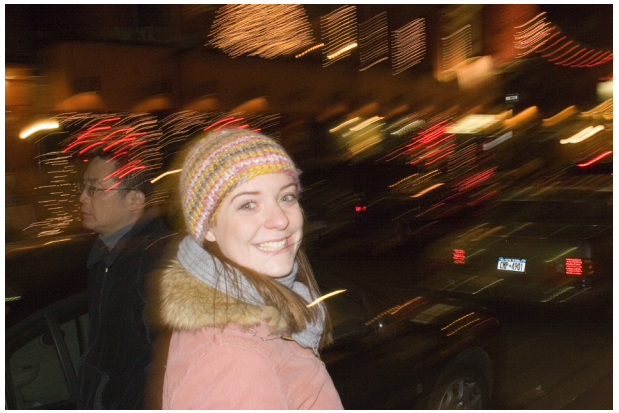
➤ Here night portrait mode was used indoors to blur a moving subject.

7.15 Slow Sync Flash—Manual Control

For more control over slow sync and the amount of blur you get, set the camera to shutter-priority and select a slow shutter speed when using flash.



▲ This unusual scene was shot using slow sync flash outdoors just after sunset. The flash partially froze the nearest gulls but the slow shutter speed let their wings blur a bit and brought out the color remaining in the sky.



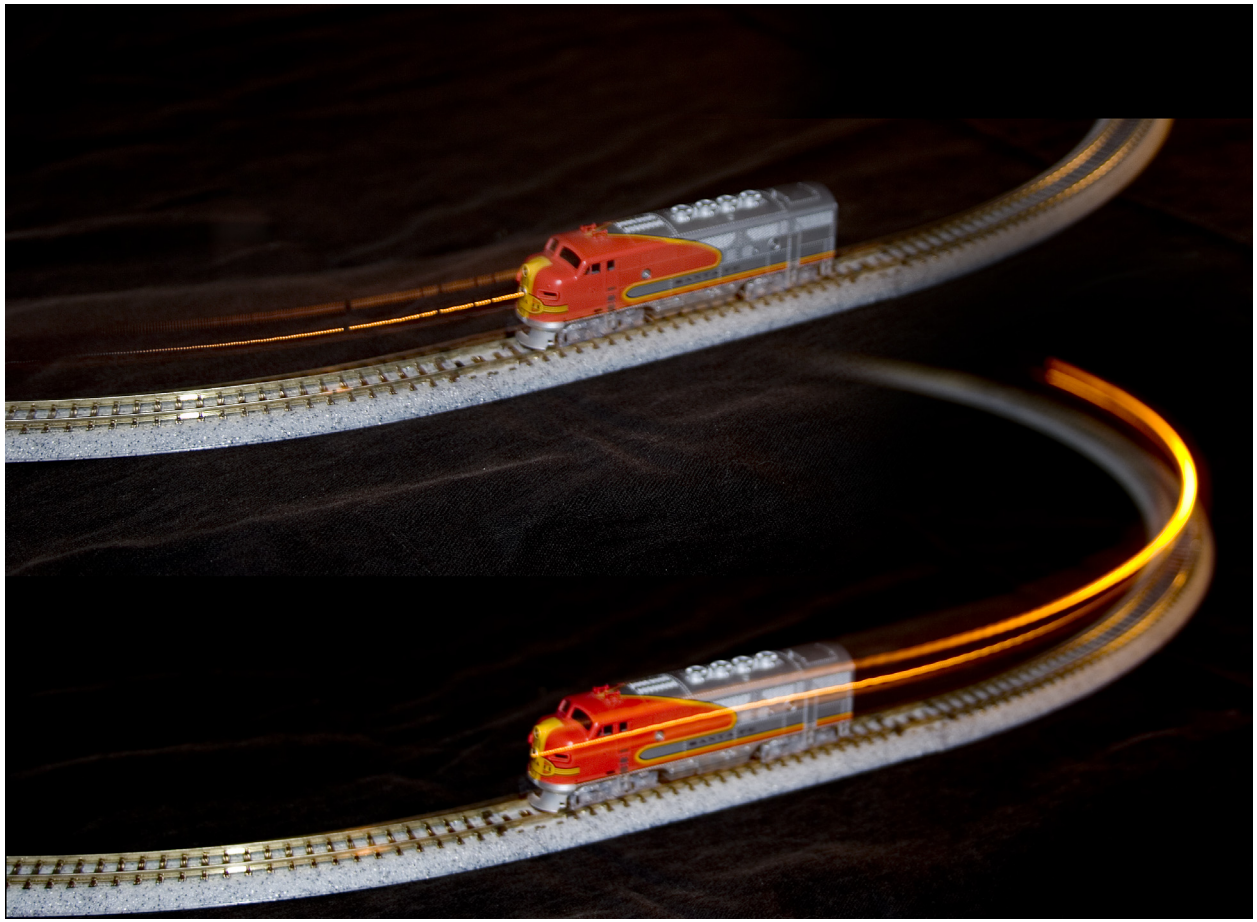
▲ Slow sync can capture some interesting effects and lend a photo a dynamic quality.



▲ Slow sync works best when you are close enough to the subject that the flash isn't overwhelmed by the ambient light.

7.16 First and Second Curtain Sync

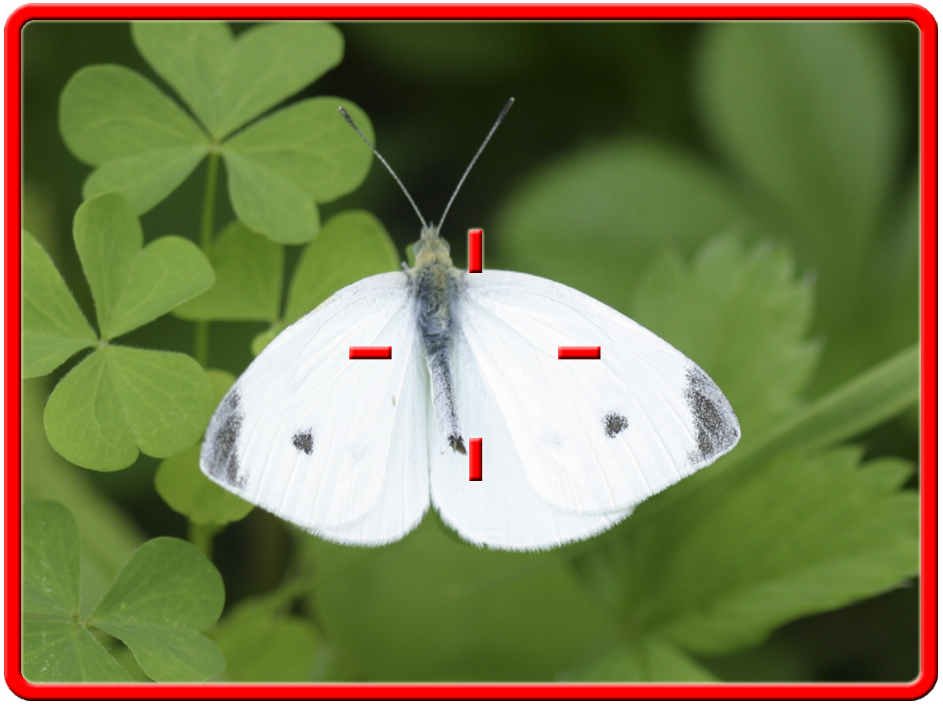
Some cameras offer two flash sync modes: first and second curtain (often called front and rear curtain). The only difference between the two is when the flash fires but the differences in some situations can be striking.



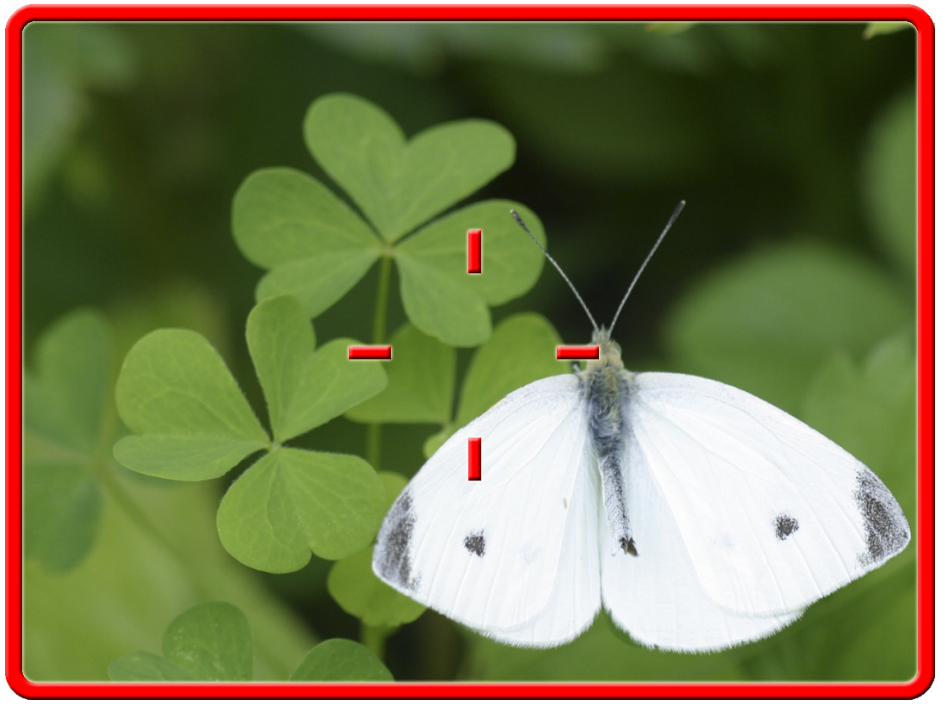
➤ First curtain sync fires the flash at the beginning of the exposure, then records ambient light. As a result, light streaks from the moving subject appear in front of it.

➤ Second curtain sync fires the flash at the end of the exposure, after the ambient light has been recorded so the streaks trail behind the subject.

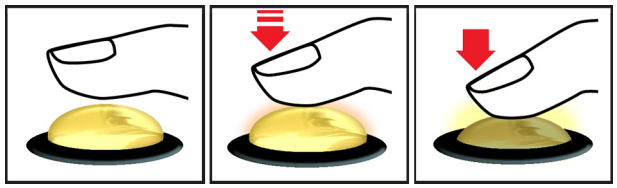
7.17 Controlling Flash Exposures—FE Lock



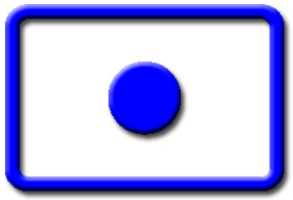
▲ When photographing an off-center subject with flash, you position the focus area, in this case the center of the viewfinder, over the subject and press the shutter button halfway down to fire a preflash that is used to calculate and lock the exposure.



▲ Without releasing the shutter button, compose the image the way you want it and press the shutter button the rest of the way down to capture it. If this hadn't been done here the camera would have calculated the exposure for the green leaves.



◀ When you press the shutter button halfway down it fires a preflash to calculate and lock flash exposure. Pressing it the rest of the way down takes the picture.



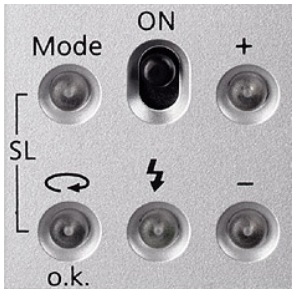
◀ FE Lock works best with spot metering because it sets the exposure for just the main subject.

7.18 Controlling Flash Exposures—Flash Exposure Compensation

Animation

Many cameras and flash units have a *flash exposure compensation* setting that adjusts the output of the flash to make it brighter or dimmer. Reducing the output darkens the part of the scene illuminated by the flash, and increasing the output lightens it. Some cameras and flash units have a variation of this technique called *flash exposure bracketing*. This mode takes a series of photos, each with a slightly different exposure just like autoexposure bracketing (AEB) but by adjusting the flash output.

➤ The Metz 28 CS-2 has + and - buttons you press to adjust flash output.









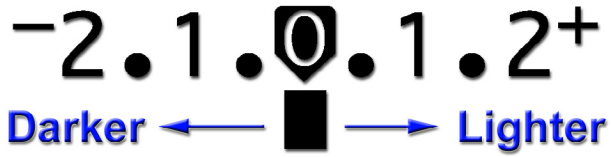






➤ The standard flash exposure compensation icon.

➤ Here five photos have been taken with flash. From left to right, flash exposure compensation reduced the flash exposure one stop from one image to the next.



➤ As with exposure compensation, many cameras have a scale that indicates the flash exposure compensation.



7.19 Controlling Flash Exposures—Flash Exposure Compensation

When a camera has both exposure compensation and flash exposure compensation, you can use them together. Exposure compensation lightens or darkens the background and flash exposure compensation lightens or darkens the main subject illuminated by the flash.





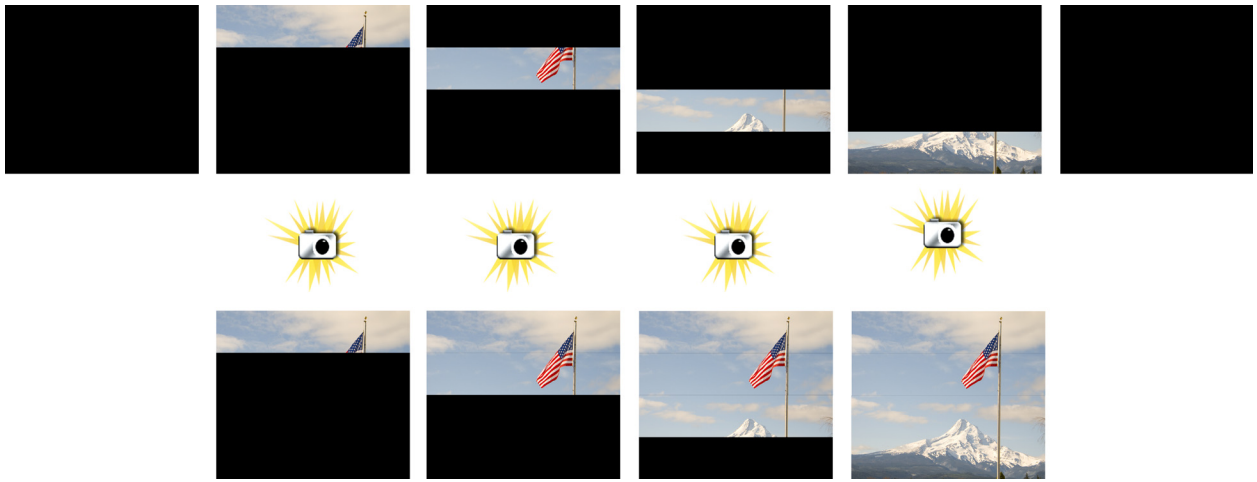
➤ In the image on the left flash was used to photograph the Cardinal flower. In the image on the right, exposure compensation was set to -2 to darken the background.



7.20 High-speed Sync

Animation

As you've seen the fastest shutter speed at which the shutter is fully open, the flash sync speed, is around 1/250 second or less, and you can't use flash at faster speeds. However, you can shoot at higher shutter speeds if your flash supports *high speed flash*, also called *high speed sync* and *focal plane (FP) flash*. This feature lets you freeze actions or use a wider aperture to get shallower depth of field.



▲ In high speed flash the flash fires repeatedly to give a steady illumination as the focal plane shutter curtains move across the image sensor (top). It's as if there is one long flash instead of a short instantaneous burst. The image (bottom) is painted onto the sensor a strip at a time as the slit between the two shutter curtains passes by.

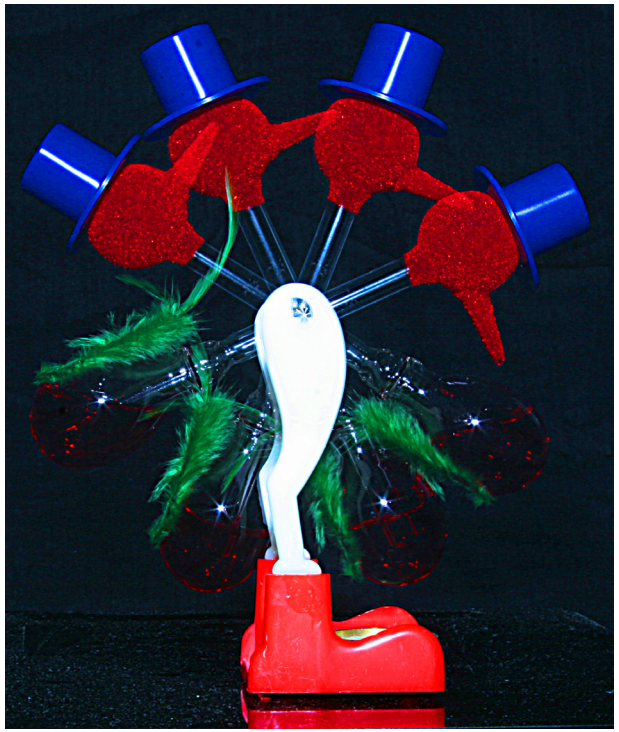


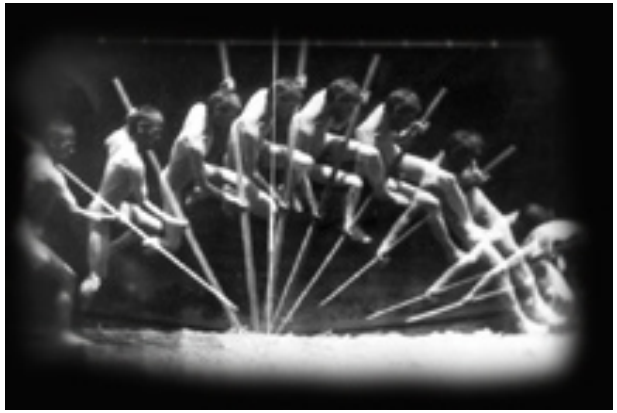
▲ When photographing wildflowers high speed flash can eliminate wind created subject movement because you can use much higher shutter speeds.

7.21 Stroboscopic Flash

Some flash units have a stroboscopic setting that fires the flash repeatedly when the shutter is fully open. This strobing captures multiple images of a moving subject in the same photograph. Often used for motion analysis, the images can reveal things not seen when observing actions in real time.

➤ Here stroboscopic flash caught a dipping bird in four positions.





➤ The first multiple exposures on the same piece of film were captured by Etienne-Jules Marey in the late 1800s. His camera shutter was a rotating metal disk with slots cut in it. As the subject moved, the rotating shutter slots captured a sequence of images.



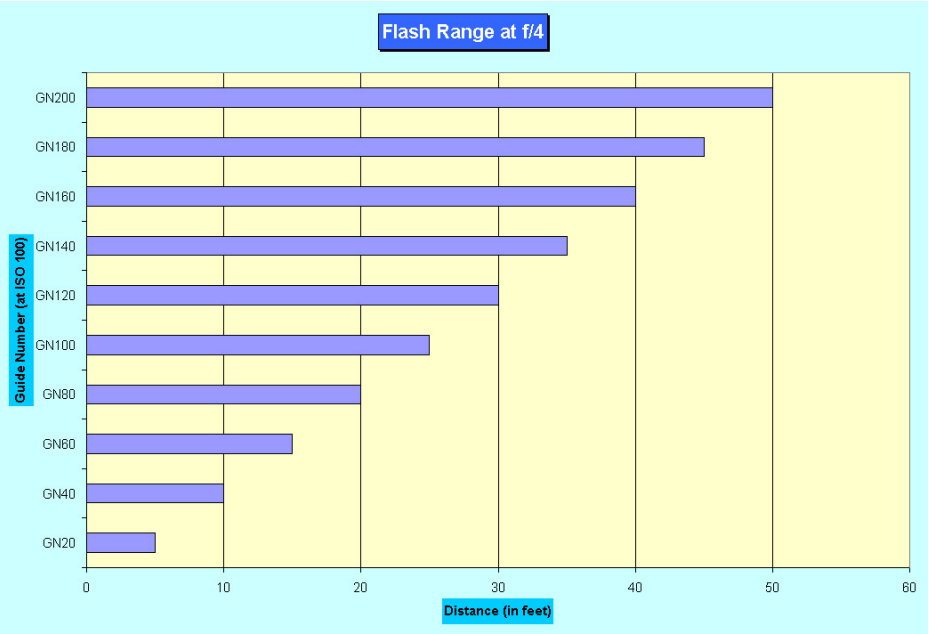
➤ Falling cat caught with stroboscopic flash as it turns to land on its feet.

Courtesy of Kim Taylor/ Warren Photographic at warrenphotographic.co.uk

7.22 Flash Guide Numbers

Excel Resource

To determine the power and range of a flash, you check its *guide number*. The higher the guide number, the greater the intensity and range of the flash. You can also use the guide number to calculate aperture settings and subject distance when using the camera and flash on manual mode—perhaps when using a flash not designed to work with your camera.



➤ Here are the effective ranges of flash units with guide numbers between 20 and 200. To convert from feet to meters multiply distances by 0.3.

• To calculate the f/stop needed, divide the guide number by the flash to subject distance.

f/stop = guide number ÷ flash-to-subject distance

• To calculate the maximum flash to subject distance, divide the guide number by the f/stop you plan on using.

flash-to-subject distance = guide number ÷ f/stop

When making these calculations, there are a few things to be aware of:

• Guide numbers are usually given for a setting of ISO 100. Doubling the ISO setting, say from 100 to 200 increases the guide number by a factor of 1.4x; quadrupling the ISO, say from 100 to 400, doubles the guide number.

• It is the flash-to-subject distance that you use, not camera-to-subject. These two distances are the same when using on-camera flash but differ when using flash on a cable or a slave flash. When using bounce flash, the distance is the longer path that the light travels.



Photo COURSE

Studio Photography

Chapter 8

8.1 Professional Studios

When we think of photography studios, our first thought is of those elaborately and expensively equipped studios used by professionals. Full of cameras, lights, reflectors, diffusers, and other equipment, the monthly expenses are significant.



▲ Rick Ashley's studio is typical of professional studios with a large open space, background, camera stand, lights and reflectors.



➤ With studio equipment even casual portraits are wonderful.



Click to visit the companion Web site

8.2 Tabletop Studios

Not everyone needs a full-time professional studio. With digital cameras and the huge expansion of Internet-based publishing and on-line auctions, millions of nonprofessionals are taking studio-like images in smaller and less expensive studios.



➤ Home and small business studios often fit on a table and use equipment that can be easily packed away or used for other purposes.

➤ The results from a smaller, even tabletop, studio can rival those taken in elaborate facilities.





Photos courtesy of TableTopStudio at www.tabletopstudio.com.

Click to visit the companion Web site

8.3 Using Studio Strobes

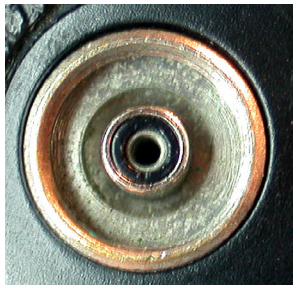
When you want the maximum amount of light or want to freeze action, you use *studio strobes*—large scale versions of the electronic flash on your camera. Since the flash is so brief many of these units have *modeling lights that* help you preview the effect the strobes will have when they fire.



➤ Monolights are strobes with all of the needed circuitry built into its head so you don't need a separate power pack.

Courtesy of Alien Bees at www.alienbees.com.





➤ Studio lights normally connect to a camera's PC terminal. These terminals are usually found on SLRs.

➤ Strobes have three parts—heads, stands, and power packs that provide a burst of power to fire them.

Courtesy of Bogen Photo Corp at www.bogenphoto.com.



➤ To meter flash exposures you need a flash exposure meter. You can also take a picture and find out what settings were used by checking the image's Exif information.

8.4 Using Continuous Lights

Strobes are expensive and aren't always necessary. An alternative is continuous lighting that has gained popularity with the introduction of daylight balanced fluorescent bulbs that stay cool, and digital camera white balance systems. One reason to go this route is because having lights on continuously lets you see the effect they have on the subject as you arrange the setup. This makes setting up much more interactive—almost like painting with light.



➤ Continuous lights usually have three parts—stands, reflectors, and bulbs.



➤ A light box set on end makes a soft light bank. It can also be used as a background when you want the background to be pure white.



➤ Compact fluorescent (CFLs) bulbs are balanced for daylight, stay cool when lit, run longer and cost less than tungsten bulbs.



➤ The least expensive lights for the digital studio are desk lamps. They combine the stand and reflector in one unit.

Photos courtesy of TableTopStudio at www.tabletopstudio.com.



Click to visit the companion Web site

8.5 Using Multiple Flash Units

If you have two flash units, or even one on the camera and a separate external flash, you can use slave flash to create studio effects. One flash acts as the master and one (or more) as the slave. When the master fires, a sensor on the slave unit senses the flash and also fires. Some flash units have the flash sensor built in and can act as a master or slave unit. Other flash units can be adapted by adding a flash trigger. With less expensive setups you control the light by changing the distance of the flash units from the subject. On more expensive units you can also use a setting that adjusts flash ratios.



➤ Slave bulbs screw into household lighting fixtures.

Courtesy of Adorama at www.adorama.com



➤ Flash units that have a slave mode, like this one from Nikon, usually come with a stand so they can be placed freely about the room.



➤ A remote trigger adapts a flash to operate as a slave. The trigger senses the flash from the master and fires the flash to which it's attached.

Courtesy of Metz at www.metz.de.



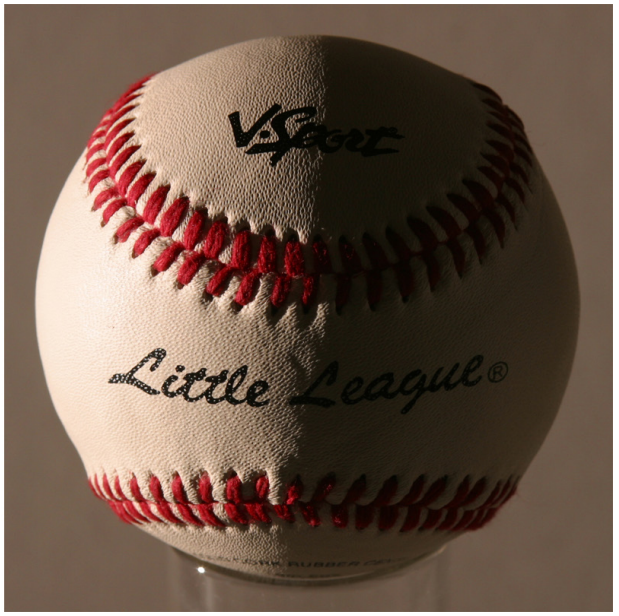
8.6 Understanding Hard and Soft Light

Animation

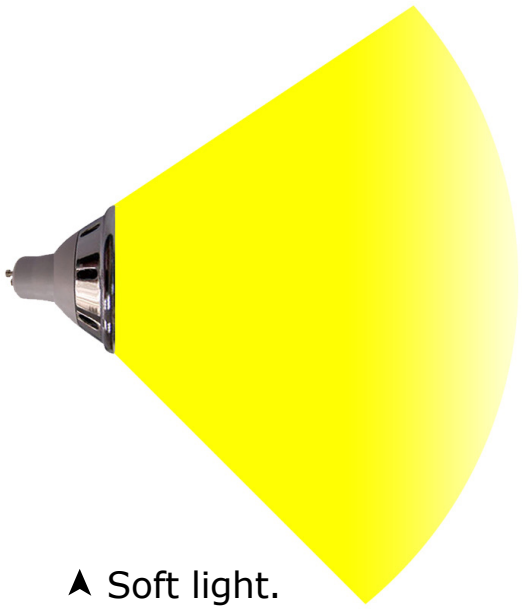
When photographing outdoors, a bright sun on a clear day casts hard light and an overcast day casts soft light. This is because the softness of light is determined by one thing—the relative sizes of the light source and the subject. The same principle is at work in the studio where you can choose which quality of light to use.



▲ Hard light.



➤ The baseball on top was photographed with a small light source so the light is hard. The bottom one was photographed with a large light so the light is soft. The differences are striking. The soft light "wraps" around the ball because the source is so much larger. Notice how the hard light has a more dramatic effect on the surface texture and the distinct line between light and dark areas of the subject.



▲ Soft light.





Click to visit the companion Web site

8.7 Creating Hard Light

The easiest way to create hard light is to shoot in the bright sunlight or take a photo with a pocket camera's built in flash. However, you can also get hard light with any flash or other light source when your light is much smaller than the subject. When using artificial lights this means moving the lights farther from the subject and not letting light bounce off walls or ceilings.





➤ Removing a reflector makes a light source smaller so its light on the subject gets harder.

Courtesy of Alien Bees at www.alienbees.com.



➤ Studio strobes often have optional bare bulb heads.

Courtesy of Norman at www.photo-control.com.



➤ With a flash in slave mode, the photographer held it off to the side to cast hard shadows on the wall that dramatically emphasize the subject.

Photos courtesy of Tim Connor.

8.8 Creating Soft Light—Reflecting and Diffusing

A light on only one side of a subject leaves the other side in shadow. By placing a reflector on the other side, you can bounce some of the light back onto the subject to open those shadows with reflected light. A small light bouncing off a large reflector not only redirects light, it also softens it because the larger reflector becomes the light source.



▲ PhotoFlex LiteDiscs collapse for easy storage and expand for use. Some models can be used as both reflectors and diffusers.

Courtesy of PhotoFlex.



◀ The LumiQuest Table Top Reflector System.

Courtesy of LumiQuest.



▲ LastoLite's pocket reflector bracket lets you position a small reflector almost anywhere.

Courtesy of Bogen Photo Corp.





▲ This pair of photos shows the dramatic impact a reflector can have. In the top photo the car is back lit so the front is in shadow. In the bottom photo a fill card is used to bounce light back to illuminate the near side.

8.9 Creating Soft Light—Reflecting and Diffusing, con't.

One very popular form of reflector is the umbrella. When using one of these, the open side of the umbrella faces the subject and the flash fires into it. The light bouncing off the inside of the umbrella illuminates the subject with soft light reflected from a very large surface area.



▲ When a light is projected into the center of an umbrella, the light bounces around and out. Since the umbrella is larger than the light, it casts a softer light on the subject.

Courtesy of Bogen Photo Corp at www.bogenphoto.com.



▲ A handy reflector to have around is an inexpensive shaving mirror.



▲ Umbrellas and other reflectors come in all sizes including these jumbos.

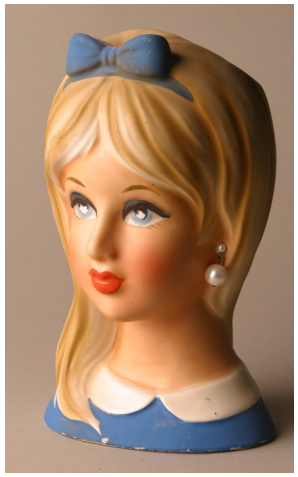
Courtesy of Bogen Photo Corp at www.bogenphoto.com.

The slightest change in a setup, even just turning the subject slightly, can change the exposure, and even focus, almost imperceptibly. Once you have determined the exposure it is often wise to switch to manual modes.

8.10 Creating Soft Light—Reflecting and Diffusing, con't.

Diffusers, usually made from translucent fabric or plastic, are placed between the light and the subject. When light from the source hits the diffuser, the diffuser becomes the light source. Since it's larger, and closer to the subject, it casts softer light that envelops the subject and fills shadows while also reducing glare and reflections.





▲ The photo of the head on the left was taken without a diffuser, the one on the right with one.



▲ Inexpensive stretcher bars and vellum can be found in almost any art supply store. The frame stretchers snap together without the need for any tools and you can attach the vellum to the frame with tape.



▲ A small diffuser can be attached to an external flash to soften the light.

Courtesy of Nikon Imaging at www.nikon.com.



◀ A large diffuser can be used indoors and out to soften the light.

Courtesy of Lastolite at www.bogenphoto.com.



▲ Softboxes fit over a light source and are lined with reflective material. The side facing the subject is a translucent white fabric. When a bare bulb fires its light bounces around inside the box and exits out through the translucent fabric, making the large fabric a much softer light source.

8.11 Creating Soft Light—Light Tents

Light tents bathe a subject in soft, even lighting and are particularly useful for complex subjects such as bouquets, highly reflective subjects such as jewelry, and translucent subjects such as glassware. A subject placed in the light tent is surrounded by a translucent material which is lit from the outside.





▲ A translucent plastic gallon milk bottle makes a fine diffuser when photographing small objects. Just cut out the top end for the camera lens and the bottom for the subject.



➤ This very complex subject was shot in a light tent. The soft diffuse light reached every part allowing it to be captured without dark shadows and burned out highlights.





▲ Light tents are really portable studios.

◄ The soft light bouncing around in a light tent lets you photograph complex objects without shadows.

Photos courtesy of TableTopStudio at www.tabletopstudio.com.

Click to visit the companion Web site

8.12 Choosing a Background

When photographing objects, they stand out better when placed in front of a background that sets it off. One of the most widely used background materials is poster board from an art supply store where it's usually found in a spectrum of colors. For larger subjects, professional photographers use seamless paper that is fed off a stand—somewhat like pulling a paper towel off a roller.



Studios use stands to hold rolls of paper in almost any color. Courtesy of Smith-Victor.



Many art supply stores sell small leftover sections of poster board.



A background sweep inside a light cube is easy to light evenly. Here the background is graduated from blue at the top to white at the bottom (top). It gives a great background to a subject (top, right).

Photos courtesy of TableTopStudio at www.tabletopstudio.com.



Graduated lighting is created by curving the background into a sweep and positioning a light above the top of the curved background and pointing down. This projects more light on the lower part of the background making it go from darker at the top to lighter at the bottom. You may want to raise the subject up from the background on a piece of glass or plexiglass so the light can sweep under it.



Click to visit the companion Web site

8.13 Choosing a Background—Dropping it Out

One of the favorite techniques of product photographers is to drop out the background so the subject appears to be floating in space with no background. The lack of a background also makes it easier to combine an image with others in a montage. The key to doing this is to get enough light on the background that it becomes an overexposed and detailess white.





▲ To create a dropped-out background (right), you can place the subject on a sheet of plexiglass and light it from below (left).



▲ A light box used for a shadowless background.





▲ A medallion placed on a light panel and shot from above has a pure white background. A small lamp is used to side light the coin to bring out its relief.







▲ An acrylic riser's shiny surface adds attractive reflections to the photographs of small objects.

Photos courtesy of TableTopStudio at www.tabletopstudio.com.

Click to visit the companion Web site

8.14 Choosing a Background—Light Panels

Light panels are an ideal source of light. If you cut a hole in a sheet of background paper and arrange it as a sweep, a glass placed on the hole appears to glow from within as light streams through the hole and through the glass.



Photo courtesy of TableTopStudio at www.tabletopstudio.com.

➤ Here a crystal glass was shot in a light cube against a black background to set it off. A hole was cut in the background paper and placed on a light panel. The glass was placed over the hole and looks like it's illuminated from within.



➤ Here a jack-in-the-pulpit was photographed against a light panel to burn out the background to a pure white.

Click to visit the companion Web site

8.15 Positioning the Camera

The position of the camera relative to the subject and background is one of the many creative decisions you have to make.

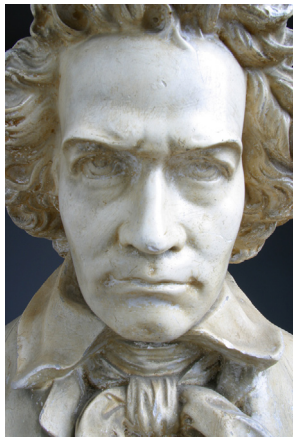




➤ In the left photo the camera was tilted so parallel lines seem to converge—an effect called keystoning. In the right photo the camera back was parallel to the subject so the lines appear parallel. If you can't get a subject perfectly square, you can adjust it with a transform command in Photoshop.



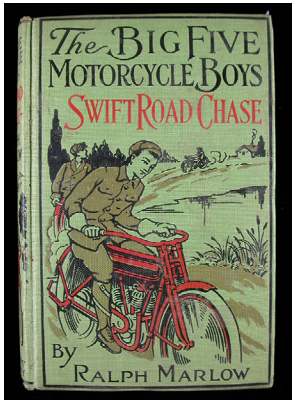






➤ As discussed in the lens chapter a wide angle lens used close to a subject (top and left) give a much different look than when the camera is moved back and the lens zoomed in to keep the subject the same size (bottom and right). The later view is the more realistic.

➤ Photos shot from close up with a wide-angle lens will show barrel distortion with all sides seeming to bulge out. To eliminate this, use a longer focal length lens or a smaller aperture that uses just the central part of the lens.

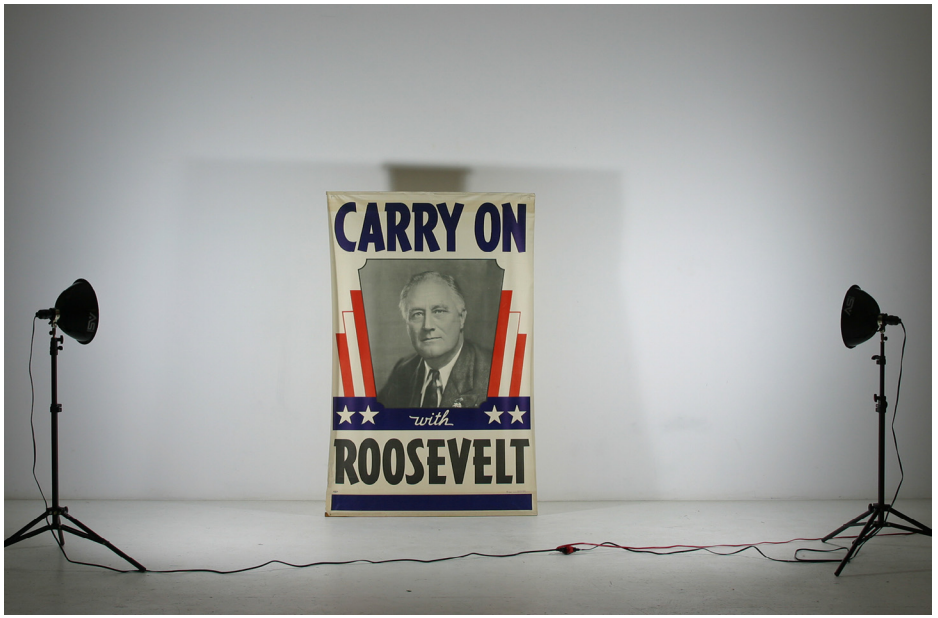


8.16 Positioning Lights—Introduction

In the studio, you usually use more than one light to illuminate a scene. The goal is often to create light that looks like that found outdoors. The lights can be hot lights, strobes, or slave flash units–or even fill cards. Sometimes you can get away with only one or two lights but the use of main, fill, background and rim lights is a classic studio lighting setup for portraits that can be adapted to other subjects.



▲ Here two lights and a diffuser are used to photograph a toy.



▲ When lighting flat objects you want the light evenly distributed over the entire surface. To do this you need two lights set at 45 degree angles so there are no hot spots or reflections.

Photo courtesy of TableTopStudio at www.tabletopstudio.com.



▲ A copy stand like this one from Novoflex makes it easy to light smaller objects.

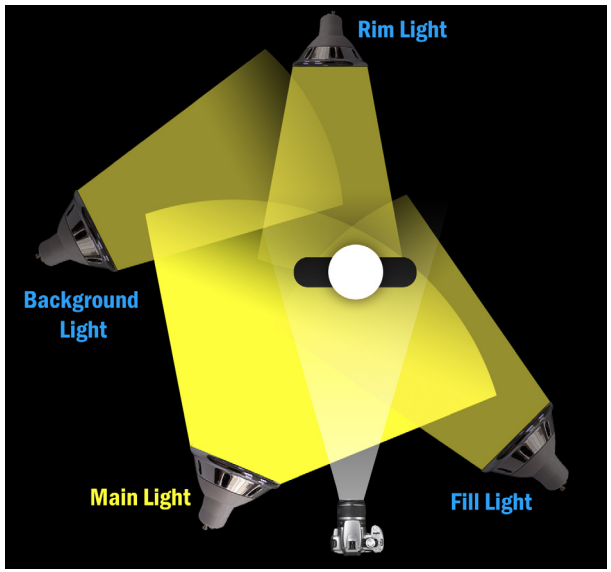


Click to visit the companion Web site

8.17 The Main Light

Animation

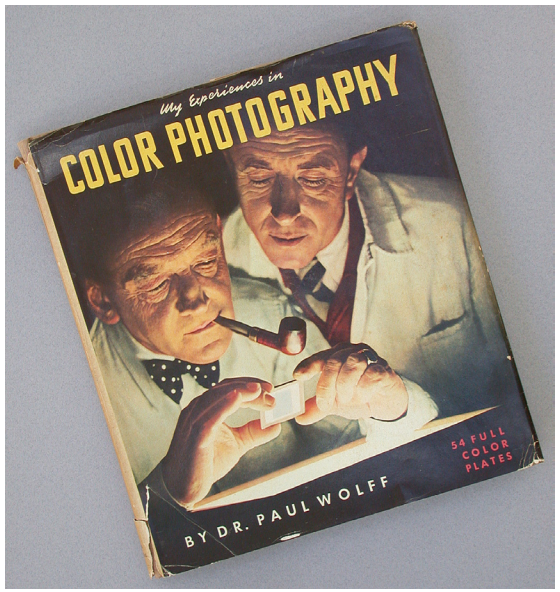
Outdoors the brightest source of light is usually the sun. In the studio, the sun's role is filled by the *main light*. Like the sun it's the brightest source of light and casts the darkest shadows.



➧ Like the sun, the main light is often positioned above and slightly to the side of the subject. Placing the light above the subject creates light on the subject that is familiar, as are the shadows it creates.



➧ Here the main light is set to the left, above, and right of the subject.



➧ Lighting from below can give an eerie effect to portraits and other subjects. It's not the way we are used to things being lit.

Click to visit the companion Web site

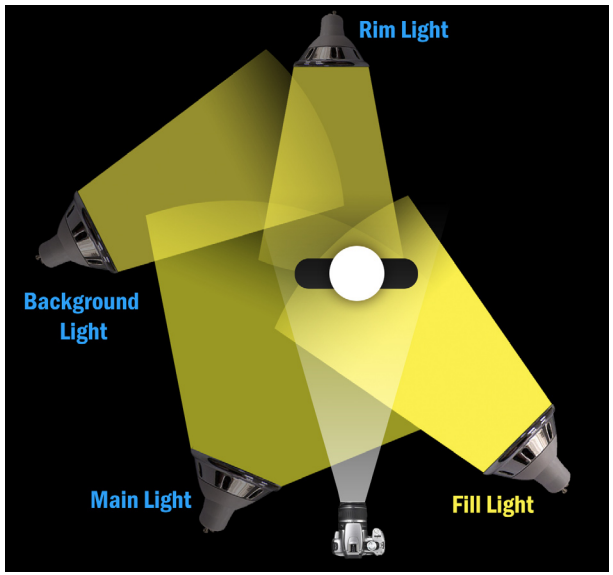
8.18 The Fill Light

Animation

A fill light represents the light that falls on an outdoor subject from the broad expanse of an open sky, or reflecting from surfaces in the landscape. The fill light is almost always less bright than the main light, in fact about half as bright. Its relative brightness can be controlled in a number of ways. For example, it can be placed farther away, you can add a diffuser, or you can use a less powerful light.



▲ The fill light on the right of the subject is moved closer and closer. The closer it gets, the more it lightens shadows created by the main light.



◀ The fill light, placed opposite the main light, opens shadows by lighting the dark side of the subject facing away from the main light.

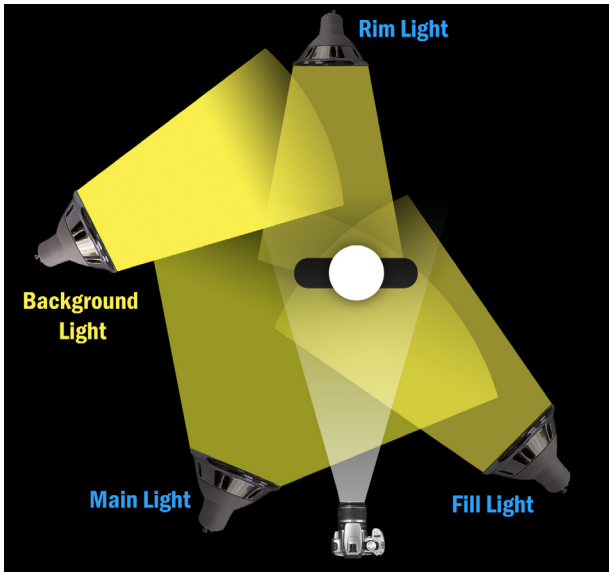
As you arrange your lights, keep in mind that light changes by one stop as you change the distance by the same ratio as the aperture scale: 2, 2.8, 4, 5.6, 8, 11, and 16. For example if the main light is 4 feet (or 4 meters) from the subject, you can place the fill light at 5.6 feet (or 5.6 meters) for a lighting ratio of 2:1.



Click to visit the companion Web site

8.19 The Background Light

A background light controls how light or dark the background behind the subject is. A lighter or darker background can help visually separate the subject from the background. It can also lighten shadows cast on the background by other lights. In fact, if made light enough, it can silhouette the subject.



➤ The background light is off to the side and lights the background behind the subject without lighting the subject itself.

➤ The background light can be varied for different effects. When only spillover light illuminates the background (upper-left) it's a uniform gray. When not illuminated at all (upper-right) it's black. When the background is lit by a spot it is graduated (lower-left). When illuminated with a bright light it is burned out to pure white (lower-right).







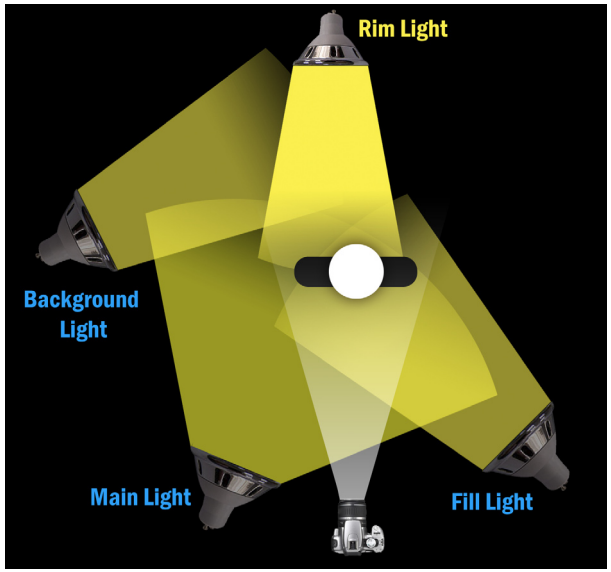




Click to visit the companion Web site

8.20 The Rim Light

A rim light positioned behind the subject and facing toward the camera illuminates the edges from behind so they glow and are visually separated from the darker background. In portrait photography a rim light is often used to back light the hair.



➤ The final image is beautifully lit and well separated from the background. It's a visually interesting image.



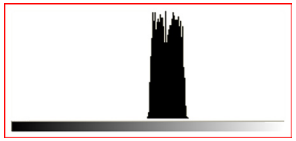
➤ The rim light is often set up behind the subject and slightly higher than the other lights. Because this light is facing the camera, it's important that it be completely blocked by the subject or out of the field of view. If not you may get lens flare and lowered contrast. One way to block the light is to position a piece of cardboard (called a gobo) between the light and subject.

8.21 Putting it All Together—Exposure and White Balance

When shooting with a digital camera, your biggest advantage is that you can see the image you just captured and make adjustments as you go along. Only when it looks perfect on the monitor, need you go to the computer to see how it looks enlarged. However, when shooting a number of subjects, as you might for a catalog, or an on-line business, it helps to develop a system that makes things faster and easier.



➧ Including a gray card in a setup helps you place middle gray and remove color casts in Photoshop.



➧ If your camera displays a histogram, the one for the gray card should be a spike right in the middle of the horizontal axis.



➧ If all of your light sources do not have the same color temperature, you can white balance for one mix but not for all possible combinations. Here Quinlan sits in front of three lights—red, green, and blue. Where he blocks the light from one bulb, a shadow forms from a mixture of the other two bulbs. You will get a similar effect in areas lit from sources other than the mix of light for which you have set white balance.



➧ The video out terminal on the camera can be used to connect a TV set so you can immediately review enlarged images.



➧ The KODAK Color Separation Guide helps you compare the color of the subject with known printing colors. You can use it as a guide when adjusting your camera's white balance, hue, and saturation.



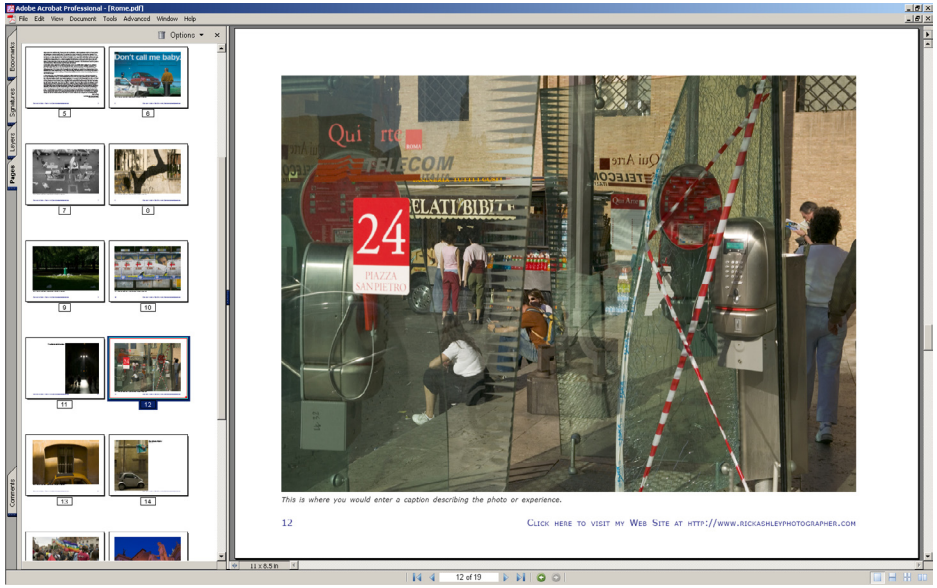
Photo COURSE

Displaying & Sharing Digital Photos

Chapter 9

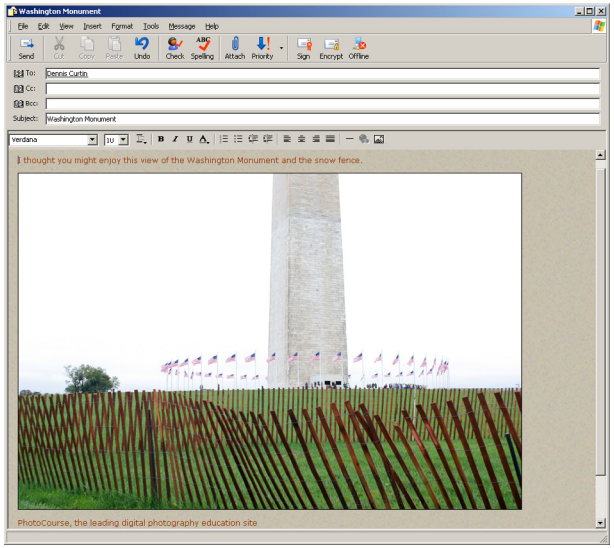
9.1 Displaying & Sharing Digital Photos—Introduction

Having photos in a digital format gives you displaying and sharing opportunities that never before existed. Many avoid the cost and labor of making prints because they are shared and displayed on the screen. Here are just some of the formats you can use to display and share your images in these new ways.

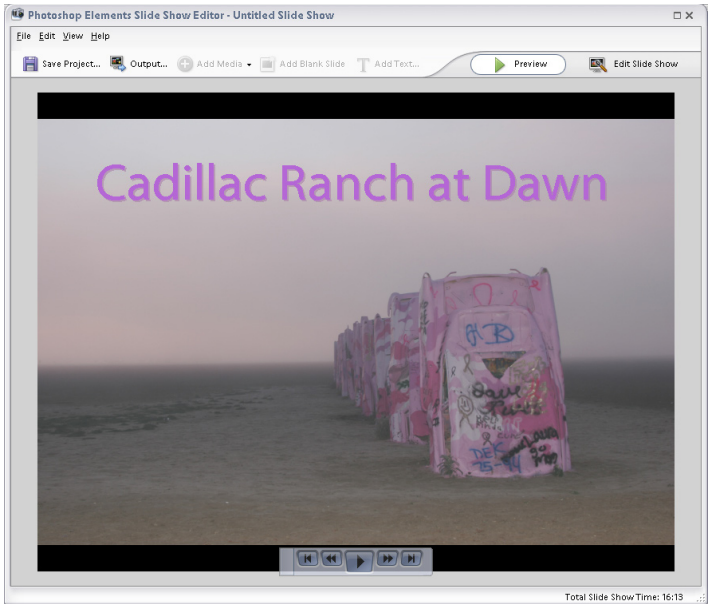


➤ You can organize photos into albums or create eBooks and then distribute them as PDF files.

Rome eBook courtesy of Rick Ashley at www.marbleheadphotos.com.



➤ You can attach or insert photos into e-mails and send them as-is. There are also services and programs that let you turn them into electronic postcards or greeting cards.



➤ You can organize photos into slide shows with background music.



Click to visit the companion Web site

9.2 Displaying & Sharing Digital Photos—Introduction, con't.

Once you have decided on the format for your photos and finish organizing them, you can then distribute them. There are two basic forms of distribution—electronically over the Internet or physically on CD/DVDs or other media. The distribution methods aren't mutually exclusive and you can use one or all of them.



▲ Internet distribution is fast and easy and takes many forms. For example, you can IM your photos, attach or insert them in e-mail messages, or post them on Web sites where everyone can see them.



▲ Keeping your photos on the computer's hard drive, lets you view them on the computer or TV set or project them using a digital projector.



◀ If you copy photos to a CD/DVD you can also distribute them for others to view on their computer or TV.



Click to visit the companion Web site

9.3 E-mailing Digital Photos

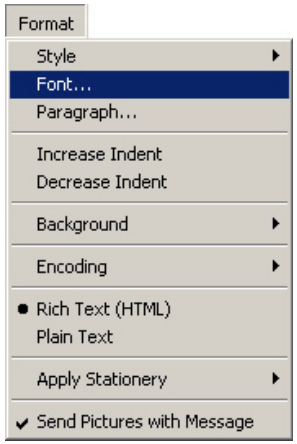
The most popular way to share a digital photo is to attach it to an e-mail message or even insert it into the body of the message. Both methods have potential problems. Attached photos are sometimes blocked because attachments can be used to spread viruses. Inserted photos are sometimes not displayed because they are an enhanced form of e-mail that uses HTML, the same language used to lay out and format Web pages. Some users have the ability to display HTML messages turned off.



➤ Enhanced e-mail is so popular it is integrated into programs such as Photoshop Elements that you also use to edit and organize your images.



➤ As a courtesy to the recipient you may want to reduce the size and quality of the images to reduce the time it takes to download.When you right-click an image in Windows XP to send it, a dialog box asks if you'd like the image made smaller.



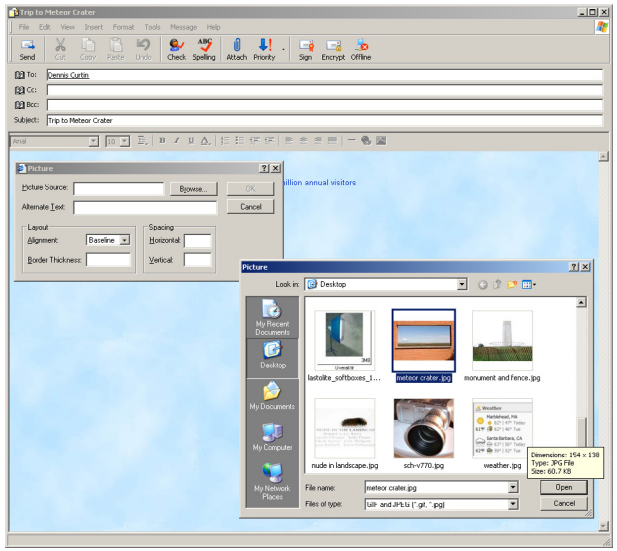
➤ You create enhanced e-mails using your e-mail program's format commands.



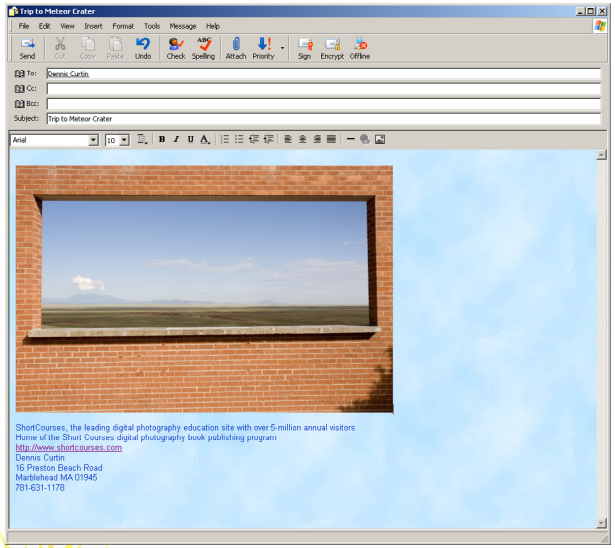
Click to visit the companion Web site

9.4 E-mailing Digital Photos, con't.

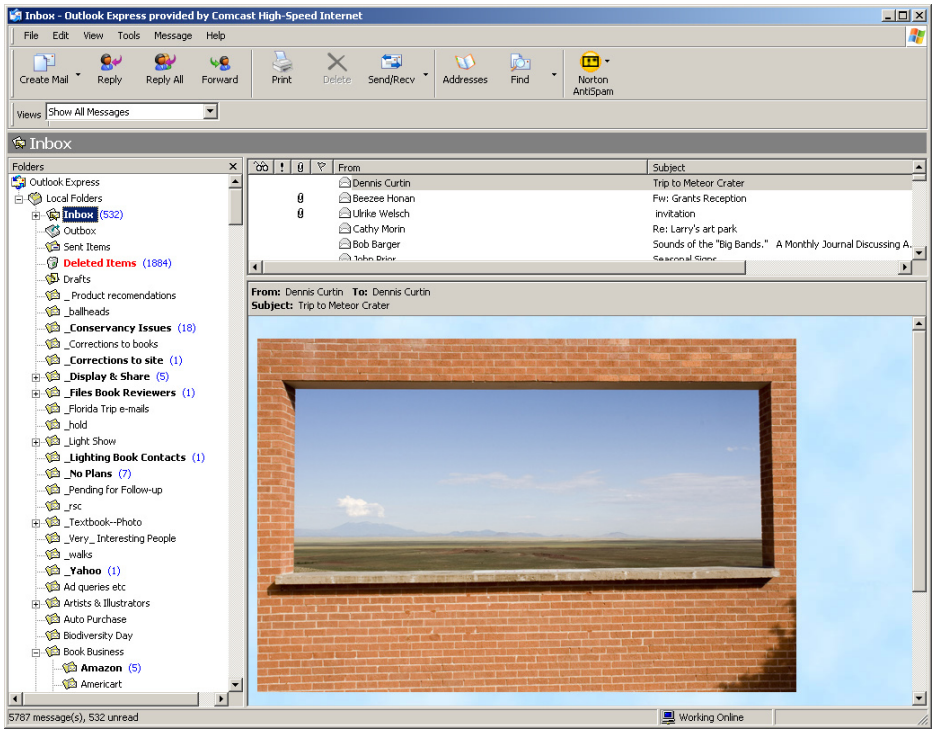
Sending an image by e-mail is as easy as 1-2-3. Here we insert a photo into the body of the message rather than attach it.



1. You first open a new e-mail and select the Insert>Picture command so you can browse your system for the image you want to send.



2. The selected image is inserted into the body of the e-mail and will go wherever it goes.



3. The recipient sees the e-mail embedded in the body of the message and can then save or print it.



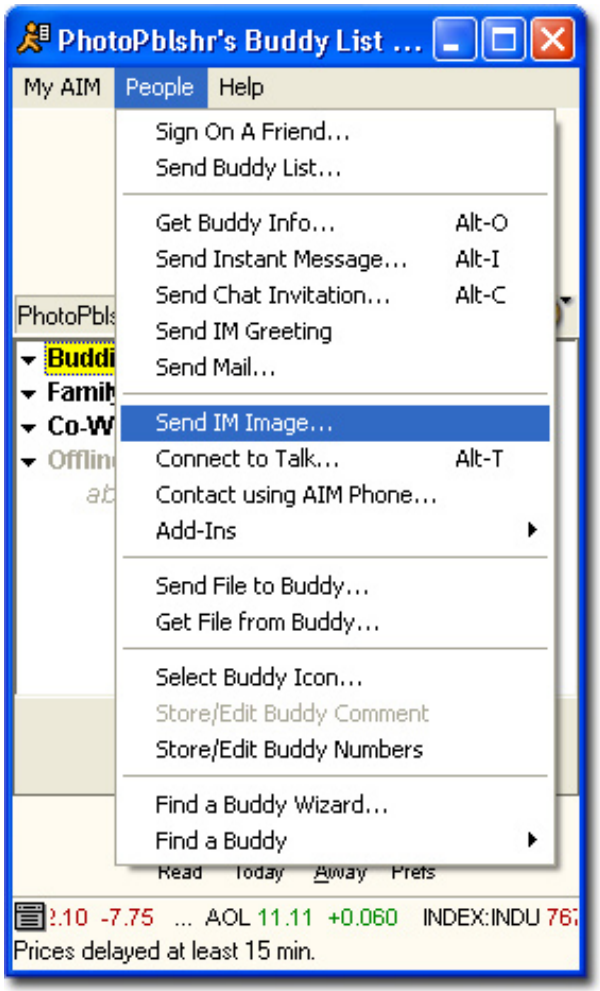
◄ Unlike the Insert command, the Attach command attaches the photo to the e-mail, much like a hiker's backpack.

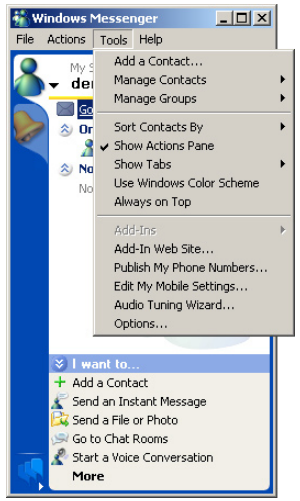


Click to visit the companion Web site

9.5 Instant Messaging

Instant messaging, often called just IM (eye-M) lets you chat privately with others, usually by typing short messages, but increasingly with voice and video. Digital photography and IM come together in a number of ways. For example, you can use your photo to identify yourself to others, but perhaps best of all, you can also exchange photos or even slide shows. To do so, you use menu commands and browse your system for the image file, or just drag and drop the image file into an open IM window. You are then notified when your recipient accepts the file. (The recipient must have file sharing enabled at their end.) How long it takes to share an image depends on the file's size and the connection speeds at both ends.





▲ AOL's Instant Messenger (left) and Windows Messenger (above) are typical of the IM programs available.



Click to visit the companion Web site

9.6 Slide Shows—Direct from the Camera

Most cameras have an auto play command that displays one image after another on the monitor like a slide show. Although used primarily to review your images, you can share the show with a larger audience using a cable that connects the camera to the TV. Some cameras let you rotate photos or even hide some so they aren't displayed during the show. Because displaying images on the TV is so popular, there are card readers that you can connect to a TV and some TVs have them built in.



➤ The auto play command displays a slide show on the camera's monitor.



➤ Most digital cameras have a video out connection so you can connect the camera to a TV set. Most cameras come with an AV cable you use for the connection.



➤ Some cameras include a remote control so you can advance through images, rotate and zoom them.



➤ SanDisk's Photo Album connects to the TV and plays shows from a variety of memory cards.

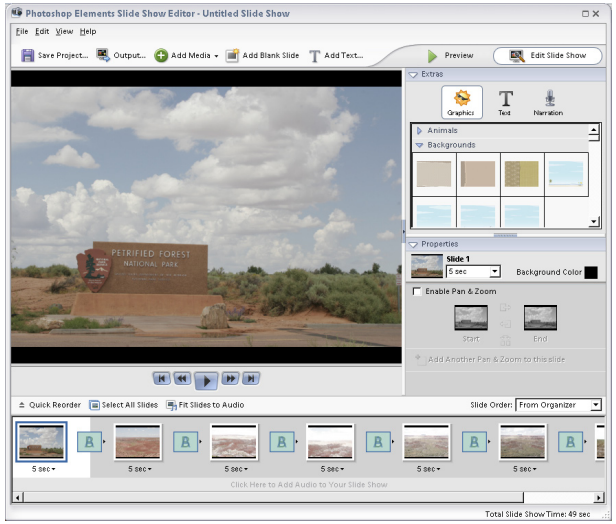
Courtesy of SanDisk.



➤ Epson's Livingstation TV sets have built-in card slots, a printer, and a CD-R/RW drive.

9.7 Slide Shows—Editing & Polishing

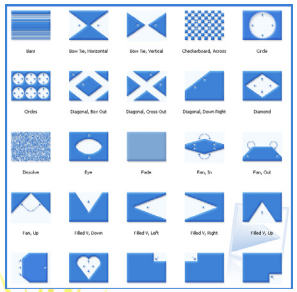
A huge step up from displaying a raw, unedited show right from the camera is an edited and polished slide show. Using a slide show program you select images and specify the order in which they are displayed, how long each is on the screen, and how each image transitions to the next. You can even add a title page and background music or narration.



➤ To assemble a show you select them or drag images onto the time line. There are commands to add text, music, and change transitions.



➤ When creating a slide show with Photoshop Album, you can preview it. When finished you can save it as a movie or PDF file.



➤ Microsoft's Movie Maker 2 does a good job of illustrating transitions using icons. This illustration shows just a small portion of those that are available.



Click to visit the companion Web site

9.8 Slide Shows—Presenting & Sharing

You can give your slide show directly from a computer or burn it to a DVD so you can share it and display it on a TV.

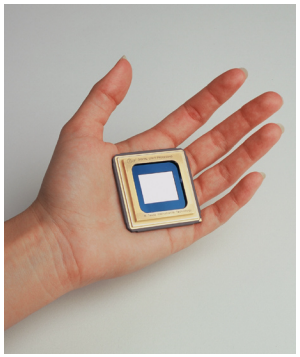


▲ Digital projectors have taken the place of the old slide projector. Some of the more expensive models are bright enough to give shows in rooms that have lots of ambient light and have a high enough resolution to project sharp, detailed pictures.

Courtesy of Epson at www.epson.com.



◀ Handheld devices like the iPod can store and display images as slides shows—even accompanied by music.



▲ A Many digital projectors use digital micromirror devices to create images. This one has over a million mirrors.

Courtesy of Texas Instruments at dlp.com.



▲ Notebooks are ideal platforms from which to present slide shows. You can play them from the hard drive or DVD and display them on the computer screen or connect it to a projector.



▲ DVD players are so inexpensive, they are now connected to almost every TV set and are an ideal way to play back slide shows burned to DVDs.

Click to visit the companion Web site

9.9 Home Entertainment Networks

With photos on the computer's hard drive, and everyone gathered in front of the big screen television with surround sound in another room you need a way to bridge the two environments—converting a home network into a home entertainment network. Although slow to take off the latest option is a *media server* that plugs into a TV or home entertainment system and communicates with other devices on the home network. Once connected, you can use a remote control to browse through your music and photos on the computer and choose what to view or listen to on the TV.



➤ The Linksys Wireless-B Media Adapter (left) brings the digital music and pictures stored on your computer to your TV without running cables through the house.



➤ Portable wireless TV screens, about the size of a notebook, display broadcast programs and your own photos as you roam within range of the network.

Courtesy of Sony.

➤ The Xbox streams recorded television, videos, movies, music, and photos from a PC to a TV screen.



9.10 Digital Frames

A great display device is the digital frame that displays one image after another. Most frames are designed to stand alone and play images stored on a memory card or even a CD. Some frames can also connect to a home network so you send photos to it from a computer. Still other frames connect to a phone line so you or others you invite can send images to it from other computers on the Internet—although there are often monthly charges to use the network.



Ceiva's internet frames display news, weather, traffic, sports and entertainment as well as photos.

Courtesy of Ceiva at www.ceiva.com.



Nokia has a digital frame that you can send photos to directly from a camera phone.

Courtesy of Nokia at www.nokia.com.



The VistaFrame™ Digital Picture Frame displays pictures directly from your camera's memory cards. No computer, camera or Internet connection is required.

Courtesy of VistaFrame at www.vialta.com



Frames have slots where you insert memory cards.

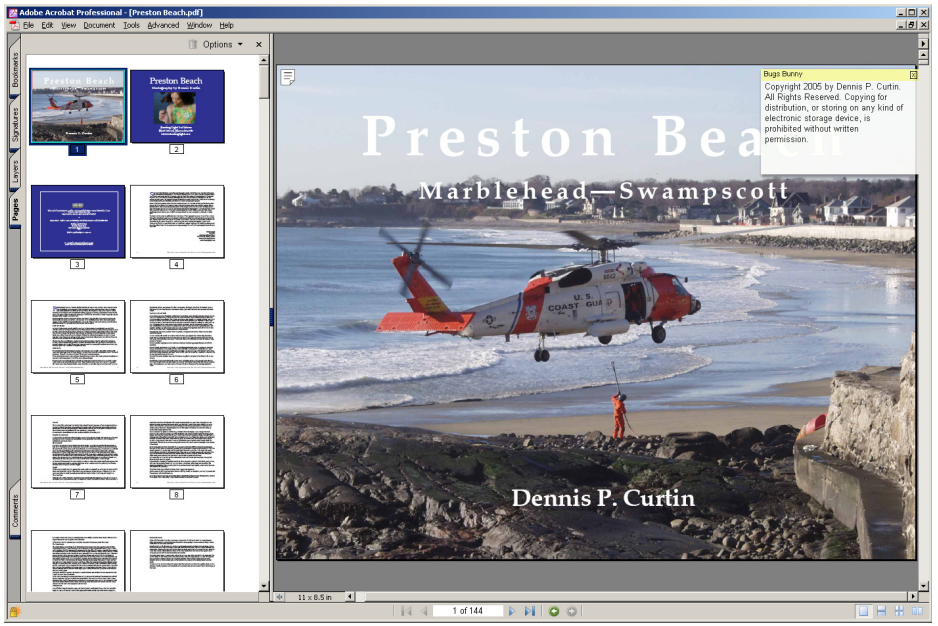
Courtesy of Edge at Nokia at www.edgetechcorp.com.

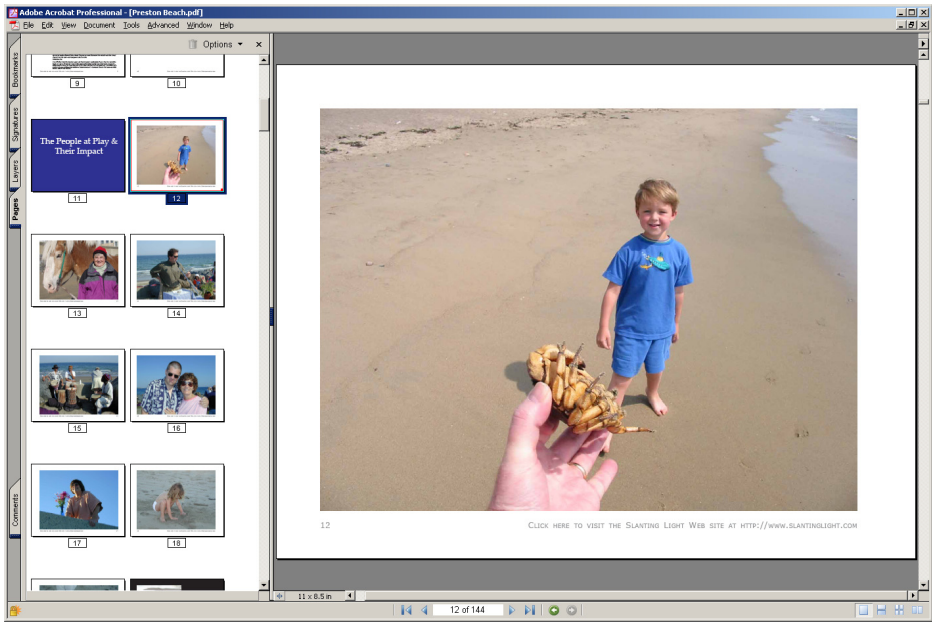


Click to visit the companion Web site

9.11 eBooks—PDF Files

PDF eBooks are the ideal way to distribute your images to a wide audience. They can have the quality of an illustrated coffee-table book but at almost no cost. What may surprise you is how easy it is. The first step is to create the original document, using whatever application program and design elements you desire including color, fonts, photos, or other illustrations. You then use this original document to create a PDF eBook that can then be distributed and viewed or printed on any system that has the free Adobe Acrobat Reader installed. (All new systems and browsers do, and if not already on your system, you can download a free copy from the Adobe Web site.)





➤ A PDF eBook displayed on the screen has clickable page thumbnails or table of contents, and many other navigational elements. Like a printed book yours can have a cover (top), text, and photo pages (bottom).



Click to visit the companion Web site

9.12 Creating a Photo Web Site

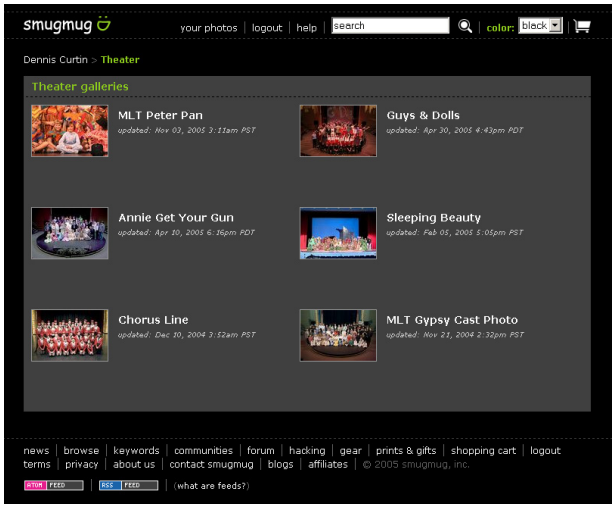
For maximum exposure, your photos need to be on a Web site and there are many ways to get them there.

• Photo sharing and printing sites are the easiest way to get your photos on-line. You just open an account and upload your images into albums or galleries. Some services let you customize the look of the site, but your control is minimal. One of the best things about these services is that you and your visitors can order prints and other photo embellished products such as mouse pads and coffee mugs.

• For total artistic control of your site, you set up your own. All you need is a domain name, a hosting service, and an authoring tool such as FrontPage. You can go to a site such as pair.com to register your own domain name and have your site hosted. Although you have to pay a fee to register a domain name and there are monthly charges to have the site hosted, your bonus is a permanent e-mail address.



➤ A photo printed on playing cards and the cover of a box to hold them at Sony's ImageStation.



➤ A Some of my galleries on SmugMug at denny.smugmug.com. Anyone in the community can download the images or have prints made.



➤ Rob Kipp posts his bird photos on a Web site so people can view them and even order prints.

Courtesy of Rob Kipp at bird-photos.com

Click to visit the companion Web site

9.13 Photo Blogs

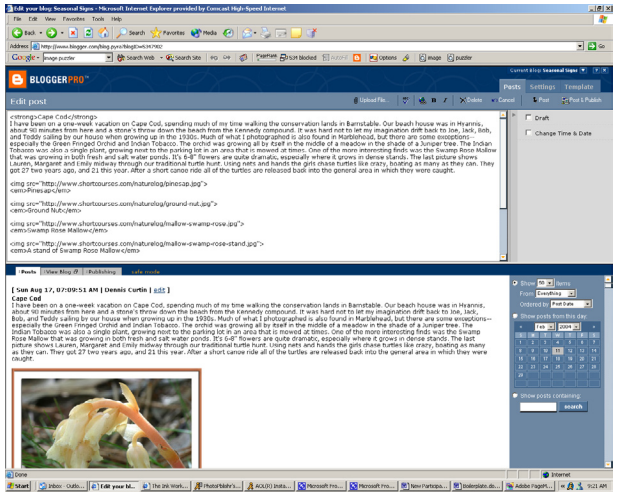
A *blog*—a contraction of *Web log*—is a web page that's easy to update. Typically made up of brief entries, newer posts are displayed at the top of the page as older ones sink toward the bottom. A *photoblog* is simply a blog where photos are the sole, or at least an important, component. A variant is a *moblog*, or a blog created with sounds, photos, and text sent in from a mobile wireless device such as a camera phone. For many people photo blogs take the place of diaries, journals, trip logs, and the like. Some services even allow visitors to add comments to your blog. This is a great way to share your photos with a group and get feedback.

To create a blog you first select a hosted weblogging service such as blogger.com. After opening an account, whenever you go to their site a form appears in your browser. You just enter your text, format it, add photos and click the Publish button to post your entry. Not only is this simple, you can make entries from anywhere you can get access to the Internet—even from a cyber cafe in Rome.

➤ Leanne Ashley, spending a school semester in Rome, updates her blog with some help from Marco Patrizi at the Internet Cafe in Piazza Piscinula in Trastevere in Rome.



➤ Making an entry in a blog is as easy as typing it in, selecting a photo, and clicking the publish button.



➤ You can change the design of an entire blog just by selecting a new template.



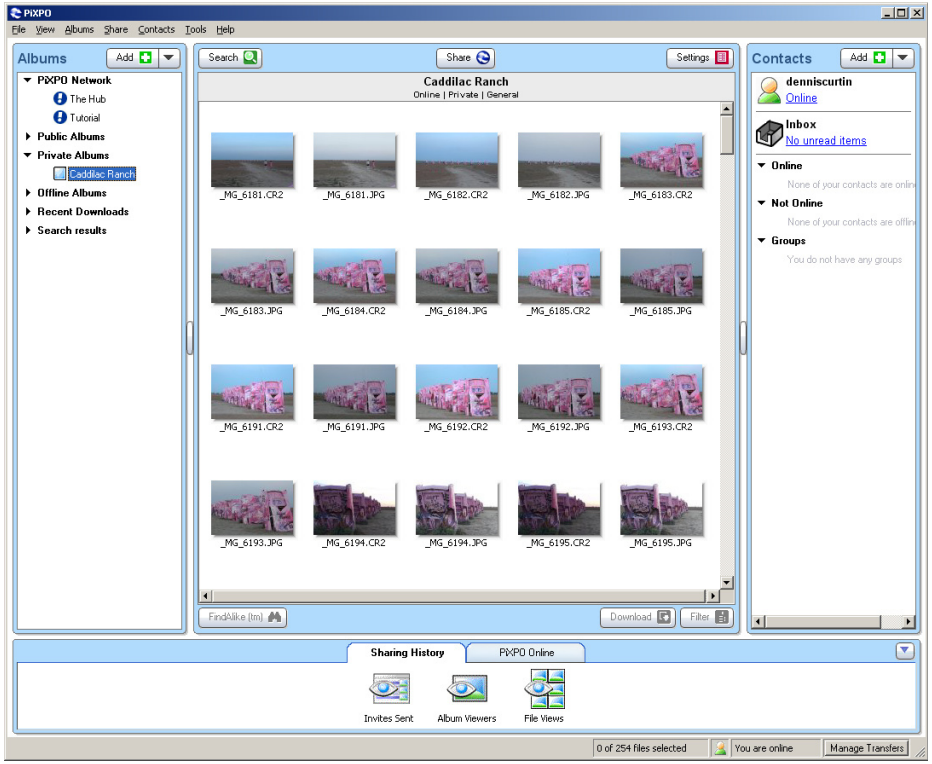
Click to visit the companion Web site

9.14 Peer-to-Peer Photo Sharing

One way to share photos is using peer-to-peer (P2P) photo sharing. First made popular by Napster, peer-to-peer software lives on. Once installed, the software creates an area that's partitioned off from the rest of your system so visitors can't get outside of the area. Any images you place in this partioned-off area are available to visitors.

After creating an album or folder, you send e-mail invitations to the people you want to visit. When they visit their Web browser or the program's application opens and they are prompted to enter the password you sent. They then see thumbnail images of the photos you have made available on your system.

Some P2P services let you chat about the photos as you and others view them, and even order prints. One use of these systems is to give you access to your own photos when not at your computer. You can connect to them from over the Internet just as if they were on the remote system.



Pixpo lets you make folders on your system available to invited guests.

This area is changing so rapidly, here are some sites to keep an eye on.

www.ourpictures.com

www.sharealot.com

www.pixpo.com

www.hello.com



Click to visit the companion Web site



Photo COURSE

Displaying & Sharing Printed Photos

Chapter 10

10.1 Printing—Introduction

Printing photos is the traditional way to display and share them. However, this area has been dramatically changed by the transition from chemical to digital processes. The ability to order high-quality prints on-line, print them on the desktop, or even on pocket-sized portable printers changes everything. One of the advantages of printing yourself is the wider choice of papers you have and the opportunity to experiment with different versions of an image.



➧ The traditional way to display prints is matted, framed, and hung on the wall.



➧ Album kits let you print and assemble bound photo albums with the images printed on the pages just as with published books. There are also on-line services that will print your images as books.

Courtesy of Red River Paper at www.redriverpaper.com.



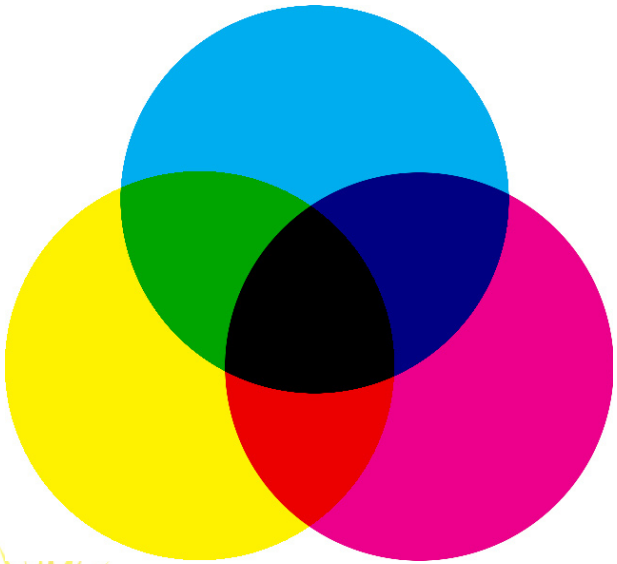
➧ Printers come in all sizes, down to this portable snapshot printer from Canon.

Click to visit the companion Web site

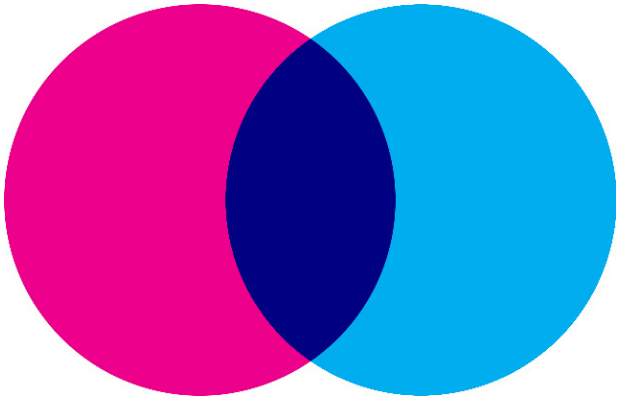
10.2 Printing Colors—CMYK

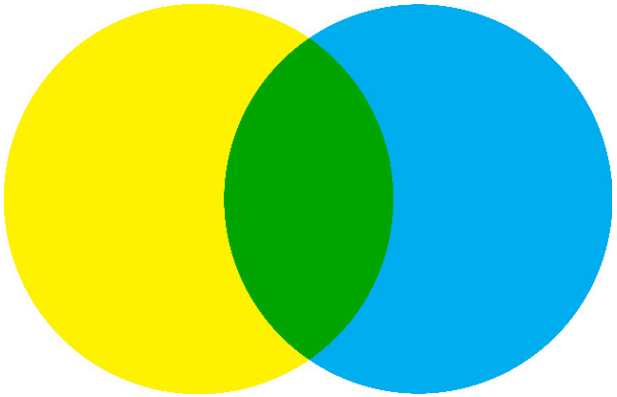
Animation

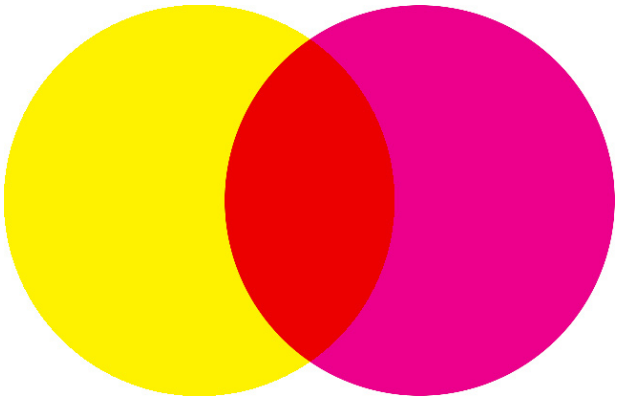
Color printers create millions of colors using just cyan, magenta and yellow inks. This is called *subtractive color* because mixing the three colors forms black. However, this blended black tends to be too dull to print type and the rich blacks needed in photos. For this reason printers use a separate black ink. These four colors give the color system its name—CMYK (C for cyan, M for magenta, Y for yellow, and K for black). Newer printers are capable of printing even more unique colors because they use up to 8 colors— the original CMYK plus lighter versions of cyan, magenta, or black. Some printers can also vary the size of each dot it prints, giving the printer even more flexibility.



➤ Printers blend cyan, magenta, and yellow inks to create the millions of colors found in a photograph.







➤ As the three basic CMYK colors visually mix, they form other colors. Combining magenta and cyan creates blue (top), combining yellow and cyan creates green (middle), and combining yellow and magenta creates red (bottom).



Click to visit the companion Web site

10.3 Printers—How an Inkjet Printer Works

Animation

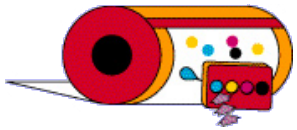
The most popular photo printer is the inkjet that creates images by spraying tiny picoliter-sized droplets of ink to create the color of each pixel in the image. The tiny dots of color in each pixel visually blend into one of millions of possible colors depending on the number and distribution of each color's droplets. Inkjet printers use two approaches to ejecting the ink from the print head onto the paper:

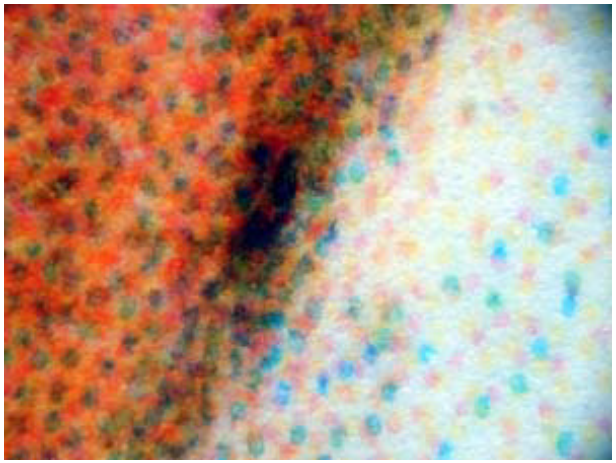
- *Bubble jets* heat ink to vaporize it into an expanding bubble that forces ink out of the nozzle. Both Canon and Hewlett Packard use this technology.

- *Piezoelectric* print heads use a vibrating crystal at the back of each nozzle's ink reservoir to force ink out of the nozzle. This technology is used by Epson.



➤ Canon's i9900 Photo Printer has 8 colors and 6,144 nozzles that deliver 11 million droplets of ink per square inch.





➤ As the print head sweeps across the paper thousands of tiny nozzles spray droplets of ink. With a microscope you can see the droplets that blend to form the image.



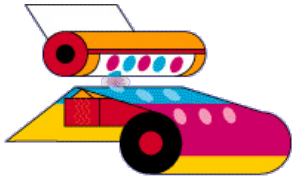
➤ The Epson R2400 prints images using 8 ink cartridge colors in sizes up to 13" x 19" and panoramic.

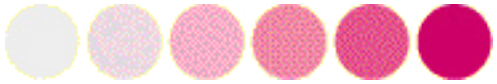
Click to visit the companion Web site

10.4 Printers—How a Dye Sub Printer Works

The only printer that can print continuous tones like those found in a traditional print is the *dye-sub* or *dye sublimation* printer. This very high-quality technology is used in small snapshot printers and in some large, professional printers. A dye-sub printer can print each pixel using the same color and tone as the pixel in the original image. When these pixels are printed closely together, usually around 300 per inch, they form smooth and even gradations just like silver-based photographic prints.

The "dye" in the name comes from the fact that the process uses solid dyes instead of inks or toner. "Sublimation" is the scientific term for a process where solids (in this case dyes) are converted into a gas without going through an intermediate liquid phase.





▲ As a separate pass is made for each of the four colors, a thermal print head's hundreds of heating elements vaporizes the solid dyes which then diffuse into the surface of the paper. Because the dyes are transparent, a cyan dot may be printed on top of a magenta dot to make a blue dot. By varying the amount of cyan, magenta, and yellow, any color may be produced.

Courtesy of Tektronix.



▲ Dye sub printers use print-sized panels of cyan, magenta, yellow and black dyes and special paper that's designed to absorb the vaporized dye.



▲ Some snapshot printers, like this one from Sony, don't need a computer.

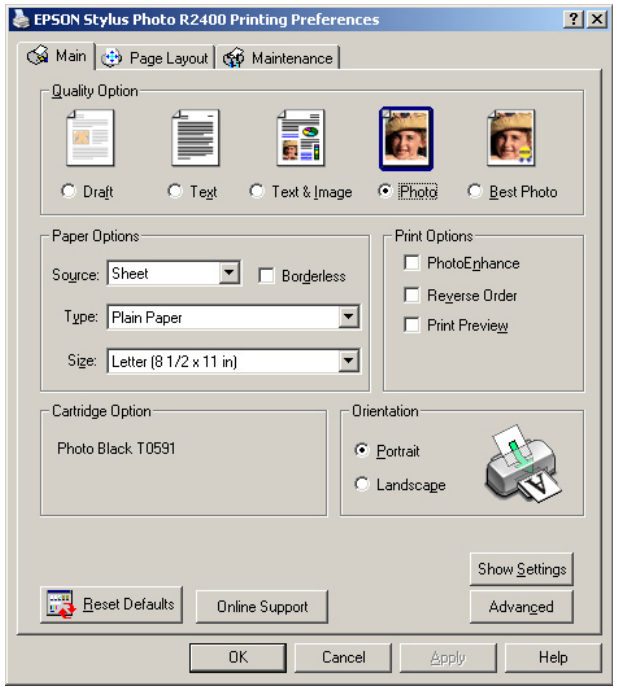


▲ An Olympus P-10 dye sub printer with dyes and paper.

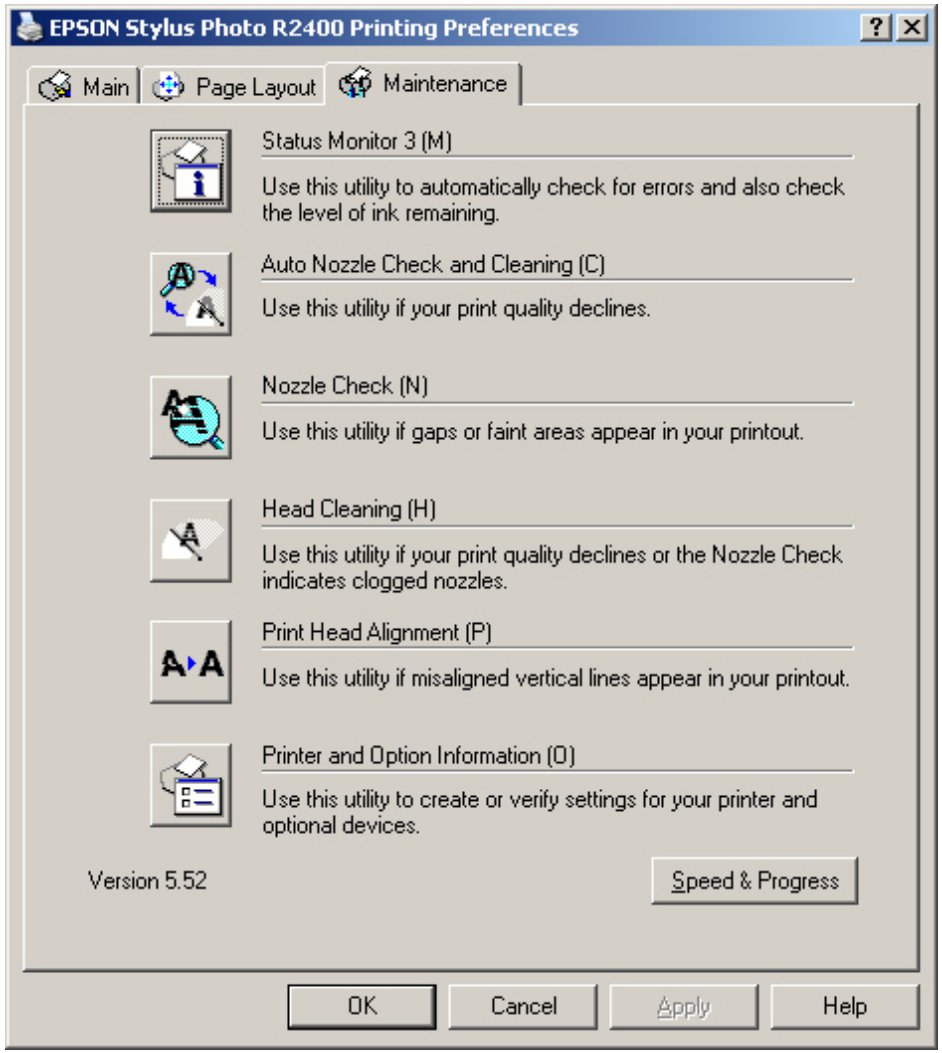
Courtesy of Olympus.

10.5 Printers—Drivers

All printers come with a software program called a *driver* that you have to install so the computer can communicate with the printer. When you use a program's *Print* command, the dialog box you see is actually the printer driver's dialog box. You use it's settings to specify the type, size and orientation of the paper, the desired output quality, and the number of copies. Based on these and other settings you make, the driver determines the most efficient way to apply ink to the page.



➤ Drivers let you select such settings as print quality, paper size and type, and portrait or landscape orientation.



➤ Drivers usually include utilities you use to adjust and clean your print head.



Click to visit the companion Web site

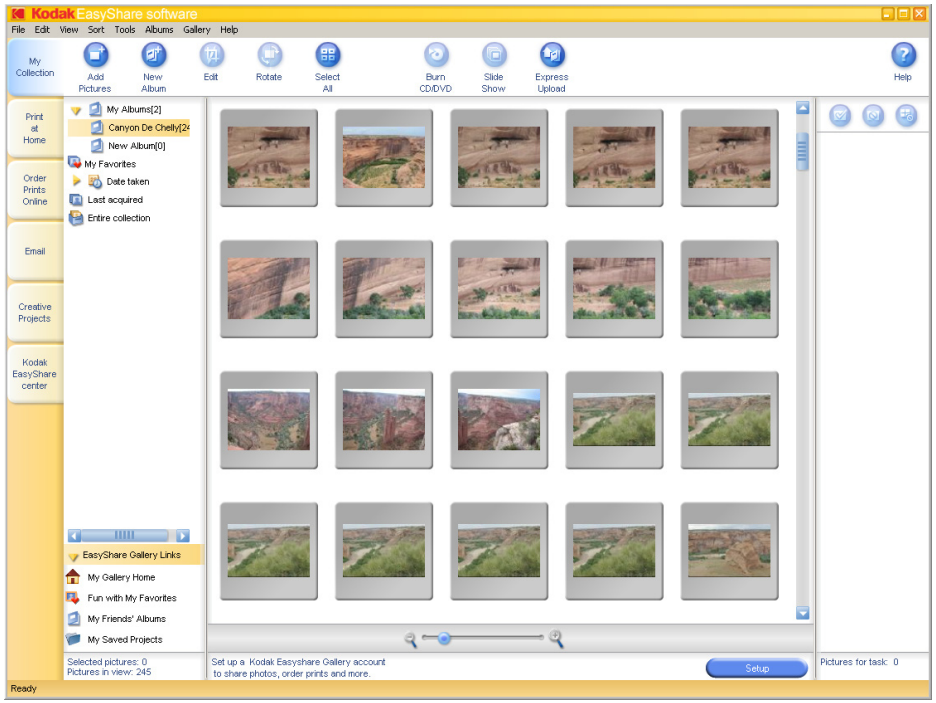
10.6 Prints—On-line

Many Web sites offer combined photo sharing and printing. After uploading your images into an on-line album or gallery you and invited guests can order prints at sizes ranging from stickers to posters. If the mood strikes, you can also have your photos printed on mugs, T-shirts, and practically any other item you can think of.

These on-line services print digital images on traditional photographic paper using a number of different technologies. They all provide photo quality images that are long-lasting and less expensive than many other high-quality digital printing methods because they don't require expensive papers, inks, or dyes.



➤ Some outlets can print very large prints for you. Courtesy of Canon.



➤ Kodak's free Easyshare software lets you organize the photos on your system and upload those you choose to the Easyshare Web site.



➤ Photo-embellished mug.

Courtesy of Sony at www.imagestation.com.



➤ To fit images onto standard print sizes, the top and bottom often have to be cut off or cropped (unless you do it first).

Click to visit the companion Web site

10.7 Prints—Locally

Just as with film, your local stores can give you one-hour prints directly from your memory card. Many locations also have self-serve photo kiosks. You just insert your camera's memory card (or almost any other media that has images on it) and make prints on the spot. Some even let you edit your images, burn CDs and upload your images to a photo sharing site on the Web. When using a self-serve kiosk for the first time, one tip is to ask a staff person to make your first print as you watch. They often have to make a few to get it perfect and don't charge you for the extras.



➤ Kiosks have slots for most cards and even CDs. Most also have Bluetooth or WiFi wireless capability so you can print directly from the camera.



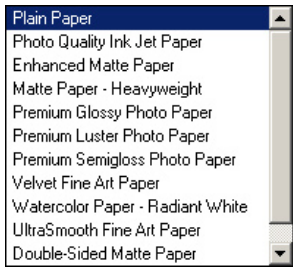
➤ Some kiosks use traditional silver-based photographic paper while others make dye-sub or inkjet prints. Because so many printing technologies are used, print quality can vary. As you try different kiosks, you might ask what technology they use so you can learn which you prefer.



Click to visit the companion Web site

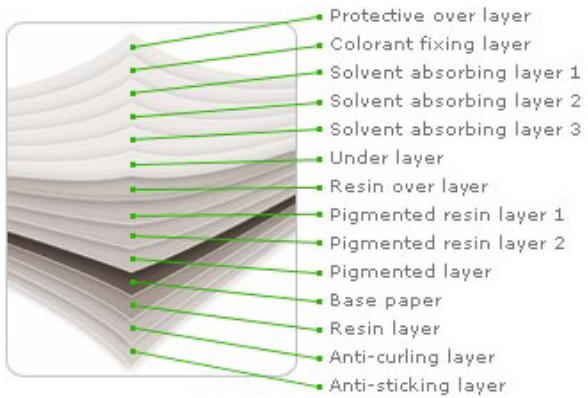
10.8 Prints—Printing Paper

Printing paper comes in sheets and rolls, in a variety of sizes, and with surfaces from glossy to textured. It also comes prescored for postcards, greeting cards, and other applications. The way your prints look, and how well they age, depends on the paper you print them on and on how you store them. With a little care, your images will be enjoyed years from now. Stick with brand names and check into the archival properties of the paper. This isn't an area where you want to cut costs.



➤ You must tell the printer which paper you are using or you won't get the best results. You do this is the dialog box that appears when you select the Print command.





➤ Inkjet papers often have a number of layers as shown in this illustration from Fujifilm.

➤ For your best images, look into fine art papers such as Hahnemuhle. These papers are more substantial and richly textured than other inkjet papers, and longer lasting. Typically made from 100% cotton these paper are also acid-free with a neutral pH.

Courtesy of Hahnemühle USA at www.hahnemuhleusa.com



➤ Photo finishers often print on traditional silver-halide photographic paper. Printers use spinning mirrors to expose the paper with red, green, and blue laser beams. The paper is then processed using traditional photographic chemistry.



Click to visit the companion Web site

10.9 Prints—Inks

Inkjet printers use up to 8 colors. Sometimes all of the colors are in one cartridge, but the preferred approach is to have them in separate cartridges so you can replace one color without replacing all. Inks come in two basic varieties: dyes and pigments.

- *Dye inks* are colored dyes dissolved in a fluid carrier. When applied to the paper, the dyes are absorbed very evenly so they reflect light very evenly, providing a wide range of bright colors.

- *Pigmented inks* are small colored particles suspended in a liquid carrier. The particles are not distributed on the paper's surface as evenly as dyes are, so the light scatters more so the range of colors is narrower than dye-based inks.

The range of colors a printer can produce is called its *gamut*. Although dye-based inks have a wider gamut, they tend to be less stable. Not only isn't the ink layer as thick as one created by pigmented inks, dyes are more affected by exposure to sunlight, ultraviolet, and ozone. Pigmented inks are preferred where longevity is desired. However, gaps between the two inks are closing as improvements are made in both areas. Dyes are becoming more stable and pigments are becoming smaller and more uniformly distributed.



➤ Epson's UltraChrome K3 inks include eight cartridges—two shades of cyan, two shades of magenta, yellow, and three shades of black.



➤ A One way to think of a gamut is as a set of colored pencils. A set with a few pencils has a small gamut while a set with many pencils has a large gamut.

Courtesy of Prismacolor at www.prismacolor.com

Click to visit the companion Web site

10.10 Prints—Matting and Mounting for Protection

The traditional way to display a print is to mat it for framing. Matting sandwiches the print between two sheets of mat board, one of them with a bevelled window through which the print shows.

To mat a print, you start with a sheet of mat board for the overmat and a mounting board for the backing. The best material is acid-free archival or museum quality mat board that won't discolor a print as it ages. Both pieces of board should be the same size but you can use different thicknesses—4-ply for the mounting board and 2-ply for the overmat or vice versa.

After trimming the mat board to the desired size, you use a mat cutter to cut a beveled window into the overmat. Mat board usually has a white core so when beveled, the image is set off by a white line. This overmat not only protects and shows off the image, it also prevents the surface of the framed print from touching the glass where it might stick, especially when it's humid.

If you cut the opening slightly larger than the image area of your print you will have room to sign and title the photo.



▲ Precut mats come in a variety of sizes, but you can have any size cut or cut them yourself—perhaps using the classic Dexter mat cutter. If you print full-frame, or any other standard size and shape, you can have a number of mats created and then change the prints whenever you want.

Courtesy of Light Impressions at www.lightimpressionsdirect.com.

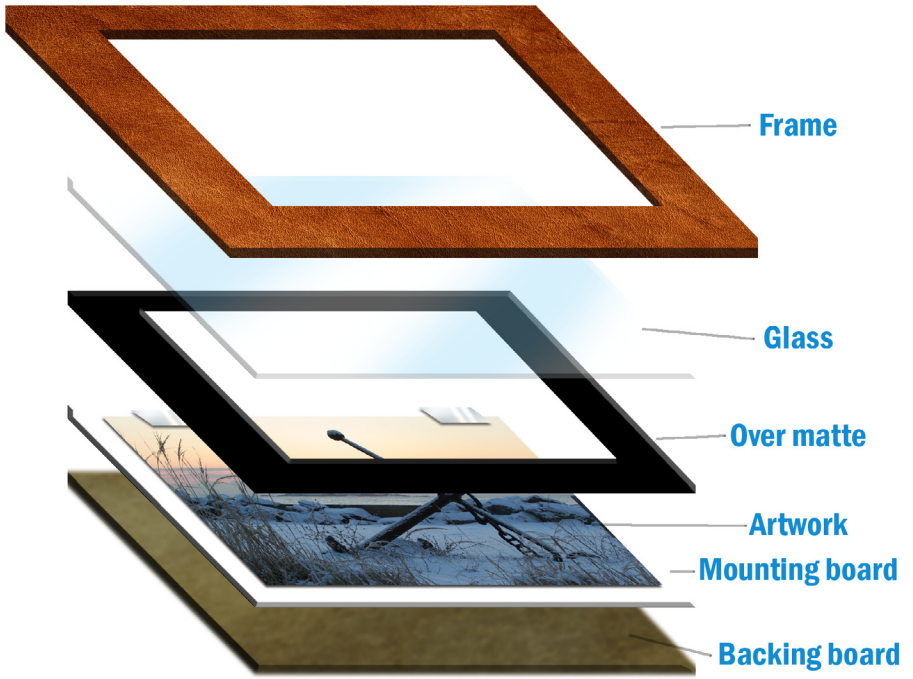


Click to visit the companion Web site

10.11 Prints—Matting and Mounting for Protection, con't.

Once the window is cut in the overmat, you hinge it to the mounting board with tape and then position the print so it's aligned with the window in the overmat. One way to attach the photo to the mounting board is with photo corners that are then hidden when the overmat is lowered. This avoids having adhesives in direct contact with your photo and also makes it easy to remove the print. Another way is to make tape hinges using acid-free linen tape. You should avoid dry mounting which uses heat, and materials such as cellulose tape, masking tape, brown paper tape, or cheap glues. Tapes and glues are considered archival only if they don't affect the print's color over time and are completely removable.

Retailers such as Light Impressions carry both archival mat board, mat cutters, precut mats, and other supplies you may need. Local art supply stores also carry these materials, and are a good source of advice and even classes.



▲ Matting and framing a print is like creating a multi-layer sandwich with all of the layers shown here.





➤ Here are details of how the mat and mounting board can be hinged to keep them aligned (left) and how tape can be used to create a "T" mount to mount the print on the mounting board (right).



Click to visit the companion Web site

10.12 Prints—Framing for Presentation

The traditional way to display a matted print is in a frame. In metropolitan areas there are frame shops that help you choose frames and mats and then do the job for you. In more remote places, and when seeking out the truly unique, the Internet is a great place to look. Frames come in an almost endless variety of styles, colors, finishes, and materials. When looking for framing ideas, visit local galleries and on-line stores. You'll find ready-made frames in standard sizes and frame kits sold as pairs in a variety of lengths so you can assemble frames of almost any size and shape. The most expensive way to go is to have a custom frame made. Other framing ideas include magnetic frames that hang on the refrigerator, Swiss corner clips that are just four small clips and a piece of glass, and finally acrylic frames often used to hold sales literature and available at office supply stores.



➤ Matted prints don't have to be framed. You can store and present them in a portfolio case.

Courtesy of Pina Zangaro at www.pinazangaro.com.



➤ Frames come in a variety of woods (top, left) and aluminum (below, right).

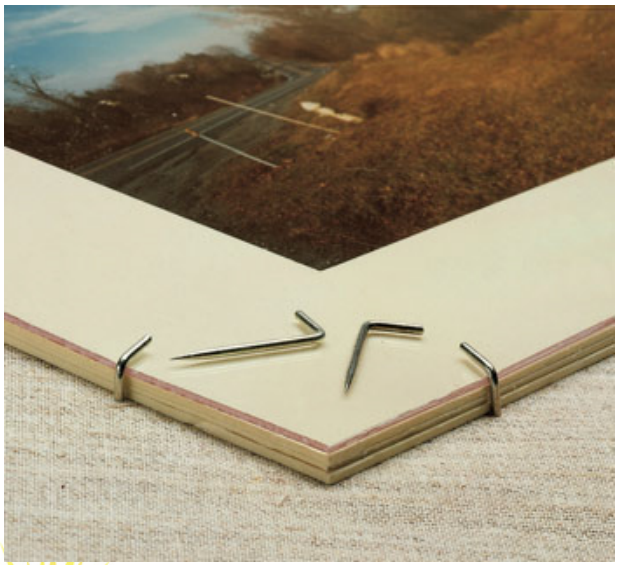
Courtesy of light Impressions at www.lightimpressionsdirect.com

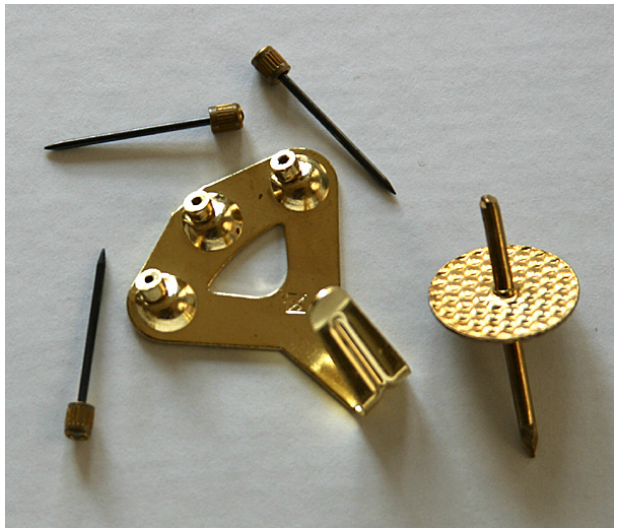
Click to visit the companion Web site

10.13 Prints—Hanging for Display

When hanging prints, avoid places where direct sunlight or other bright light hits them to reduce fading. If you can't avoid strong light, you can rotate your images or look into Plexiglas or acrylic that filters out UV light.

To hang photos you use picture hanging hooks and some are available with such thin nails they leave almost no hole. Adhesive mounting tape or squares lets you hang frames without using nails and leaving holes in the walls.





➤ "L" pins mount a glass-covered photo to exhibition board or other material. These pins eliminate the cost of frames and are ideal if you want to change exhibits often.

➤ Picture frame hooks come with needle thin nails that don't mar walls.



➤ Display ledges come in a variety of lengths and let you display framed photos without hanging them. This makes it very easy to rotate photos in your display.

10.14 Prints—Storing Archivally

As one print after another emerges from your printer, if you don't frame them immediately, you need a way to store them safely. One of the simplest ways is to use boxes, but they (or any other storage system) should be archival. For the ultimate protection, you can use acid-free tissue between each photo and wear white cotton gloves when handling them.



➤ Boxes protect prints from light, dust, and mechanical damage. Some have metal reinforced corners so you stack them without the lower boxes collapsing. Storage boxes don't have to be boring, and if attractive enough they can also serve as presentation devices.

Courtesy of Pina Zangaro at www.pinazangaro.com.



➤ Binders and sheet protectors are an easy way to store images.

Courtesy of Pina Zangaro at www.pinazangaro.com.

➤ Flat files may be familiar from museums, art galleries, and offices. They have large, but shallow drawers used to hold prints.



Click to visit the companion Web site

10.15 Photo Albums—Sheet Protectors

One of the easiest ways to create a photo album is to just slip your prints into plastic sheet protectors and put them into a loose-leaf binder. You can even slip two prints back-to-back into each sheet protector so as you turn pages they form a two-page spread. There are binders that use more than three rings. They definitely look more attractive, but because they are not widely available so you may be locked into a single source of supplies. The binder covers used with sheet protectors are wider than most because they have to accommodate the additional width of the strips on each sheet protector that contains the binding holes. Sheet protectors are available in a number of layouts including those that hold 8.5 x 11 prints and those with multiple pockets for smaller prints. Binders come with D-rings or O-rings (D-rings hold 20% more pages than O-rings). Avoid PVC (polyvinyl chloride) sheet protectors and only use those made of polyethylene and polypropylene.



➤ Attractive cover sets such as this one from Kolo holds sheet protectors.

Photo Credit: Kolo,LLC at www.kolo.com.



➤ Binders that hold sheet protectors and have slip cases for additional protection are great for both storage and display.

Courtesy of Light Impressions at www.lightimpressionsdirect.com.

Click to visit the companion Web site

10.16 Photo Albums—Album Kits

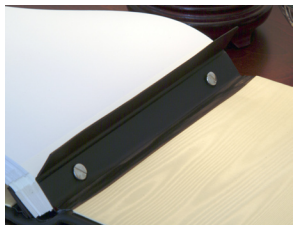
One of the most polished looking albums has your images printed directly onto the album pages, often on both sides. These pages have attached mounting strips that are punched with holes and scored for easy turning or have similar binding strips that you attach after printing. The album's pages are bound in a cover—some of which have a place for a small photo or label identifying the subject or theme. Most of these albums use *Chicago screws* to hold the covers and pages together. The covers each have a narrow flap punched with holes and creased so they are folded under when the covers are closed. A post and screw is inserted through each hole in both covers and matching holes punched in the album pages. When the screws are tightened and the covers are closed, the post heads are concealed. Pages can be added or removed from albums bound in this manner. The number of pages that can be included depends on the length of the Chicago screws.

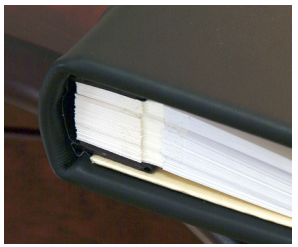


➤ This Kolo set contains a cover set with post binding and inkjet pages that are printable on both sides.

Courtesy of Photo Credits: Kolo, LLC at www.kolo.com.







➤ Many albums use Chicago screws to hold together the covers and scored pages.

Courtesy of Red River Paper at www.redriverpaper.com.

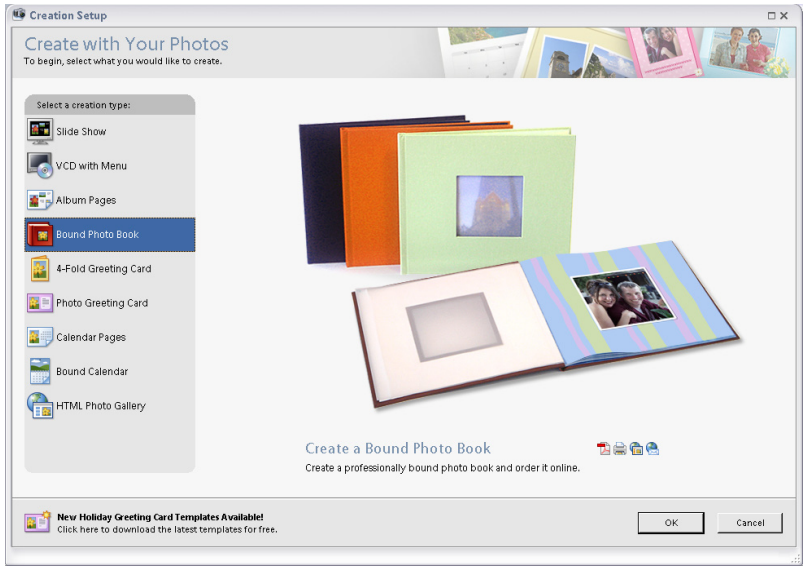


➤ Chicago screws have two parts—a screw and a post and come in a variety of lengths.

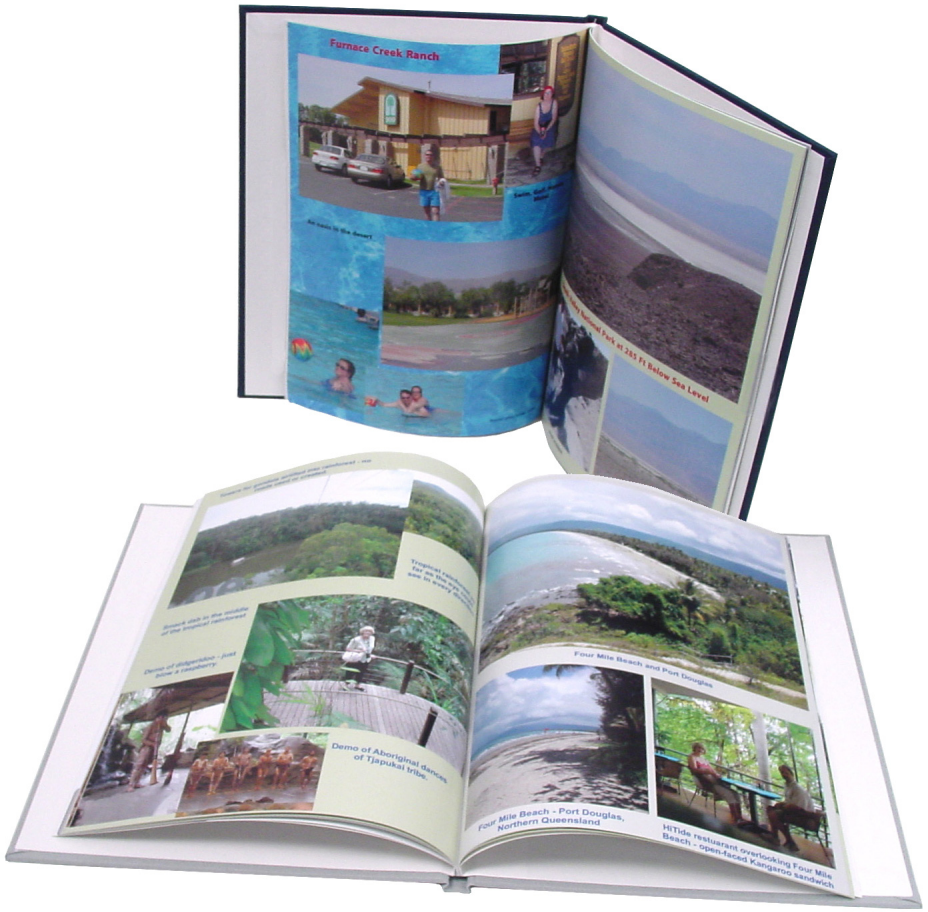
Click to visit the companion Web site

10.17 Photo Albums—Outside Printers

There are a number of on-line sites that will print photo albums for you so they look like a published book. Some programs, such as Apple's iPhoto and Adobe's Photoshop Elements let you assemble albums before uploading them for printing. You also have choices about cover materials and other aspects of the job. Once your book is created you may also be able to save it as an eBook in Adobe's PDF format so it can be distributed over the Internet by e-mail and viewed with any up to date browser or computer with Acrobat Reader installed.



Using Photoshop Elements you can lay out a photo book and then upload it to an on-line service for printing.



Sony's ImageStation Web site lets you design your own AlbumPrint photo book and have it printed and bound in portrait or landscape mode.

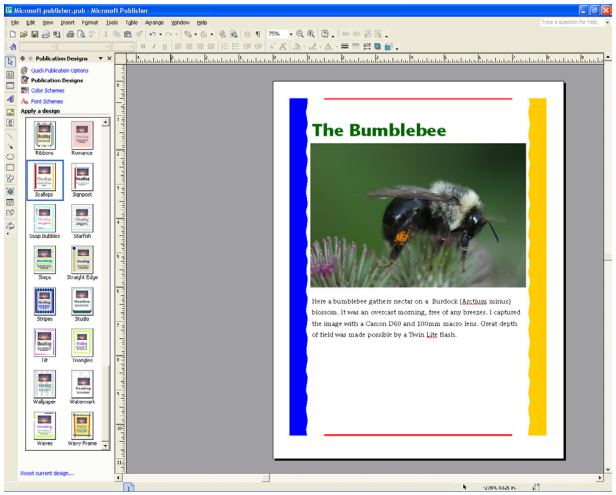


Click to visit the companion Web site

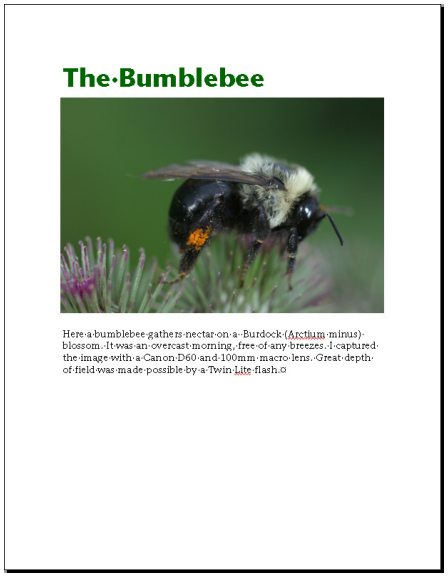
10.18 Photo Albums—Desktop Publishing

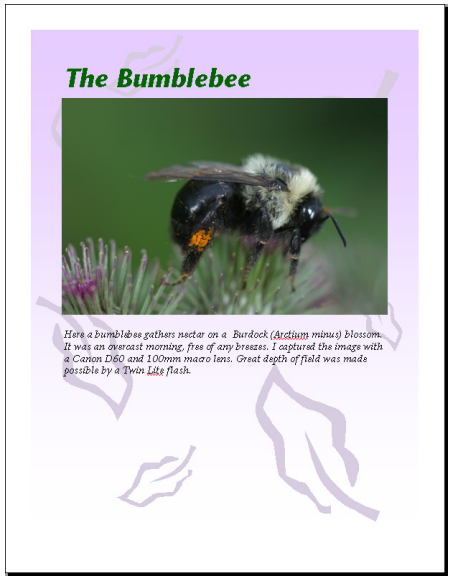
To self-publish a photo album, a journal, or any other photo illustrated book, you need to lay out both photos and text. Professionals use desktop publishing (DTP) programs such as Quark and InDesign, but they cost hundreds of dollars and have fairly steep learning curves. If you don't have access to one of these programs, you can use an easier to learn program such as Microsoft Publisher for much less money.

A desktop publishing program differs from a word processing program. You create text boxes into which you enter titles, text, or captions. You can drag corners or sides to change the box's size or shape, drag the entire box to a new position, and even rotate it so the type is at an angle. Pictures are placed on the page and can also be sized, dragged, and rotated. The text boxes and pictures remain in position, even when you add or delete text. Text can flow from one box to another, as it might in a multi-page document, or be contained in just one box as it might be in a heading or caption.



➤ Microsoft Publisher lets you place and size photos on the page and add text boxes into which you enter text.





➤ Desktop publishing programs have templates for booklets, cards, business cards and other publications you can use as-is or adapt.



Click to visit the companion Web site

10.19 Printing Photos

When making prints, there are two related terms you have to understand—dots per inch and pixels per inch:

• *Dots per inch* (dpi) refers to how many dots of ink the printer can create on the page. These tiny dots are used to create the pixel's colors. On some printers you can use the printer driver to change the dots per inch.

• *Pixels per inch* (ppi) refers to the size of the pixels on the printed page. You use your photo-editing programn to specify this setting. Most images print best at between 200–300 ppi.

Since image sizes are described in pixels and photographic prints in inches, you sometimes have to convert between these units. To do so, you divide the image's dimension in pixels by the printer's dots per inch (dpi). For example, to convert the dimensions for a 1500 x 1200 image being printed at 300 ppi you divide as follows to find that your print will be 5" x 4".

Width: 1500 pixels ÷ 300 dpi = 5"

Height: 1200 pixels ÷ 300 dpi = 4"



➧ Here are the relative sizes of a 3000 x 2000 image printed or displayed on devices with different dots per inch. At 72 dpi it's 41.7" x 27.8", at 300 dpi it's 10" by 7", and at 1500 dpi, it's only 2" x 1.3"—a little larger than a stamp.



Click to visit the companion Web site

10.20 Printing Photos—Exploring Print Sizes

Excel Resource

The size of a printed image depends on the number of pixels in it and how closely together they are printed—the dots per inch.

Exploring the size of printed images			
1	Width of image (in pixels)	1,600	pixels
2	Height of image (in pixels)	1,200	pixels
3	Printer's resolution (in dpi)	200	dpi
4	Width of print (in inches)	8.00	inches
5	Height of print (in inches)	6.00	inches

Clicking the Excel Resource *button on the title bar opens Microsoft Excel, if it is on your system, and then loads the calculator worksheet you can use to explore this concept.*

ENTRIES

1. Width of image (in pixels) is where you enter the image's width in pixels.

2. Height of image (in pixels) is where you enter the image's height in pixels.

3. Printer's resolution (in dpi) is where you enter the resolution your printer uses (this isn't the same as the number of ink drops it sprays, and is usually set in a photo-editing program).

ANSWERS

4. Width of print (in inches) is calculated by dividing the width of the image in pixels (line 1) by the dots-per-inch used to print it (line 3).

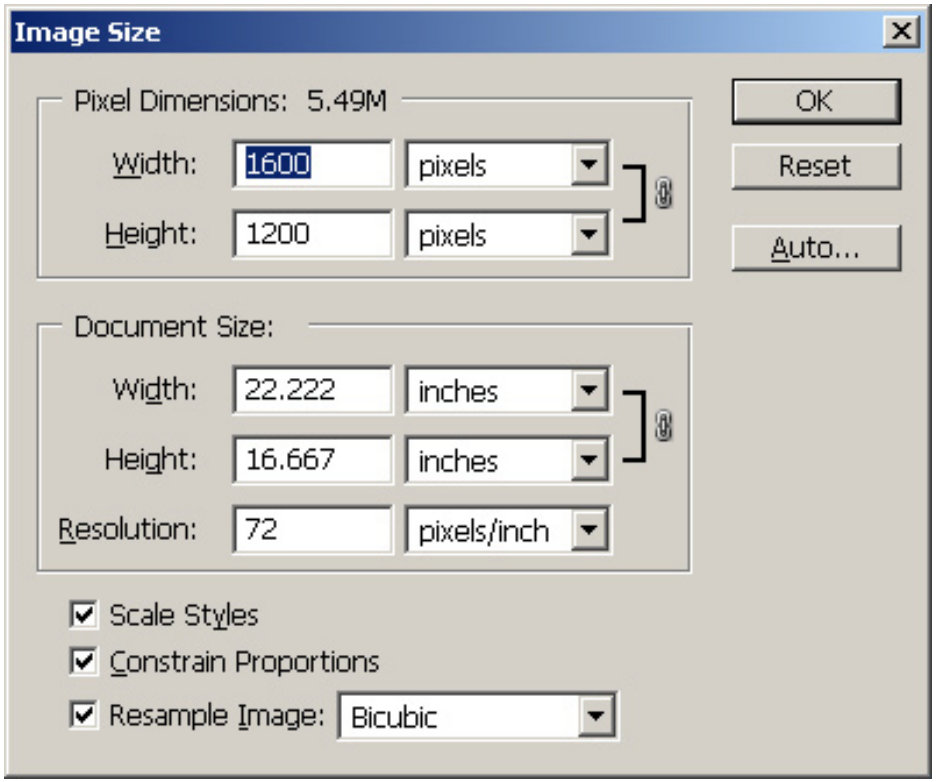
5. Height of print (in inches) is calculated by dividing the height of the image in pixels (line 2) by the dots-per-inch used to print it (line 3)



10.21 Understanding Pixels per Inch

Normally you don't have to change the number of pixel's in an image to change the size of a printout. That task is handled by the software program you use to print the image. For example, if you place an image in a program such as QuarkXpress or PageMaker, it's automatically printed at the size you specify in those programs. In Photoshop you specify the print size (called its *document size*) independently of the image size (called its *pixel dimensions*).

One thing to keep in mind is that if you enlarge a print too much, it won't be as sharp as you may desire. That's because a certain minimal number of dots per inch, usually between 200 and 300 are needed to get a good print. Pixels begin to show when the print is enlarged to a point where the dots per inch (dpi) fall too low. If your printer prints the sharpest images at 300 dpi, you need to determine if the size of the image you plan on printing will fall below this level. To do so, you divide the chosen dpi by the width of the image in inches. For example, if you print an image that's 1600 pixels wide so the print is 10" wide, there are only 160 dots per inch (1600 pixels ÷ 10 inches = 160 pixels per inch). However, if you print the same image so it's 5 inches wide, the dots per inch climbs to over 300.



▲ In Photoshop, you can display the image size dialog box, turn off "Resample Image" and then specify any print size. The resolution of the image is calculated and displayed in pixels per inch. If it's between 200–300, the results should be good on most inkjet printers.



Click to visit the companion Web site

10.22 Exploring Pixels Per Inch

Excel Resource

When making prints, you usually want somewhere between 200–300 pixels per inch although some prints work well at both lower and higher resolutions. Here's how you calculate the pixels per inch for an image.

Clicking the Excel Resource *button on the title bar opens Microsoft Excel, if it is on your system, and then loads the calculator worksheet you can use to explore this concept.*

Exploring pixels per inch			
1	Width of digital image (in pixels)	1,600	pixels
2	Height of image (in pixels)	1,200	pixels
3	Desired width of print (in inches)	6	inches
4	Height of print (in inches)	4.5	inches
5	PPI (pixels per inch)	267	dpi

ENTRY

1. Width of image (in pixels) is where you enter the image's width in pixels.

2. Height of image (in pixels) is where you enter the image's height in pixels.

3. Desired width of print (in inches) is where you enter the width of the print you want in inches.

4. Height of print (in inches) is calculated so the print has the same aspect ratio as the image. The formula is in the form of a:b::c:d.

ANSWER

5. DPI (dots per inch) is calculated by dividing the width of the image in pixels (line 1) by the desired width in inches (line 3).