

Index

Numbers

4/3 (Four Thirds) System standard, 122-123
35mm lenses, 120-121

A

accumulative noise, 81
achromats, 35
action mode, 74
active autofocus, 19

- echo active autofocus, 40
- triangulation active autofocus, 41

actuating ring, 65
actuators, 45
Adams, Ansel, 77, 82, 182
additive color, 188
afocal lens systems, 56
airbrush, 169
Airy disc, 32
Airy, George, 32
Albers, Josef, 185
algorithms

- digital zoom, 59
- image processing, 110-111

aliasing, 195
ambient light levels, 88
amperage, 86
amplified noise, 81
analog, 108

AndreaMosaic, 176
angle of view, 55
antishake systems, 124-125

- piezoelectric supersonic linear actuator stabilization, 128-129
- videocams, 20

aperture, 64-65, 74-75
Arbus, Diane, 4
array processors, 110
artifacts, 111-113
autofocus, 10, 39

- controlling with human eye, 46-47
- digital camcorders, 19

automatic exposure, 75
Autostitch, 178
available light, 85
axis of lens, 34

B

banding, 113
bare bulb lighting, 95
barn doors, 95
beam splitters, 9, 21
bias noise, 81
bilinear interpolation, 110
bimorphs, 44
bit sensors (flash memory), 115
Blitzlichtpulver, 25
blocks (flash memory), 115

blooming, 103-104
 blur, 60, 111
 blur functions, 148-149
 reducing
 electronic image stabilization, 126
 vari-angle prism (VAP) systems, 127
 Bob Miller's Light Walk, 27
 bokeh, 38, 65
 boom mikes, 21
 bracket exposures, 73
 bracketing, 76
 Brown, Matthew, 178
 built-in flash, 92
 Burn tool, 168

C

calculating depth of field, 61
 calibrating color, 190-191
 camcorders, 18-19, 116-117
 cameras. *See* digital cameras
 Cameron, James, 15, 17
 Capa, Robert, 27, 143
 capacitors, 87, 109
 capturing images. *See also* image sensors
 to film, 100-101
 to microchip, 102-103
 Carlyle, Jane Welsh, 119
 carrier fluid, 197
 cartridges (printers), 194
 cathode ray tube (CRT), 186
 CCD (charge-coupled device), 18, 109
 cells, 176

celluloid film, 100
 center-weighted light measurement, 71
 CFA (color filter array), 107
 changing colors, 172-173
 charge-coupled device (CCD), 18, 109
 circle of confusion, 60
 Cloning tool, 164-165, 169
 close-up mode, 74
 CMOS (complementary metal-oxide semiconductor), 18, 47, 109
 coated paper, 197
 color filter array (CFA), 107
 color filters, 191
 color profiles, 190-191
 color spaces, 185, 190
 colorants, 197
 colorimeters, 190
 colors
 additive color, 188
 changing, 172-173
 color calibration, 190-191
 color filters, 191
 color profiles, 190-191
 color spaces, 185, 190
 creating, 188-189
 CMYK, 189
 Foveon image sensors, 106-107
 gamut, 82, 189
 halftoning, 189
 interpolation, 106
 overview, 99
 restoring, 168-169

- RGB (red, green, blue) standard, 188
- subtractive color, 188
- tristimulus values, 191
- complementary metal-oxide semiconductor (CMOS), 18, 47, 109
- compound lenses, 36-37
- compressing
 - photos, 112-113
 - video, 116-117
- concave surfaces (lenses), 34
- continuous tone, 189, 198
- control gate (flash memory), 115
- converging lenses, 34
- converging positive elements, 53
- convex surfaces (lenses), 34
- Copal square shutters, 66
- couplers, 101
- critical focus, plane of, 60
- cross dissolving, 174
- CRT (cathode ray tube), 186
- CMYK, 189

D

- damaged photos, restoring
 - color photos, 168-169
 - dust and tears, 164-165
 - old/heirloom photos, 166-167
- dark current, 80
- dark noise, 80
- Death of a Loyalist Soldier, Spain, 1936* (photo), 143
- Delete buttons, 13
- delta, 117
- demosaiicing, 110
- depletion layer, 68
- depth of field, 60-61, 121
- detachable flash, 92
- detail, human perception of, 32-33
- detecting movement, 125, 128-129
- developers, 101
- diaphragm, 64-65
- dichroic prisms, 21
- diffraction, 29, 32
- diffusers, 191
- digital, 108
- digital camcorders, 18-19, 116-117
- digital cameras
 - 4/3 (Four Thirds) System standard, 122-123
 - overview, 4-7
 - parts of, 9-13
 - flash memory, 114-115
 - focus rings, 11
 - Four Thirds (4/3) System standard, 122-123
 - USB connections, 12
- Digital Dog, 185
- digital magnetic tape, 21
- digital multiplier, 121
- digital photos
 - compressing, 112-113
 - editing
 - blur functions, 148-149
 - changing colors, 172-173
 - enlarging photos for editing, 154-155
 - focus, 146-147
 - histograms, 156

- lighting, 152-153
- morphing, 174-175
- overexposure, 151
- panoramas, 178-179
- photo enhancement, 156-157
- photo mosaics, 176-177
- pixel-level manipulation, 144-145
- underexposure, 150
- enlarging, 155
- layers, 160-161
- printing, 182-183
- restoring damaged photos
 - color photos, 168-169
 - dust and tears, fixing, 164-165
 - old/heirloom photos, 166-167
- digital retouching. *See* photo editing
- digital video cameras, 15-17
- digital zoom, 19, 58-59
- diopter eyepiece correction, 13
- Display Mate, 191
- distortion, 54-55
- dithering, 189
- diverging lenses, 34
- Dodge tool, 168
- DOF (depth of field), 60-61
- doping with boron, 68
- dots per inch (dpi), 195
- doublets, 131
- Downs, Tim, 176
- dpi (dots per inch), 195
- drying agents, 197

- dust
 - in digital cameras, 136-137
 - removing, 164-165
- Dust & Scratches tool, 166-167
- dye sublimation printers, 198
- dyes (printers), 197
- dynamic range, 82, 104, 153, 157
 - HDR (high dynamic range), 158-159

E

- Eastman, George, 7
- echo active autofocus, 40
- Einstein, Albert, 163
- electrolytic capacitors, 87
- electromagnetic spectrum, 28
- electronic circuitry, 9
- electronic flash. *See* flash
- electronic image stabilization, 18, 126
- electronic viewfinder (EVF), 51
- elements, 36
- enhancing photos, 156-157
- enlarging photos, 154-155
- EVF (electronic viewfinder), 51
- exposure systems, 70-73. *See also* light
 - aperture, 74-75
 - bracket exposures, 73
 - bracketing, 76
 - built-in flash, 73
 - center-weighted light meters, 71
 - diaphragm, 64-65
 - digital camcorders, 19

- EV (exposure value), 74, 159
- exposure compensation, 73, 76-77
- exposure modes, 73, 75
- full-frame light meters, 70
- ISO settings, 73
- measuring light with, 68-69
- noise, 80-81
- overexposure, 151
- scene modes, 74
- shutters, 66-67
 - shutter button lock, 73
 - shutter speed, 74-75
- special programs, 73
- spot metering, 71
- underexposure, 150
- white balance, 78-79
- eXtreme Digital (xD) Picture Card, 114
- eyepieces, 51
- eyes, controlling autofocus with, 46-47

F

- f-stops, 65
- field of view, 121
- fill flash, 92-93, 97
- film photography, 100-101, 108
- fish-eye lenses, 53, 132
- fixed-focus lenses, 38
- fixing bath solution, 101
- flash, 11, 85-87
 - built-in flash, 92
 - calculating amount needed, 88-89
 - fill flash, 93
 - flash attachments, 92
 - macro flash, 93
 - red-eye reduction, 92
 - softboxes for, 97
 - in studio lighting, 94
 - synchronization with shutter, 90-91
- flash guns, 92
- flash memory, 114-115
- flattening layers, 161
- floating gate (flash memory), 115
- fluorescent lighting, 94
- focal length, 35
 - f-stops, 65
 - perspective and, 55
- focal planes, 37, 60
 - focal plane shutters, 90
 - focal plane sync, 91
- focal points, 34
- focus
 - autofocus, 39
 - active autofocus, 40-41
 - limitations of, 43
 - passive autofocus, 42-43
 - detail, human perception of, 32-33
 - fixed-focus lenses, 38
 - focusing lenses, 34-35
 - light field cameras, 134-135
 - magnifying glass effect, 36-37
 - photo editing, 146-147
 - unfocused images, 38
- focus rings, 11, 21, 39

focussing screens, 51
 Four Thirds (4/3) System standard, 122-123
 Fourier transform, 135
 Foveon image sensors, 106-107
 FP sync, 91
 frames, 18
 Fresnel lens, 89
 Fuji SR image sensor, 104
 full-frame, 70

G

gamut (color), 82, 189, 194
 Gates, Bill, 99
 gelatin emulsion, 100
 ghosts, 179
 Gradient tool, 169
 grain (film), 100
 grayscale, 77
 ground glass, 50
 gyroscopes, 125

H

Haas, Ernest, 27
 halftoning, 189
 HDR (high dynamic range), 158-159
 Healing tool, 164-165, 168
 heirloom photos, restoring, 166-167
 high dynamic range (HDR), 158-159
 high speed sync, 91
 histograms, 82-83, 156, 168
 history of photography, 24-25

holes (semiconductor), 68
 hot mirrors, 102
 hot pixels, 80
 hot shoes, 87
 HSS (high speed sync), 91

I

image circle, 121
 image processors (digital camcorders), 18
 image sensors, 9, 102-103
 CCD (charged-coupled device), 109
 CMOS (complementary metal-oxide semiconductor), 109
 digital camcorders, 18
 digital lenses versus 35mm lenses, 120-121
 Foveon image sensors, 106-107
 Fuji SR, 104
 processing algorithms, 110-111
 videocams, 21
 image stabilization (IS), 129
 image storage, 12-13
 images
 blurs
 electronic image actuator stabilization, 126
 vari-angle prism (VAP) systems, 127
 capturing to film, 100-101
 capturing to microchip, 102-103
 photos. *See* digital photos
 incandescent lighting, 94
 incoherent lights, 10
 index of refraction, 31
 inertia, 125

infinity (focus), 40
infrared light, 10, 19
ink droplets (printers), 194
inkjet printers
 cartridges, 194
 dots per inch (dpi), 195
 dyes versus pigments, 197
 ink droplets, 194
 jaggies (aliasing), 195
 overview, 193
 paper, 197
 piezoelectric nozzles, 196
 print heads, 194
 thermal nozzles, 196
interline CCD imagers, 109
internal light metering system, 11
internal memory, 12
interpolation, 106, 110-111
invariant features, 178
ionization, 87
IS (image stabilization), 129
ISO settings, 73, 81

J-K

.j2k file extension, 113
.jp2 file extension, 113
jaggies (aliasing), 195
JPEG 2000, 113

K (Kelvin), 78
key frame compression, 117
Keystone 8mm video cameras, 15-16
Koren, Norman, 185

L

landscape mode, 74
layers, 160-161, 169
LCD screens, 10, 13, 186
piezo ceramic lead zirconium titanate (PZT), 44
leaf shutters, 90
least circle of confusion, 61
LED (light emitting diode), 47
Leibovitz, Annie, 63
Lensbaby, 131
lenses, 9, 27
 autofocus, 39
 active autofocus, 40-41
 controlling with human eye, 46-47
 limitations of, 43
 passive autofocus, 42-43
 compound lenses, 36-37
 correcting, 152-153
 digital versus 35mm lenses, 120-121
 distortion, 54-55
 dust on, 136-137
 f-stops, 65
 fisheye lenses, 53
 fixed-focus lenses, 38
 focusing, 34-35
 Four Thirds (4/3) System standard, 122-123
 Fresnel lens, 89
 light field cameras, 134-135
 light refraction, 30-31
 magnifying glass effect, 36-37
 magnifying lenses, 34
 multiple lenses, 37

- negative (diverging) lenses, 34
- normal lenses, 53
- positive (converging) lenses, 34
- simple lenses, 36-37
- telephoto lenses, 52-53
- tilt-and-shift lenses, 130-131
- two lenses as one, 132-133
- ultrasonic motors (USMs), 44-45
- unfocused images, 38
- videocams, 20
- viewfinders, 50-51
- wide-angle lenses, 52-53
- zoom lenses, 56-57

levels (histograms), 168

light. *See also* exposure systems

- Airy disc, 32
- ambient light levels, 88
- available light, 85
- controlling with diaphragm, 64-65
- diffraction, 29
- electromagnetic spectrum, 28
- flash, 11, 85
- incoherent light, 10
- infrared light, 10, 19
- internal light metering system, 11
- light meters, 70-71
- measuring, 68-69
- overview, 28-29, 63
- refraction, 30-31
- studio lighting, 94-97
- tricks of light and human perception, 49
- wavelength, 28, 35
- white balance, 78-79

- light emitting diode (LED), 47
- light field cameras, 134-135
- light fields, 135
- light meters, 8, 10, 70-71
 - center-weighted, 71
 - full-frame, 70
 - measuring light with, 68-69
 - spot metering, 71
- linear sensors, 42
- liquid crystal display (LCD) screens, 186
- long lenses, 53
- lossy compression, 112
- Lowe, David, 178

M

- macro flash, 93
- macro photography, 93
- magnifying glass effect, 36-37
- magnifying lenses, 34
- manual exposure mode, 75
- measuring light, 68-69
- memory
 - flash memory, 114-115
 - internal memory, 12
 - memory cards, 13
- Memory Stick (Sony), 114
- menu controls, 8-10
- microchips, capturing photos to, 102-103
- microphones
 - boom mikes, 21
 - videocams, 20
- middle gray, 76

- mirrors, 9
- modeling, 94
- Monitor Wizard, 191
- monitors
 - color calibration, 190-191
 - CRT (cathode ray tube), 186
 - LCD screens, 186
 - overview, 185
- morphing, 171, 174-175
- mosaics, creating, 176-177
- motion correction, 128
- motion estimation, 117
- motors, voice coil, 127
- movement, detecting, 125, 128-129
- MPEG compression, 116
- multi-band blending, 179
- multiple lenses, 37, 132-133
- Muse, Bill, 171

N

- N-layer, 68
- negative (diverging) lenses, 34
- negative concave lenses, 37
- Ng, Ren, 134
- night portrait mode, 74
- noise, 80-81, 100
- noise-to-signal ratio, 81
- non-linear editing software, 21
- normal lenses, 53

O

- old photos, restoring, 166-167
- On/Off switches, 8
- optical zoom, 19. *See also* zoom lenses
- oscillation circuitry, 137
- oscillators, 67, 86
- overexposure, 151

P

- P-layer, 68
- Paint Shop Pro tools. *See* tools
- panoramas, creating, 171, 178-179
- paper (printers), 197
- paper trains, 199
- parallax, 50
- passive autofocus, 42-43
- PC terminals, 87
- perception
 - depth of field, 60-61
 - overview, 49
- perspective, 54-55
- photo editing. *See also* restoring damaged photos
 - changing colors, 172-173
 - editing
 - blur functions, 148-149
 - enlarging photos for editing, 154-155
 - histograms, 156
 - lighting, 152-153
 - overexposure, 151
 - photo enhancement, 156-157
 - underexposure, 150

- focus, 146-147
- layers, 160-161
- morphing, 174-175
- morphing programs, 171
- overview, 140-141, 163
- panoramas, 171, 178-179
- photo mosaics, 176-177
- photomosaic process, 171
- pixel-level manipulation, 144-145
- photo enhancement, 156-157
- photo mosaics, creating, 176-177
- photodiodes, 69, 73, 108
- photographic noise, 80
- photomosaic process, 171
- photon counters, 191
- photons, 101
- photos. *See* digital photos
- Photoshop
 - HDR (high dynamic range), 158-159
 - tools. *See* tools
- photosite, 81
- photovoltaic effect, 69
- picoliters, 194
- piezo, 196
- piezo benders, 44
- piezoelectric effect, 44
- piezoelectric nozzles (printers), 196
- piezoelectric supersonic linear actuator
 - stabilization, 128-129
- pigments (printers), 197
- pinhole cameras, 27
- pitch, 124
- pixel-level photo editing, 144-145
- pixels, 18, 102
- plane of critical focus, 60
- plotters, 193
- point-and-shoot (POS) cameras, 70
- Poisson statistics, 81
- polarity, 44
- polyester in film, 100
- portrait mode, 74
- POS (point-and-shoot) cameras, 70
- positive (converging) lenses, 34
- positive convex lenses, 37
- posterization, 113
- power packs, 94
- preflash, 89
- preview buttons, 65
- primaries, 132
- prime lenses, 56
- print heads (printers), 194, 199
- printers
 - continuous tone, 189
 - dithering, 189
 - dye sublimation printers, 198
 - inkjet printers, 194-195
 - cartridges, 194
 - dots per inch (dpi), 195
 - dyes versus pigments, 197
 - ink droplets, 194
 - jaggies (aliasing), 195
 - overview, 193
 - paper, 197

- piezoelectric nozzles, 196
- print heads, 194
- thermal nozzles, 196
- overview, 183
- plotters, 193
- printing photos, 182-183
- processing algorithms, 110-111
- processing film, 101
- professional digital video cameras.
See videocams
- profiles, color, 190-191
- programmed exposure, 75
- pulse coded modulation, 65
- pushing film, 81
- PVC pipe in studio lighting, 95
- PZT (piezo ceramic lead zirconium titanate), 44

R

- radius, 147
- RANSAC (RANdom SAmple Consensus), 179
- RAW format, 112
- Rayleigh limit, 33
- read noise, 81
- read-out registers, 109
- rear curtain sync, 91
- red-eye reduction, 92
- reducing agents, 101
- reference pixels, 113
- reflectors, 95-97
- refraction, 30-31
- restoring damaged photos
 - color photos, 168-169
 - dust and tears, 164-165
 - old/heirloom photos, 166-167
- retouching photos. See photo editing
- RGB (red, green, blue) standard, 188
- ring flash, 93
- Rockwell, Ken, 17, 24
- rotors (USMs), 45

S

- scale-invariant feature transform (SIFT), 178
- scene modes, 74
- SD (Secure Digital) Card, 114
- Selection tool, 168
- servo motor, 65
- Shahn, Ben, 85
- shakes, controlling, 124-125, 128-129
- Sharpen tool, 169
- shift color, 111
- shift image stabilization, 129
- short lenses, 53
- shutters, 11, 66-67
 - shutter buttons, 10
 - shutter lock, 71, 73
 - shutter priority exposure mode, 75
 - shutter speed, 74-75
 - synchronization with flash, 90-91
- SIDMs (smooth impact drive mechanisms), 128
- SIFT (scale-invariant feature transform), 178
- signal noise, 81
- Silver, Rob, 171
- silver-halide grains, 122
- simple lenses, 36-37
- single lens reflex (SLR) cameras, 132
- slow sync, 91
- SLR (single lens reflex) cameras, 132

SM (Smart Media) cards, 114
 smooth impact drive mechanisms (SIDMs), 128
 snoot lights, 95-97
 softbox lighting, 95-97
 Sony Memory Stick, 114
 spatially varying pixel exposures, 105
 spectral sensitizers, 100-101
 sports mode, 74
 spot metering, 71
 stabilizers, 21
 stators, 45
 step-up transformers, 86
 Stieglitz, Alfred, 143
 stitching software, 178
 stop bath solution, 101
 storing images, 12-13
 strobes, 94
 studio lighting, 94-97
 subtractive color, 188
 sync cables, 87
 synchronizing flash and shutter, 90-91

T

tears, fixing, 164-165
 telephoto lenses, 52-53
 thermal (dye sublimation) printers, 198-199
 thermal nozzles (printers), 196
 threshold, 147
 through-the-lens (TTL) viewfinders, 51
 thyristors, 89
 tiles, 111

tilt-and-shift lenses, 130-131
 time value exposure mode, 75
 tokens, 113
 tools
 airbrush, 169
 Burn, 168
 Cloning, 164-165, 169
 Dodge, 168
 Dust & Scratches, 166-167
 Gradient, 169
 HDR (high dynamic range), 158-159
 Healing, 164-165, 168
 Selection, 168
 Sharpen, 169
 Unsharp Mask, 147
 transducers, 40
 transformers, 137
 triangulation active autofocus, 41
 trigger charges, 87
 trigger plates, 87
 tristimulus values, 191
 TTL (through-the-lens) viewfinders, 51
 twilight mode, 74
 Type I (flash memory), 114
 Type II (flash memory), 114

U

ultra-wide lenses, 133
 ultrasonic motors (USMs), 44-45
 ultrasonic waves, 45
 umbrellas, 95, 97
 uncoated paper, 197

underexposure, 150
uncompressed files, 112
unfocused images, 38
Unsharp Mask, 147
USB connections, 12
USMs (ultrasonic motors), 44-45

V

vanishing point, 54
vari-angle prism (VAP) systems, 20, 127
variations, 169
vibration reduction (VR) systems, 124-127
Vidal, Gore, 119
video compression, 116-117
videocams, 15-17, 20-21
 anti-shake methods, 20
 beam splitters, 21
 boom mikes, 21
 dichroic prisms, 21
 digital magnetic tape, 21
 focus rings, 21
 image sensors, 21
 Keystone 8mm, 15-16
 lens elements, 20
 microphones, 20
 stabilizers, 21
 vari-angle prisms, 20
 zoom lenses, 20
view cameras, 130

viewfinders, 8, 11, 13, 18, 50-51
virtual focal points, 34
voice coil motors, 127
VR (vibration reduction) systems, 124-125

W

warping, 174
watercolor effect, 111
wavelength, 28, 35
wavelet technology, 113
wells (photodiodes), 103
white balance, 10, 78-79, 94
wide-angle lenses, 52-53

X

X ratings (flash memory), 114
X-sync, 90
xD (eXtreme Digital) Picture Card, 114

Y-Z

yaw, 124

Z-buffering, 161
Zone System, 77, 182
zoom controls, 11
zoom lenses, 19-20, 56-59