High School
Intro to Media
Packet 1
Ritchie

4TH QUARTER CURRICULUM PACKET

Hayward Community School District
715-634-2619

#HurricaneStrong

Intro to Media- Home Coursework Packet

Mr. Ritchie, 4th Quarter 2019

Hello!

Since it will be too difficult to achieve the objectives of Intro to Media, I am including coursework that I am giving to the Digital Photography class. Since this is a home-based class, should you choose to take intro to media again, or take Digital Photography and Graphics in the classroom, each would be a different experience. Thanks for your understanding; these concepts are the basis of both courses.

I'm starting off this distance learning packet with some information about how I'd like you to proceed with your Digital Photography Coursework. This will be a fun class!

My first questions of everyone are, **Do you have access to a Smartphone or Digital Camera? Stable and reliable internet connection?**

I have a couple of cameras to loan if needed... Don't worry about how fancy- or good the camera is--- The true quality of a photograph comes from the photographer… Not the camera!!!

Your first assignment is to call me at (715) 651-7188. My office hours are 9 a.m. to 1 p.m. Daily. The purpose of this call is to discuss the options for you to turn in your completed work. I am providing assignments for 6 weeks of lessons even though we are scheduled to be back in school on Monday, April 27th. (At the time this was written.)

This packet coursework is REQUIRED and will be graded on a pass/fail grade scale. You have will have assignments worth 75 points weekly and extra credit activities will be available throughout the course.

Expectations:

- I would like you to work on this course for at least 20-30 minutes every weekday. Part of the experience of this class is to see how your images progress from the beginning to the end of the course. I often give extra credit to those that choose to go above and beyond.
- I would like you to keep a photo journal of what you have completed during the week. The details are listed at the top of the next page.
- I would like you to call, Facetime, Video Chat or otherwise contact me **once a week** after you have completed your assignment. We will schedule a day of the week so that we can be consistent. **My office hours are 9 a.m. to 1 p.m. Daily. Please leave a message if I happen to be on the other line.**

Enrichment Activities

- Enrichment activities and other fun stuff will be posted on Google Classroom. These may be links to videos, tutorials, etc.

- You may spend extra time and effort in developing your skills as a photographer. (I will probably ask which concepts you are applying) You may choose to stay indoors or go outside- Please follow local and national health recommendations and be safe!
- For best results, download Google Photos from your App store. It will help transfer the photos you take to edit, email, or print at a later date.

ALWAYS REMEMBER! If you are stuck, have questions, trouble thinking of photo subjects, want to learn more, or **need help in any way, I am here for you. Save my number (715) 651-7188 or send an email jritchie@hayward.k12.wi.us**

Accountability Photo Journal:
The purpose of this document is for you to write, in at least three well-written sentences, your own daily notes to narrate the photos taken of your journey in this course.

Photo Journal Daily Requirements:
1. 5 Quality Photos Daily
2. At least 3 well-written sentences.
3. Save these reports weekly and turn in with your assignments.

Example:

(Have your photos available to turn in separately)

Day & Date	Journal Entry
Monday 4/13/2020	Today I took time to read pages 5-15 in the text and underlining words I thought were the main ideas. I was also able to take a few photos of my dog. I learned that I needed to call her name for her to stop and look towards me. I had to be quick because she would run towards me and the picture was blurry or I wasn't able to get a good shot.

Course Schedule:

Week 1- Introduction to Digital Images

Objectives: Upon successful completion of this unit students will be able to:

- Recognize important terminology related to Digital Images.
- Understand the difference between ***Lossy*** vs. ***Lossless*** file types.
- Choose various file types based on the application for student work.

Assignments:

1. 1Textbook Reading: Chapter 1 Digital Images and Digital Cameras"
2. Supplemental Reading: 5 File Types (and When to Use Them)
3. Chapter 1 Worksheet Quiz Chapter 1
4. Week 1 Photo Journal
5. Take a photo of yourself (so that I can remember faces & names together.)

Week 2- Capturing Light & Color

Objectives: Upon successful completion of this unit students will be able to:

- Describe the relationship between color temperature and white balance.
- Explain at least two best practices for taking photos in various light conditions.
- Apply the use of direct or diffused light in student work.

Assignments:

1. Textbook Reading: Chapter 5- Capturing Light & Color
2. Supplemental Reading: Instantly Improve Your Images- Gary Gough
3. Unit 2 Worksheet/ Quiz
4. Week 2 Photo Journal
5. Photo Category 1- Student Choice

Week 3- Basic Photo Composition

Objectives: Upon successful completion of this unit students will be able to:

- Recognize two basic principles of photographic composition.
- Apply the principles of Rule of Thirds and Fill the Frame in their photo assignments.

Assignments:

1. Photo Composition Handout – Elements of composition
   https://www.walsworthyearbooks.com
   Six Rules of Thumb for Good Photo Cropping
   https://www.walsworthyearbooks.com/six-rules-of-thumb-for-good-photo-cropping/
2. Week 3 Photo Journal
3. Skills Test: 1. Rule of Thirds 2. Fill the Frame
4. Photo Category 2- Student Choice

Week 4- Using Leading Lines

Objectives: Upon successful completion of this unit students will be able to:

- Recognize the basic photo composition principle of leading lines.
- Apply the principle of Leading Lines in their photo assignments.

Assignments:

1. Supplemental Reading Handouts: Leading Lines
2. Unit 3 Worksheet/ Quiz
3. Week 3 Photo Journal
4. Photo Category 3- Student Choice

Week 5- Finding a Natural Frame

Objectives: Upon successful completion of this unit students will be able to:

- Recognize the basic photo composition principle of natural framing.
- Apply the principle of natural framing in their photo assignments.

Assignments:

1. Supplemental Reading: Using Natural Framing to Guide the Viewer's Eye
2. Week 3 Photo Journal
3. Photo Category 4- Student Choice

Week 6- Careers in Digital Imaging

Objectives: Upon successful completion of this unit students will be able to:

- Explore careers related to photography and graphic arts
- Compose photographs that incorporate many composition principles in their final photo assignment.

Assignments:

1. Textbook Reading: Chapter 1: Careers in Photography
2. Supplemental Reading: Handout Top Ten Composition Techiques
3. Unit 6 Worksheet/ Quiz
4. Week 6 Photo Journal
5. Photo Category 5- Student Choice

Week 1

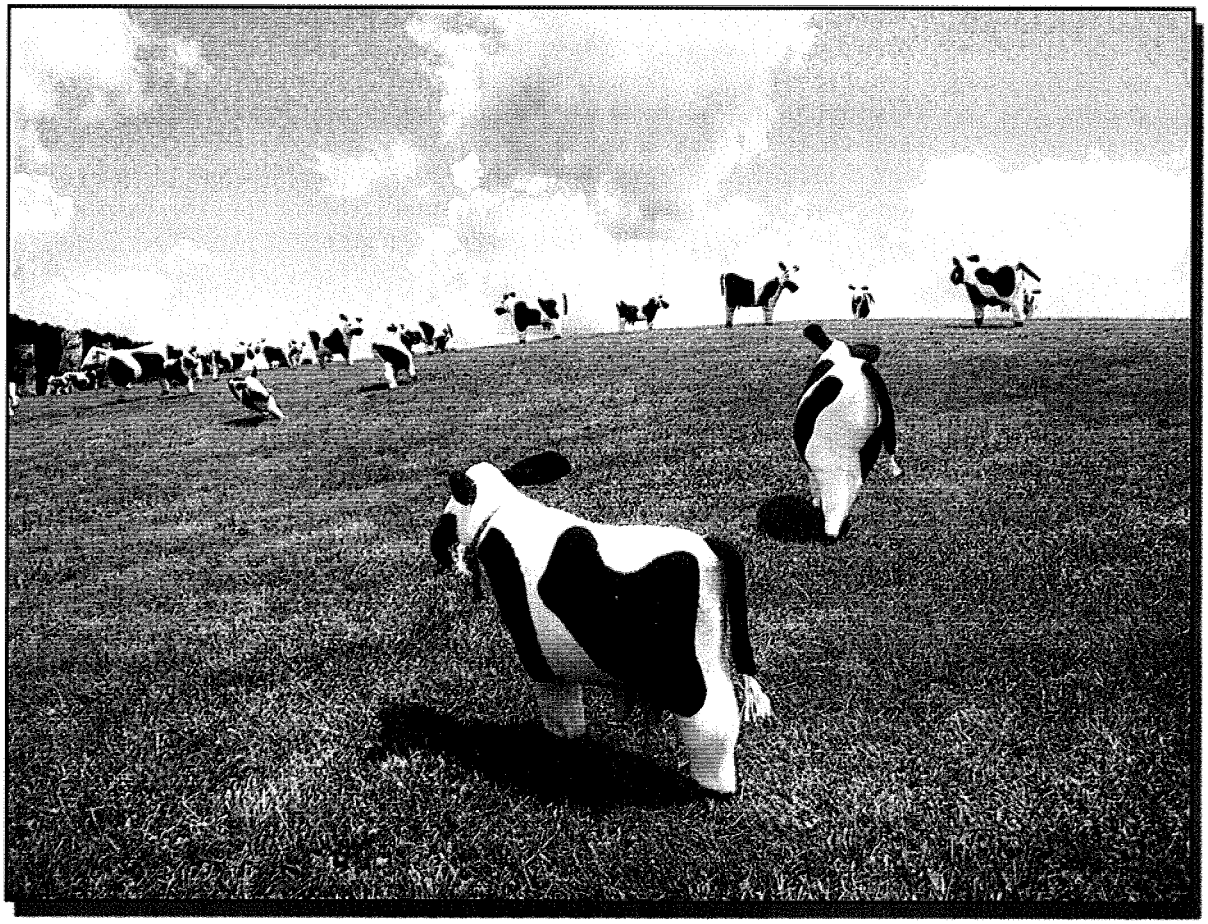
Name:_____ Section _____ Date:_____

HHS Digital Photography Unit 1. Reading Packet

Directions: Read and use an active reading strategy to take notes, write down questions, note important terms or ideas. You may write, underline or highlight on this page or the text!

Contents: **Textbook of Digital Photography, Chapter 1 Digital Images & Digital Cameras**
Supplemental Reading: 5 File Types in Photography and When to Use Them.

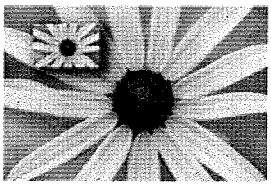
Chapter 1
Digital Images & Digital Cameras



CONTENTS

Digital images are formed from tiny dots of red, green and blue color. The dots, usually many millions per image, blend into the smooth continuous tones we're so familiar with from film. These images are captured directly with digital cameras, or by scanning a transparency, negative, or print. The end result is an image in a universal format that can be easily manipulated, distributed, and used. This digital format for images, and the development of the Internet in particular, have opened exciting new vistas for photography which we'll explore in this text. To begin, we first look at digital cameras and digital images. This chapter lays the foundation for your understanding of digital imaging.

Digital Photography—The Past and the Future



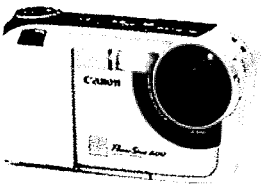
The small image is typical of photos captured by the first digital cameras. The larger image is typical of those captured by more recent models.

It was only a few short years ago, around 1995, when digital photography appeared on the scene for most of us. In that year, Apple's QuickTake 100 and Kodak's DC40 both broke the $1000 barrier for digital cameras. These filmless cameras captured very small images, but they were immediate hits. Small businesses, realtors, insurance agents, and other early adopters snapped them up. They were so popular that the early models were soon followed by a steady stream of digital cameras from Casio, Sony, Olympus and others. The race was on and the stream of new cameras not only continues, it accelerates. Things have advanced so far that the same money that would have bought one of those early cameras will now buy one that captures images 20 times larger and has many more features such as video, sound, and professional style controls.

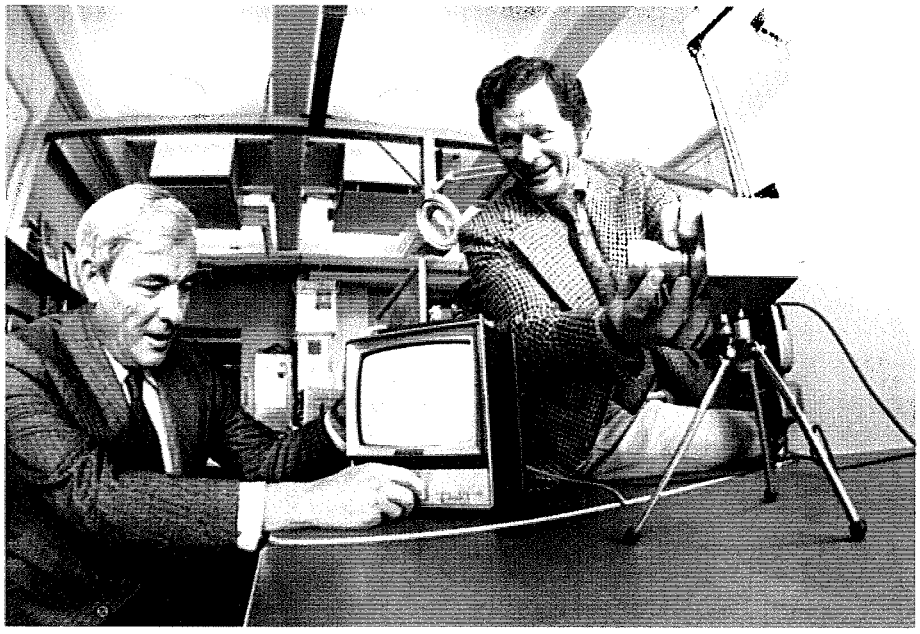
The Canon EOS DCS 3 digital camera was introduced in July 1995 and captured images containing 1.3 million pixels. It cost about $17,000.

These cameras weren't developed in isolation. Professional cameras, based on film cameras but with image sensors added to capture digital images, were growing in popularity among professionals. However, their high prices, often $20,000 or more, made these cameras available only to an elite few. Kodak had also already introduced the Photo CD process where they inexpensively scanned slides and negatives into a digital format. The process caught on with professionals, but not with amateurs as Kodak had hoped. Meanwhile, publishing, advertising, medicine, and many other fields were going digital. Digital images slipped easily into this trend because they could be instantly displayed, e-mailed, and inserted into documents. It was professionals who led the change from film to digital, but it wasn't long before many more of us were headed in the same direction. Film is no longer just a mature industry, it's dying. Given the scale of this change, how did it all come to pass?

If there were ever two inventors who haven't gotten the public credit they deserve, it's George Smith and Willard Boyle who invented the charge-coupled device (CCD) at Bell Labs. At the time they were attempting to create a new kind of semiconductor memory for computers. A secondary consideration was the need to develop solid-state cameras for use in video telephone



The Canon PowerShot 600 digital camera was introduced in July 1996 and captured images containing 500 thousand pixels. It was priced just over $1000.



Willard Boyle (left) and George Smith (right). Courtesy of Lucent Technologies.

With cameras now being added to cell phones, you can click photos and send them to a friend or post them on a Web site. Image courtesy of Sony-Ericsson.

service. In the space of an hour on October 17, 1969, they sketched out the CCD's basic structure, defined its principles of operation, and outlined applications including imaging as well as memory.

By 1970, the Bell Labs researchers had incorporated the CCD into the world's first solid-state video camera. In 1975, they demonstrated the first CCD camera with image quality sharp enough for broadcast television. CCDs then quickly went on to revolutionize the fax, scanner, copier, bar code, and medical photography fields.

One of the more exciting, and demanding applications has been in astronomy. Since 1983, when telescopes were first outfitted with solid-state cameras, CCDs have enabled astronomers to study objects thousands of times fainter than what the most sensitive photographic plates can capture, and to capture in seconds images that would have taken hours before. Today all optical observatories, including the Hubble Space Telescope, rely on digital information systems built around mosaics of ultrasensitive CCD chips. Researchers in other fields have put CCDs to work in applications as diverse as observing chemical reactions in the lab and studying the feeble light emitted by hot water gushing out of vents in the ocean floor. CCD cameras also are used in satellite observation of the earth for environmental monitoring, surveying, and surveillance.

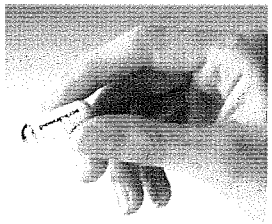
With digital cameras now embedded in phones, personal digital assistants, toys, and other devices, there is no telling where we are heading. All we can say for sure is that things will continue to change rapidly and it will be exciting to follow and take part in this photographic revolution.

Digital photography started 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. Credit: Jeff Hester and Paul Scowen (Arizona State University), and NASA (http://hubblesite.org).

CREDIT

The material in this section about Willard Boyle and George Smith is adapted from material written by Patrick Regan of Bell Labs Media Relations.

Types of Digital Cameras



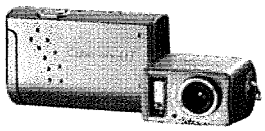
A digital camera is embedded in a disposable capsule that is swallowed by the patient. As the capsule passes through the GI tract, it transmits video signals which are stored in the receiving unit. These signals also enable the system to trace the physical course of the capsule's progress. Courtesy of Given Imaging.

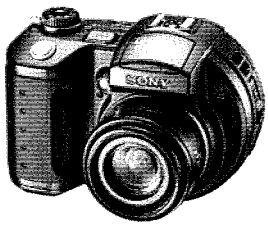
Digital cameras come in all shapes and sizes and no one yet knows what a digital camera should look like. 35mm cameras have taken familiar forms because form follows function and they require room for the film and light path as well as prisms and such. Digital cameras are freed of many of these limitations so they can take new forms. During these early days, some companies make their cameras look like familiar 35mm cameras while others veer off in new directions. Increasingly cameras are even built into other devices such as cell phones and digital camcorders.

Regardless of how digital cameras look, the market for them is roughly divided into categories with blurry lines separating cameras based mainly by image size, features, and of course, price.

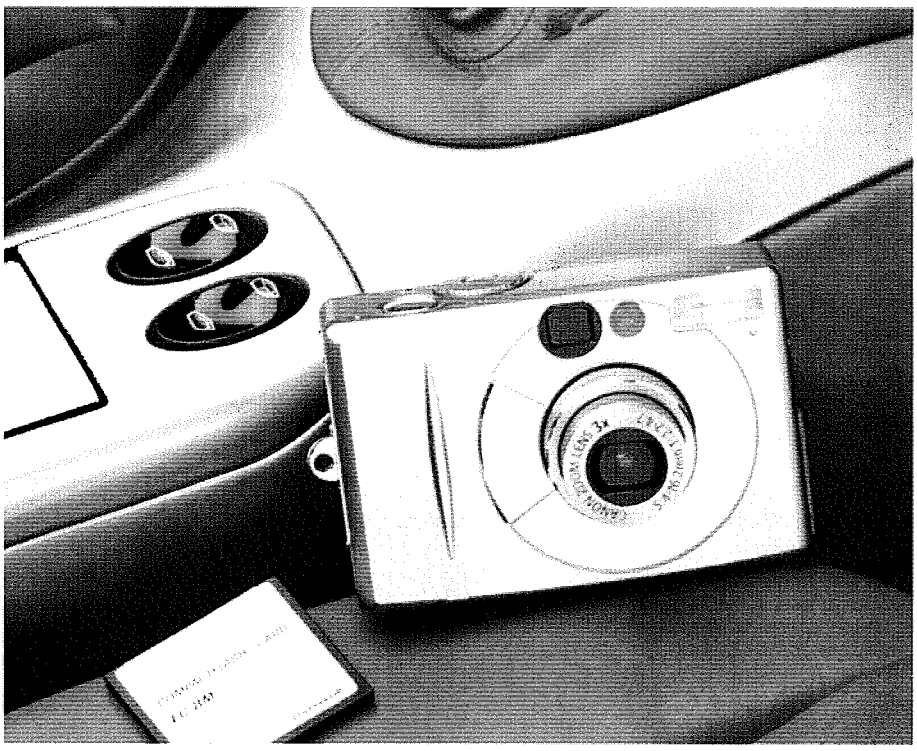
Point and Shoot Cameras

For the past few decades, serious photographers have mainly been using traditional 35mm SLR cameras. But these large and heavy cameras are inconvenient to say the least, so most serious photographers have always stuck a point and shoot camera in their shirt pocket. The photos from these small cameras may not be quite as good (and that is debatable), but they go anywhere, and pictures that would otherwise be missed are captured. These cameras are fully automatic and usually don't provide you with every possible creative control—that's why they are called "point and shoot." Point and shoot cameras have earned their stripes and are welcome additions to even the most professional photographer's camera collection. Increasingly, point and shoot cameras are being embedded in mobile devices such as camera phone, smart phones and personal digital assistants (PDAs). These embedded cameras, once almost toy-like, are rapidly moving up the quality ladder with 3 megapixel sizes available in some parts of the world.





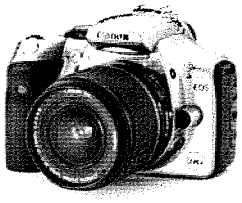
Digital point and shoot cameras are fully automatic and usually small and easy to carry. Courtesy of Sony (top and bottom) and Canon (right).



ADVANCED AMATEUR CAMERAS

Positioned just above the point and shoot cameras is a family of cameras with larger image sizes and more advanced features. These cameras appeal to serious photographers who like to have more creative control of their camera's settings and make larger prints. Because their features appeal to both experienced amateurs and professionals, they are sometimes called *prosumer cameras*. With these cameras you have as much, or more, creative control as you do with 35mm SLR cameras.

High-end amateur cameras have both automatic and manual exposure modes plus many other features. Courtesy of Canon.



Advanced amateur and professional cameras are often designed to work with traditional 35mm SLR lenses and other accessories. Courtesy of Canon.

PROFESSIONAL CAMERAS

At the highest end of the spectrum are the professional digital cameras including digital versions of professional 35mm SLR film cameras. One huge advantage these cameras have is that they accept most of the accessories such as lenses and flash units designed for the film versions. They also work much the same way as the film version, so if you are familiar with that version there is less to learn.

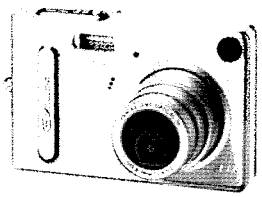
Large format cameras used by most studio and a few nature photographers have also gone digital. In most cases you can switch between digital and film just by switching the camera's back. A digital back can replace the film magazine on a medium format camera and slide into the back of a 4 x 5 or larger camera just like a film holder. These digital backs come in two basic forms: linear and area arrays.

Digital backs are designed to be used with traditional large format cameras in place of film. Courtesy of BetterLight.

■ *Linear array backs* scan the image much like a scanner scans a page. The image gets built up one line at a time. The time it takes to scan an image makes these backs suitable only for static subjects under continuous illumination. Scan backs usually use three strips of CCDs (called a *trilinear array*) so it can capture a full color image in one scan.

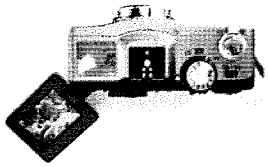
■ *Area arrays* are like the CCDs in consumer digital cameras and capture full color images instantaneously. A few use three separate image sensors, each with its own colored filter so it captures just red, green, or blue light.

Choosing a Digital Camera

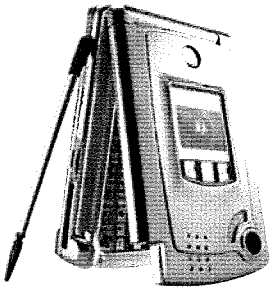


Casio makes cameras no larger than a credit card and not much thicker. Courtesy of Casio.

As you might expect, Sony explores new directions with some of their digital cameras. Courtesy of Sony



Swiveling and tilting monitor.



Cameras are now being built into personal digital assistants and smartphones like this Motorola MPx.

Generally, you can get good results from any camera, provided it has the features you need. Although not all of these are essential, the following features (which are discussed in detail later in this eText) are things to consider.

■ *Image size or resolution* is often overrated. Generally the larger the image a camera can capture, the sharper it will be when enlarged. However, most images are reproduced in print at between 200–300 pixels per inch so even less expensive cameras will give good 4 x 6 inch prints. Images on the Web are normally displayed at less than 100 pixels per inch, so you can get good results with images that are quite small.

■ *Image quality* is determined by the amount of compression and the file format used. Normally, cameras capture JPEG images in a variety of compressions. A few cameras also let you shoot in higher quality, uncompressed formats such as TIFF or RAW.

■ *Storage media* varies widely and the kind you use doesn't matter a great deal, with one exception. If you have more than one digital camera, or other digital device that uses storage media, it's nice to have them use the same kind so you don't need to buy more then one kind of media.

■ *Lenses* can make a huge difference. If the camera has a built-in zoom lens, it's zoom range is important as is its maximum aperture. Larger, and more expensive SLR cameras often have interchangeable lenses. The lens also determines how close you can get to a subject, or how far away.

■ *Auto focusing* doesn't always work the way you like, so manual focus is a nice feature to have.

■ *Autoexposure* is available on every camera, but aperture- and shutter-priority modes are nice to have. Exposure compensation lets you lighten or darken images when automatic exposure doesn't work the way you want. Histograms let you analyze your results with more precision.

■ *Macro mode* lets you get closer to small subjects or capture fine details on larger ones.

■ *Hot shoes* let you mount a more powerful and flexible external flash on the camera. There are also other ways to connect a flash or strobes.

■ *AC adapters* let you keep the camera on all of the time without it going into sleep mode or running down the batteries. These are ideal when using the camera to give a slide show.

■ *A monitor* lets you review your images as soon as you shoot them. The best monitors swivel and tilt so you can shoot with the camera held above your head or close to the ground.

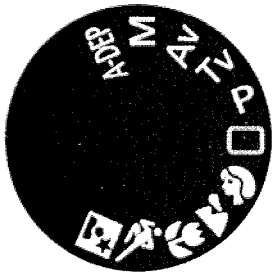
■ *Video out connections* lets you connect your camera to a TV set so you can see larger versions of the images as you shoot them.

■ *A self-timer or a remote control* lets you trigger the shutter without shaking the camera and blurring the images.

■ *Video modes* let you capture short video clips that you can play back on the computer or integrate into slide shows.

■ A *diopter adjustment* lets you adjust the viewfinder so you don't need glasses when composing images.

Jump Start—Taking Photos with Auto Mode



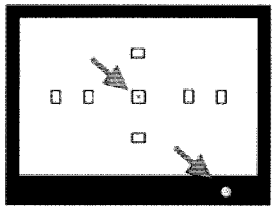
Many digital cameras have a mode dial you turn to select various exposure modes including automatic.

All digital cameras have an automatic mode that sets focus and exposure for you. With the camera set to this mode, all you have to do is frame the image and push the shutter button. You'll find that this mode is great in the vast majority of situations because it lets you focus on the subject and not on the camera. Here are some things to expect with almost all digital cameras.

■ *Getting ready.* Turn the camera on and set it to auto mode. To conserve your batteries, turn off the monitor and compose your image through the optical viewfinder. If the camera has a lens cap, be sure to remove it.

■ *Holding the camera.* To take pictures, hold the camera in your right hand while supporting the lens with your left. Be sure not to block the flash, autofocus port, or lens.

■ *Framing the image.* The viewfinder shows you the scene you are going to capture—although most show only about 95% of the scene. If your camera has a zoom lens, you can zoom it 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.



Some digital cameras have more than one focus point and light the one that's being used when you press the shutter button halfway down (top arrow). When focus locks, an indicator light is often displayed (bottom arrow).

■ *Autofocus.* Compose the image in the viewfinder making sure the subject that you want sharpest is in the focus area in the center of the viewfinder. 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 lets you easily focus on a subject that isn't in the exact center of the viewfinder.

■ *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.

■ *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.

YOUR DECISIVE MOMENT

When taking a picture don't jab the shutter button! Press it gently halfway down and pause there until the camera locks focus and exposure. Only then do you press it gently the rest of the way down to take the picture.

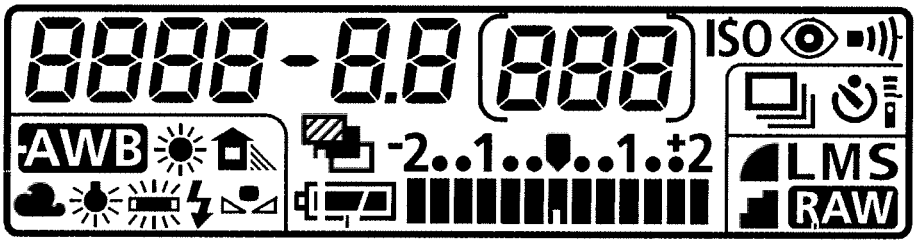
■ *Automatic white balance.* Because the color cast in a photograph is affected by the color of the light illuminating the scene, the camera automatically adjusts color balance to make white objects in the scene look white in the photo.

■ *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. As you take photos, they are first stored in the camera's internal memory called a "buffer." When the buffer is full you'll have to wait until one or more of the images has been transferred to the memory card before taking any more pictures.

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

Using Buttons and Menus

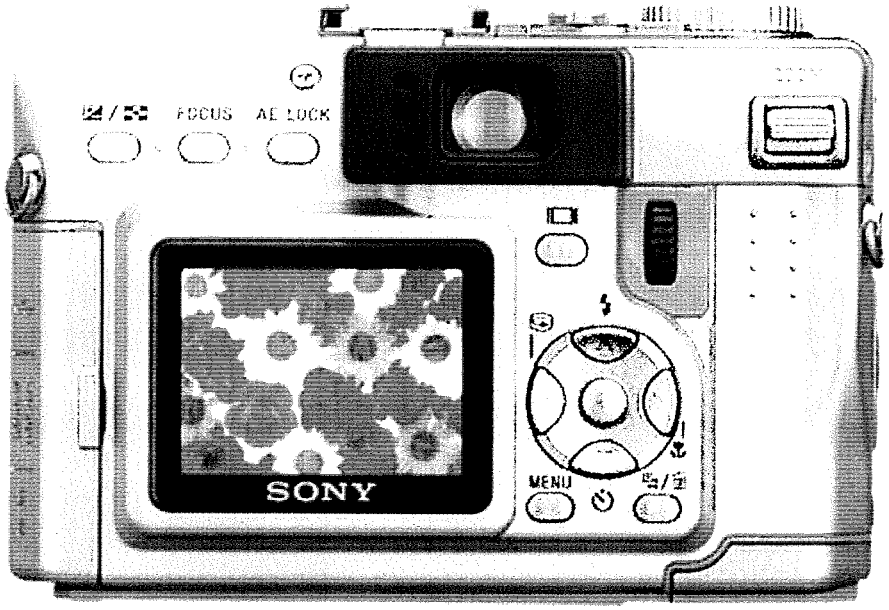
To operate a digital camera you use buttons and menus. When reading about digital photography you'll often encounter the term *mode*. This basically means the same as a setting. Many cameras have a small control panel that displays the current camera settings and how many pictures remain. You should make it a practice to check this control panel whenever you start shooting. If you don't you may find you've been using the wrong settings.



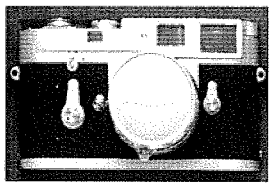
Control panels on many cameras indicate the current settings—often with icons.

BUTTONS

Buttons work in one of two ways depending on the camera. With some, you press the button one or more times to switch modes. On others you hold a button down while you turn a dial. Buttons are frequently marked with icons so you know their function.



Many cameras have at least a few buttons that you use to select various settings.

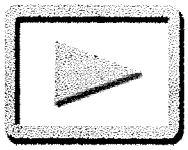


If you like the classic Leica, the Minox Digital Classic Camera Leica M3 is the way to go. It's tiny but captures 2.1 megapixel images.

MENUS

Menus are displayed on the monitor, usually when you press a menu button. The menu that's displayed depends on what mode the camera is in.

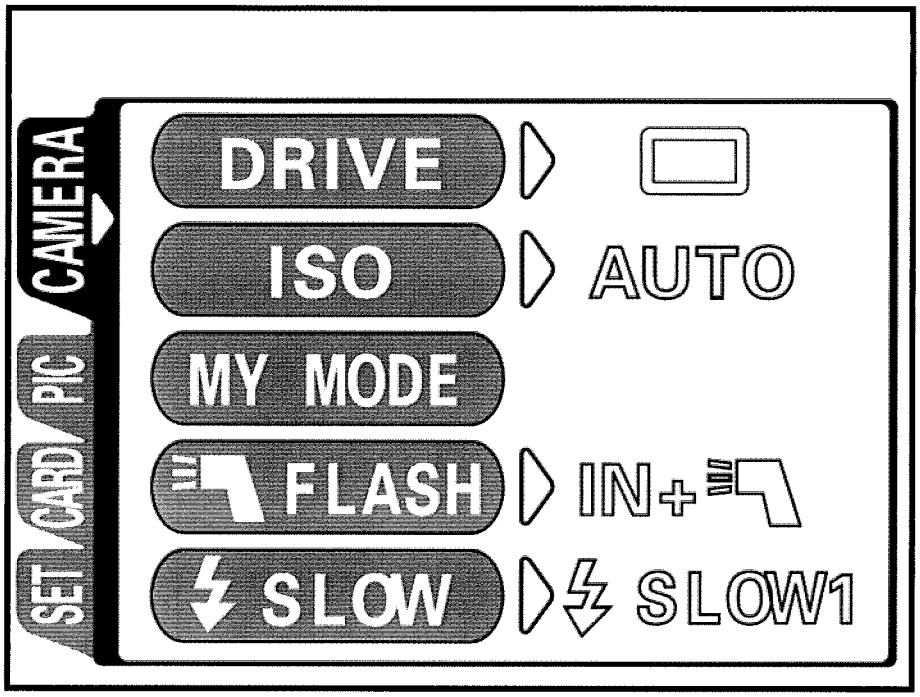
■ *In shooting or record mode* you usually make settings that affect the images you capture. You've seen how you can use the auto exposure mode. That's one of the most commonly used shooting modes. There are other exposure modes, and recording modes that capture movies, panoramas, and series of images.



A common playback mode icon.

■ *In playback mode* you can scroll through the images you have captured. You can usually display an image full-screen or display a series of smaller thumbnails. If you find images you don't want, you can delete them.

Menus normally have commands that you can select by pressing buttons or turning a dial on the camera.



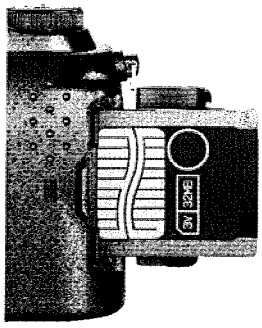
When playing back images, or shooting them, you can usually connect your camera to a TV using a supplied cable. When playing the images back, you can give slide shows this way.

This might be a good point to introduce some good news. If you ever delete files or format a memory card by mistake, you can recover them. The first step is to stop taking pictures because new ones can overwrite the old and make them impossible to recover. Next, get a program that recovers the files. These include PhotoRescue, Digital Image Recovery, Image Recall, and Easy Recovery.

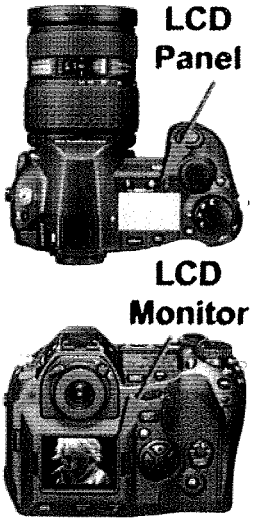
RESETTING COMMANDS

Many settings are remembered even when you turn the camera off and back on. This can really screw up photos if you don't remember to reset the command.

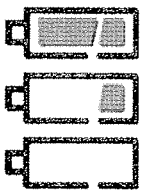
Good Things to Know



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



Most cameras have an LCD panel that displays settings and an LCD monitor that displays images and menus.



Icons on the camera's control panel or monitor indicate the status of the batteries. The icons, many of which look like these, show when the battery is fully charged, getting low, and empty.

When you first start taking photos, it sometimes seems that there is too much to learn all at once. Here are some things you may want to know right off.

■ *Date and time.* The first time you use a digital camera, or if the batteries have been removed or dead for an extended period, you should enter the date and time. Having the correct date and time automatically added to each image file as you take photos will help you organize and identify your images later.

■ *Batteries.* Most digital cameras use rechargeable nickel-metal hydride or lithium batteries and come with a charger. If you can't turn on the camera, the batteries are dead or have been removed. If your batteries drain quickly, stop using the monitor to take and review pictures. If it's cold, keep the batteries or camera under your coat.

■ *Sleep Mode.* If the camera seem to be turned off, it may just have entered sleep mode. If you don't use any controls for a specified time, the camera enters this mode to reduce battery drain. To wake it up, press the shutter button halfway down, or turn the camera off and back on. After an hour or so of inactivity, some cameras shut off completely. You can often change the time it takes before the camera enters sleep mode.

■ *Indicators.* When you turn the camera on, look for a battery shaped icon that indicates when the batteries are fully charged, getting low, or run down empty and should be replaced immediately. Also look to see if there are any error messages and check how many pictures will still fit on the memory card.

■ *Saving images.* If an image is being stored when you turn the camera off, the image will be completely stored before the camera powers down. Don't open the battery or memory card access covers while an image is being saved. Doing so can not only damage the image being saved, it can also damage the card.

■ *Image review.* Some cameras will briefly display the image you just took as it is being saved. Usually you can turn this review feature on or off.

■ *Display.* You can usually adjust the brightness of the monitor. Make it brighter in bright light and dimmer in dim light. It's hard to evaluate exposure, color, and focus on these small monitors, but they are a basic guide. Always confirm your results on the computer screen.

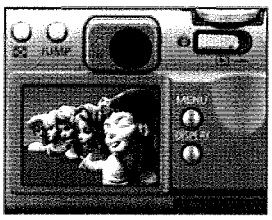
■ *Tripods.* Many cameras have a socket so you can attach it to a tripod.

■ *TV playback.* Most digital cameras can be connected to a TV set so you can share your photos with others. You don't have to show the images you just took. You can copy images from the computer back to the flash card to give edited shows.

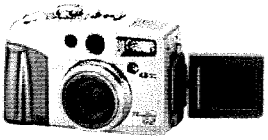
■ *Out of Memory.* If you can't take a picture, it may be because the memory card is full. To free up room for new pictures, move the image files to a computer and erase the memory card, delete some you don't need, or switch to a smaller image size.

■ *Wrong settings.* If your pictures are not at all the way you expect, it may be because the camera remembered a change you made in the settings and continues to use those changed settings. Some cameras remember changes even when you turn a camera off and back on.

Composing Images

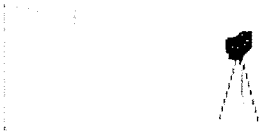


Monitors show you what the view looks like through the lens.



The best monitors are those that swivel and tilt to any angle.

With a swiveling monitor, you can shoot up at things close to the ground such as this salamander.



Landscape mode shows the image horizontally.

Portrait mode shows the image vertically.

To help you compose images, digital cameras usually have both a monitor and viewfinder. The primary roles of these two features are quite different, although there is some overlap.

MONITORS

Monitors are small LCD color displays built right into most cameras. Their size is specified in inches, and the measurement, like those of TV sets, is based on the diagonal measurement. These screens range between 1.5 and 3 inches and serve a number of useful functions:

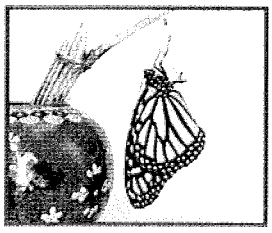
- *Menus* are displayed on the monitor so you can change camera settings.
- *Image composition.* On many, but not all cameras, you can compose the image on the screen before you take it. SLR cameras don't let you do this because they use a mirror to bounce the image formed by the lens into the viewfinder. The image sensor only creates the image when the shutter is open.
- *Image review. You* can review an image you've taken so you know it's the way you want it. No more surprises as so often happens when you use a film camera and pick up your traditional prints.
- *Image management.* You can scroll through the images you've taken and create slide shows, delete, rotate, rename, print, protect, copy or otherwise manage them. Many cameras also display thumbnails of a group of images so you can quickly locate the image you're looking for. Most also let you enlarge the image on the monitor to zoom in on details in your photo—a great way to check sharpness. A few cameras let you view histograms of your image so you can check the tonal range.
- *Direct printing.* They let you select images for printing when you bypass the computer.

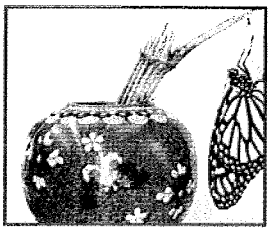
On cameras that let you compose the image on the monitor the image is taken directly from the image sensor, so it is a true TTL (thru-the-lens) view. Although you can use it to compose photos as you take them, this normally doesn't work well for a number of reasons.

- *Battery drain.* Large monitors drain batteries quickly, so it's best to keep them turned off and use the optical viewfinder for taking pictures.
- *Glare.* The image on the monitor can be difficult to read in bright sunlight.
- *Steadiness.* You may have to hold the camera at arm's length, an awkward position that tends to introduce blur into your images through camera shake.

Although the monitor should normally be turned off when taking pictures to conserve battery power, there are a few situations in which it becomes indispensable.

- *Close-ups.* When using a camera that isn't an SLR for close-ups, the monitor is a great way to compose and focus the image since it shows the scene exactly the way it will be in the image you'll capture.
- *Odd angles.* When photographing over a crowd, at ground level, or around a corner, you can compose the image without holding the camera up to your eye.





Because an optical viewfinder is offset from the lens, what you see through the viewfinder (top) is different from the image you actually capture (bottom).

Electronic viewfinders are small flat-panel displays inside the viewfinder. Courtesy of Zight.

A common monitor icon.

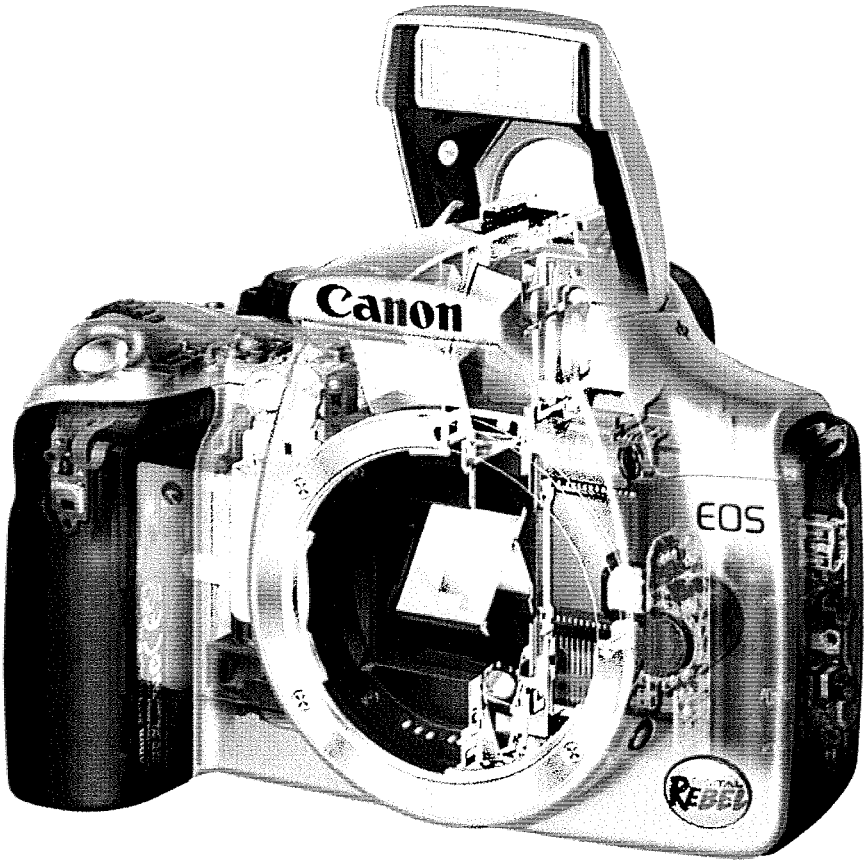
VIEWFINDERS

Viewfinders are ideal for following fast action as it unfolds—waiting for the decisive moment. One of their advantages is that they don't draw battery power so your batteries last much longer. But that's not all. The best optical viewfinders, known as *real-image viewfinders* are coupled to the zoom lens and show the same area covered by the image sensor. There are two kinds of viewfinder displays, optical and electronic and they either show the scene through the lens (SLR) or through a separate viewfinder window.

■ *Optical viewfinders on SLR cameras* show the scene through the lens (TTL) just as 35mm SLRs do. A mirror bounces light coming through the lens into a prism that directs it out of the viewfinder. When you take a picture, the mirror swings up to let light hit the shutter and image sensor. These are true "what you see is what you get" viewfinders because you see exactly what the lens sees.

■ *Optical viewfinders on point-and-shoot cameras* show the scene through a separate window that is slightly offset from the view seen by the lens. The offset view isn't a problem except in close-up photography where parallax causes you to see a view that is slightly offset from the one the lens sees so a subject centered in the viewfinder won't be centered in the image.

■ *Electronic or digital viewfinders* use a small LCD monitor built into the viewfinder that shows you the same image being seen by the image sensor. Because these displays are electronic, menus can be superimposed over the scene so you can change settings without lowering the camera from your eye. This is especially useful on bright days when a monitor is hard to read because of glare. It's also advantageous for people who need reading glasses because the menu can be read without glasses.



In this cutaway view of the Canon Digital Rebel you can see the mirror that bounces light up into a prism for the viewfinder. The mirror swings up out of the way when you take a picture. Courtesy of Canon.

Capturing Images

Continuous mode stores a number of images in the buffer so you can capture fast action in a series of images.

The icon on top indicates continuous mode and the one on the bottom single-shot mode.

To take pictures, hold the right side of the camera with your right hand while supporting the lens or camera body with your left. Be sure not to block the flash, autofocus port, or lens. The shutter button has two stages, except on fixed focus cameras. When you press it halfway down, the camera sets focus and exposure. When you press it all the way down, you take the picture. To anticipate action shots so you can react more quickly, hold the button halfway down while focused on the scene. When you then press the button the rest of the way, the camera shoots immediately because focus and exposure have already been calculated. This speeds up your reaction time a lot, but it also drains your batteries faster. You can also press the shutter button all the way down in one action, but there will be a delay before the photo is taken.

Henri Cartier-Bresson is famous for his photographs that capture that "decisive moment" when normally unrelated actions intersect in a single instant that makes an arresting photograph. His eye-hand coordination was unrivaled, and he was able to get the results he did because he was always ready. There was never any fumbling with controls or lost opportunities. Most digital cameras have an automatic exposure system that frees you from the worry about many controls. However, these cameras have other problems that make decisive moments hard to capture. There are two delays built into digital cameras that affect your ability to respond to fast action when taking pictures.

- *The first delay* is a very brief delay between pressing the shutter button and actually capturing the image. This delay, called the *refresh rate*, occurs because 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*, the *recycle time*, occurs when the captured image is processed and stored. This delay can range from a few seconds to half a minute.

Both of these delays affect how quickly a series of photos can be taken one after another, called the *frame rate*, shot-to-shot rate, or click to click rate. If the delays are too long, you may miss a picture.

At one time, when you took a photo, you couldn't take another one until the image was stored on the camera's storage device—usually a flash card. This takes a few moments so to speed things up, *buffers* have been added to cameras. A buffer is nothing but very fast memory, much like that in your computer or game machine. With one of these cameras, you can take another picture before the first one is saved to the storage device. In fact, you can keep pressing the shutter button to take one picture after another until the buffer becomes filled. At that point you have to wait until at least one image is saved to the storage device and its space in the buffer becomes available for another picture. Many cameras have a *continuous mode* that also uses the buffer. With the camera set to this mode, when you hold down the shutter button the camera continues taking photos one after another until the buffer is full. How quickly each photo is captured is called the *frame rate*. Many consumer cameras can capture between 2 and 3 pictures per second and professional models can go much higher than that.

What is a Digital Photograph?

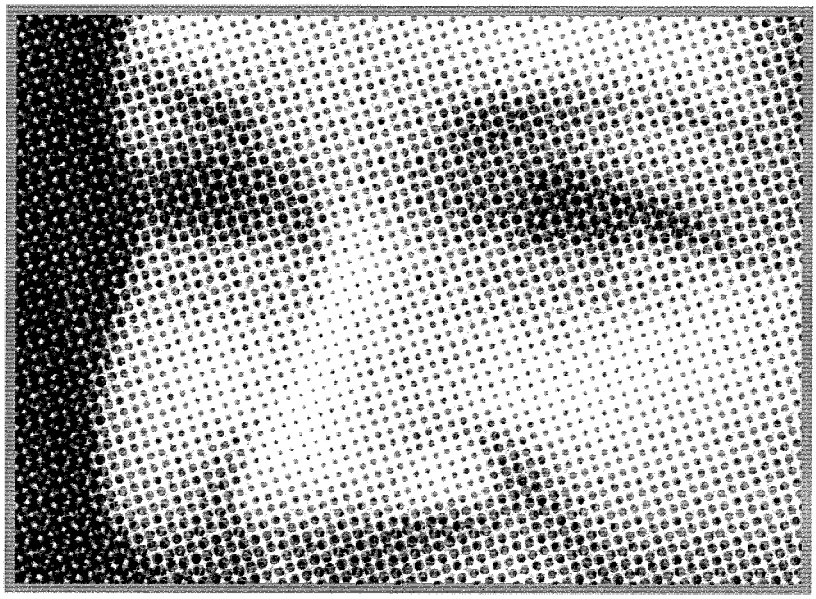
This book is about digital photography. Understanding the end product, the digital photograph, is a good place to begin understanding the entire digital photography process. It is all about dots.

Photographs have always been made up of minute dots whether silver crystals in the film or halftone dots on a printed page. Digital cameras and scanners have just taken this dot-like quality to a new level by capturing an image's dots electronically and then using computer power to organize, edit, enhance, store, and distribute them.

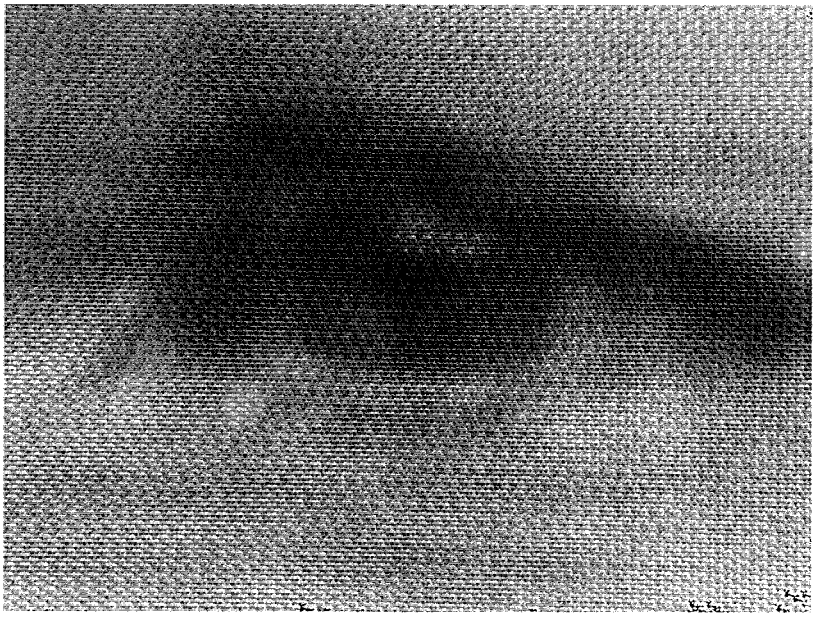
Digital photographs are made up of hundreds of thousands or millions of tiny red, green, and blue dots forming what are called *picture elements*—or just *pixels*. Like the impressionists who painted wonderful scenes with small dabs of paint, your computer and printer can use these tiny pixels to display or print photographs. To do so, the computer divides the screen into a grid of pixels, each with a red green and blue dot. It then uses the values stored in the digital photograph to specify the brightness and color of each pixel in this grid—a form of painting by number. Prints are made in a similar way, but using a different set of colors. Controlling, or addressing a grid of individual pixels in this way is called *bit-mapping* and digital images are sometimes called *bit mapped images*.

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.

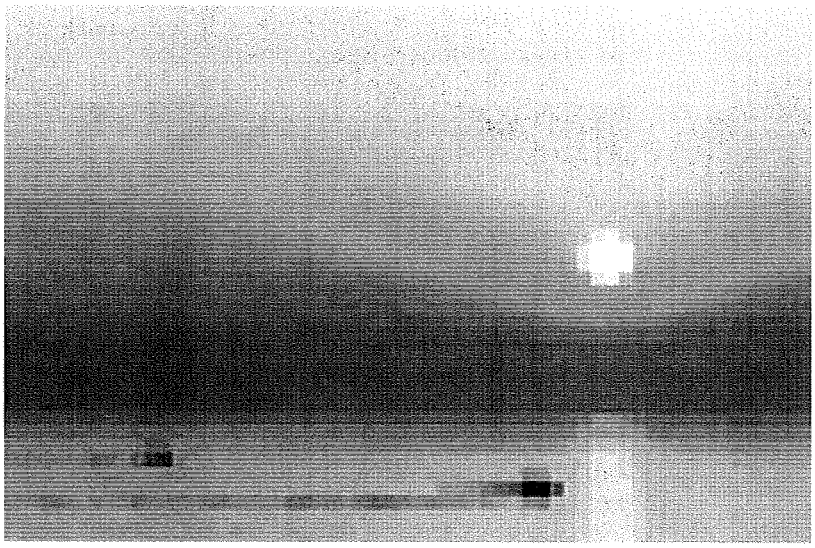
Dots making up a newspaper photo.



Dots on the monitor making up a photo. Each dot in the image is made up of three smaller dots in the colors red, green, and blue.



Dots in a digital image.



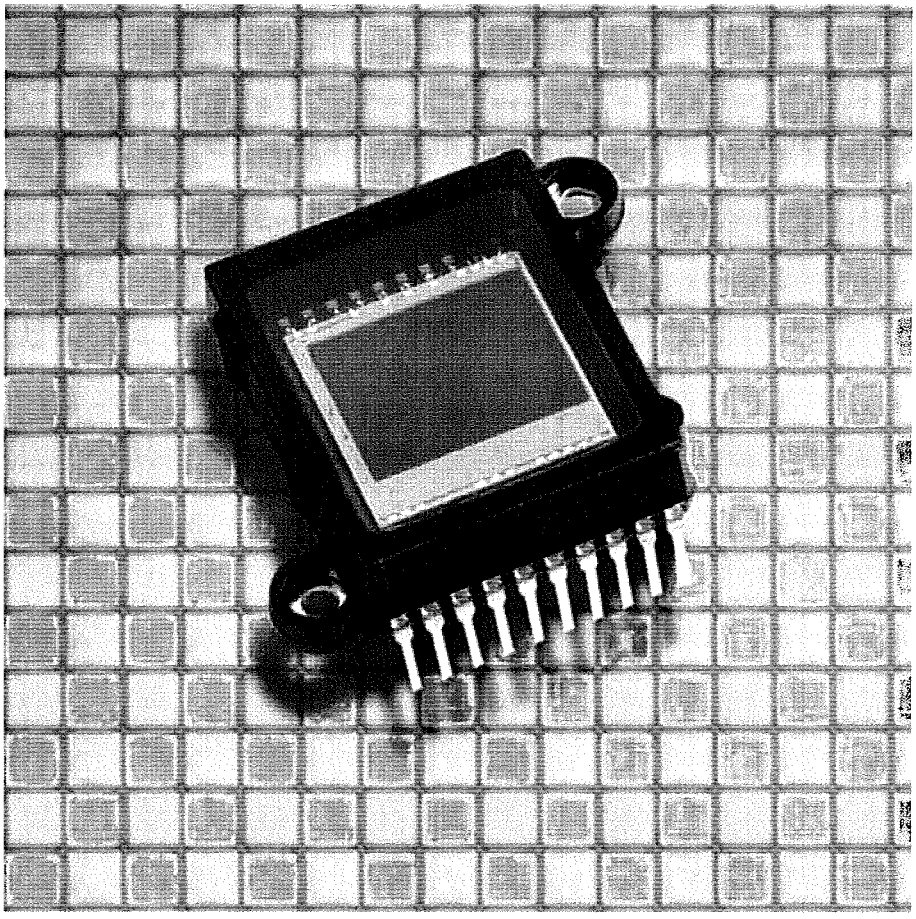
TIP

To see these dots for yourself, use a magnifying glass to examine your computer's monitor and a color photo in a magazine, book, or newspaper.

The Image Sensor

Digital cameras are very much like 35mm film cameras. Both contain a lens, an aperture, and a shutter. The lens brings light from the scene into focus inside the camera so it can expose an image. The *aperture* is a hole that can be made smaller or larger to control the amount of light that enters the camera. The *shutter* is a device that can be opened or closed to control the length of time the light is allowed to enter.

The big difference between traditional film cameras and digital cameras is how they capture the image. Instead of film, digital cameras use a solid-state device called an *image sensor*. In most, but not all, digital cameras the image sensor is a charge-coupled device (CCD). On the surface of this fingernail-sized silicon chip is a grid containing hundreds of thousands or millions of photosensitive diodes called *photosites*, photodetectors, *photoelements*, or *pixels*. Each photosite captures a single pixel in the photograph to be. Image sensors vary widely in size, ranging from fingernail size to full-frame—as large as a frame of 35mm film.

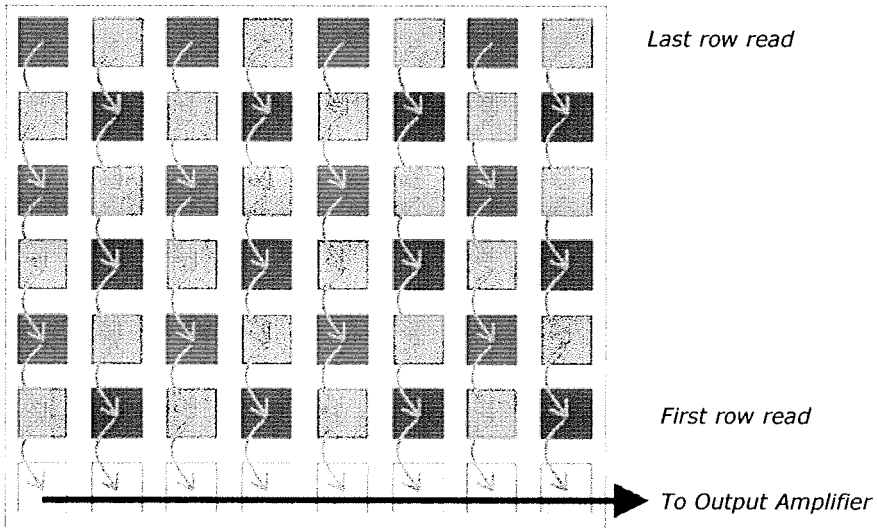


An image sensor sits against a background enlargement of its square photosites, each capable of capturing one pixel in the final image. Courtesy of IBM.

Until recently, CCDs were the only image sensors used in digital cameras. They have been well developed through their use in astronomical telescopes, scanners, and video camcorders. However, some cameras now use CMOS (pronounced *see-moss*) image sensors. Both CCD and CMOS image sensors capture light on a grid of small photosites on their surfaces. It's how they process the image and how they are manufactured where they differ from one another.

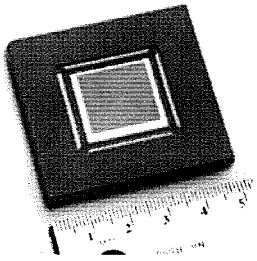
CCD IMAGE SENSORS

A charge-coupled device (CCD) gets its name from the way the charges on its pixels are read after an exposure. As soon as the exposure is complete, the charges on the first row are transferred to a place on the sensor called the *read out register*. From there, the signals are fed to an amplifier and then on to an analog-to-digital converter. Once the row has been read, its charges on the readout register row are deleted, the next row enters, and all of the rows above march down one row. The charges on each row are "coupled" to those on the row above so when one moves down, the next moves down to fill its old space. In this way, each row can be read—one row at a time.



The CCD shifts one whole row at a time into the readout register. The readout register then shifts one pixel at a time to the output amplifier.

CMOS IMAGE SENSORS



Foveon's 16.8 million pixel image sensor, manufactured using CMOS process technology.

Image sensors are manufactured in factories called wafer foundries or fabs where the tiny circuits and devices are etched onto silicon chips. The biggest problem with CCDs is that they are created in foundries using specialized and expensive processes that can only be used to make other CCDs. Meanwhile, more and larger foundries across the street are using a different process called Complementary Metal Oxide Semiconductor (CMOS) to make billions of chips for computer processors and memory used in your notebook or desktop computer. CMOS is by far the most common and most efficient chip-making process in the world. The latest CMOS processors, such as the Pentium 4, contain an amazing 42 million active elements. Using this same process and the same equipment to manufacturer CMOS image sensors cuts costs dramatically because the fixed costs of the plant are spread over a much larger number of devices. As a result of these economies of scale, the cost of fabricating a CMOS wafer is less than fabricating a similar wafer using a specialized CCD process. Costs are lowered even farther because CMOS image sensors can have processing circuits created on the same chip at the time it is made. When CCDs are used, these processing circuits must be on separate chips.

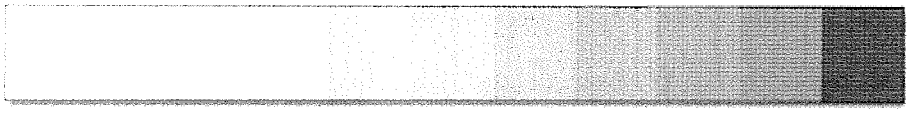
Early versions of CMOS image sensors were plagued with noise problems, and used mainly in low-cost cameras. However, great advances have been made and CMOS image sensors are now used in some of the finest professional cameras.

Digital Color

When you press the shutter button of a digital camera, a metering cell measures the light coming through the lens and sets the aperture and shutter speed for the correct exposure. When the shutter opens briefly, each pixel on the image sensor records the brightness of the light that falls on it by accumulating an electrical charge. The more light that hits a pixel, the higher the charge it records. Pixels capturing light from highlights in the scene will have high charges. Those capturing light from shadows will have low charges.

When the shutter closes to end the exposure, the charge from each pixel is measured and converted into a digital number. This series of numbers can then be used to reconstruct the image by setting the color and brightness of matching pixels on the screen or printed page.

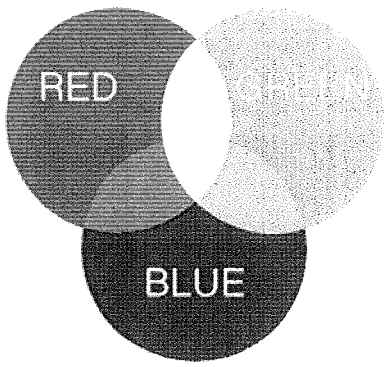
It may be surprising, but pixels on an image sensor can only capture brightness, not color. They record only the *gray scale*—a series of 256 increasingly darker tones ranging from pure white to pure black. How the camera creates a color image from the brightness recorded by each pixel is an interesting story.



The gray scale contains a range of tones from pure white to pure black.

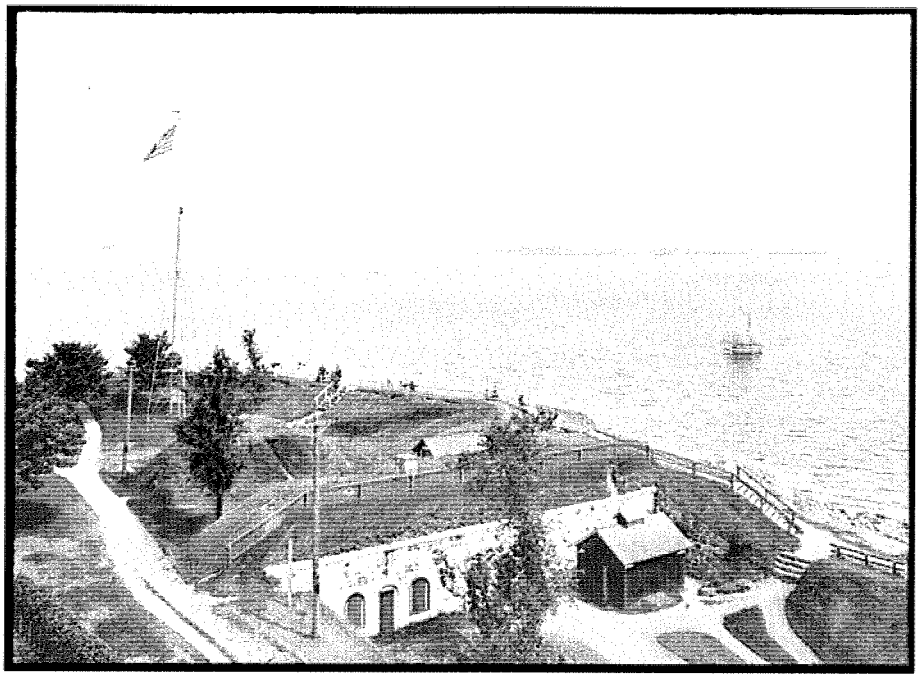
When photography was first invented, it could only record black and white images. The search for color was a long and arduous process, and a lot of hand coloring went on in the interim (causing one photographer to comment "so you have to know how to paint after all!"). One major breakthrough was James Clerk Maxwell's 1860 discovery that color photographs could be created using black and white film and red, blue, and green filters. He had the photographer Thomas Sutton photograph a tartan ribbon three times, each time with a different color filter over the lens. The three black and white images were then projected onto a screen with three different projectors, each equipped with the same color filter used to take the image being projected. When brought into alignment, the three superimposed images formed a full color photograph. Over a century later, image sensors work much the same way.

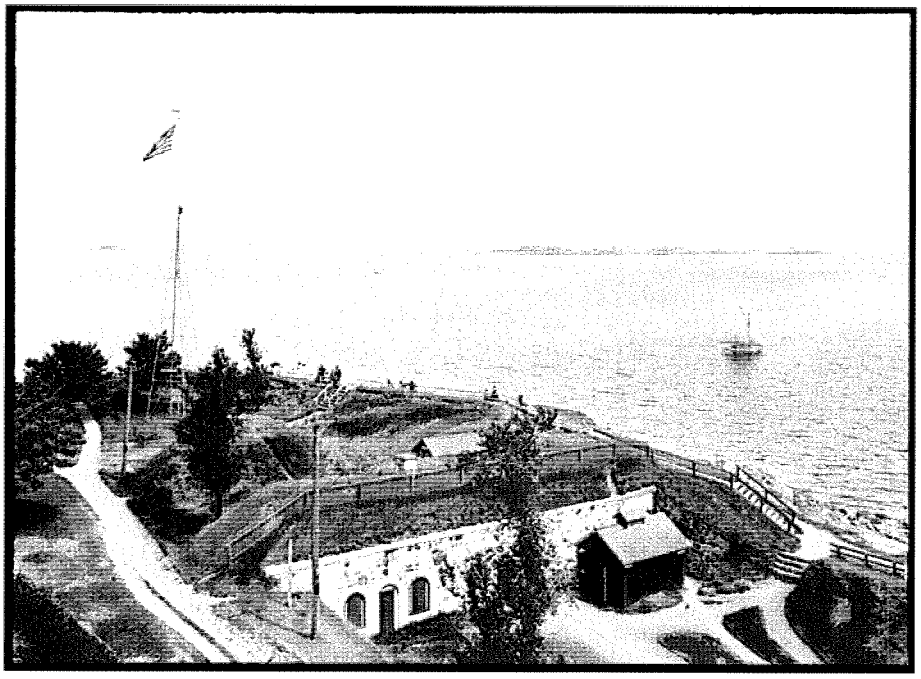
Colors in a photographic image are usually based on the three primary colors red, green, and blue (RGB). This is called the *additive color system* because when the three colors are combined or added in equal quantities, they form white. The RGB system is used whenever light is projected to form colors as it is on the display monitor (or in your eye).

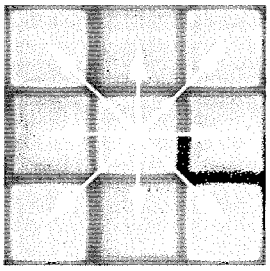


RGB uses additive colors. When all three are mixed in equal amounts they form white. When red and green overlap they form yellow, and so on.

These two photos of the town I live in, were taken around 1900 before color film was widely available. Published as lantern slides, you can see what a difference hand coloring makes.







Here the full-color of the center green pixel is about to be interpolated using the colors recorded by the eight surrounding pixels.

Since a full-color image can be created from red, green, and blue light; placing red, green, and blue filters over individual pixels on the image sensor can create color images just as they did for Maxwell in 1860. Through a process called *interpolation*, the camera computes the full color of each pixel using the color it captured directly through its filter, and the other two colors captured by the pixels around it through their differently colored filters. ("I'm bright red and the green and blue pixels around me are also bright so that must mean I'm really a white pixel.") This step is computer intensive since comparisons with as many as eight neighboring pixels are required to perform this process properly.

When you view a natural scene, or a well done color photograph, you are able to distinguish millions of colors. Digital images can approximate this color realism, but whether they do so on your system depends on its capabilities and its settings. The number of colors in an image is referred to its *color depth*, pixel-depth, or bit depth. Older PCs were stuck with displays that showed only 16 or 256 colors, however, all newer systems can display what's called 24-bit True Color. It's called True Color because these systems display 16 million colors, about the number the human eye can distinguish.

G	R	G	R	G	R
B	G	B	G	B	G
G	R	G	R	G	R
B	G	B	G	B	G
G	R	G	R	G	R
B	G	B	G	B	G

Each pixel on an image sensor has red, green, and blue filters intermingled across the photosites in patterns designed to yield sharper images and truer colors. The patterns vary from company to company but the most popular is the Bayer mosaic pattern shown here. There are twice as many green filters as the other colors because the human eye is more sensitive to green and therefore green color accuracy is more important.

Why does it take 24 bits to get 16 million colors? It's simple arithmetic. To calculate how many different colors can be displayed, raise the number 2 to the power of the number of bits used to display them. For example, 8-bits gives you 256 colors because 2^8=256 and 24 bits gives you 16 million because 2^{24} is almost 17 million.

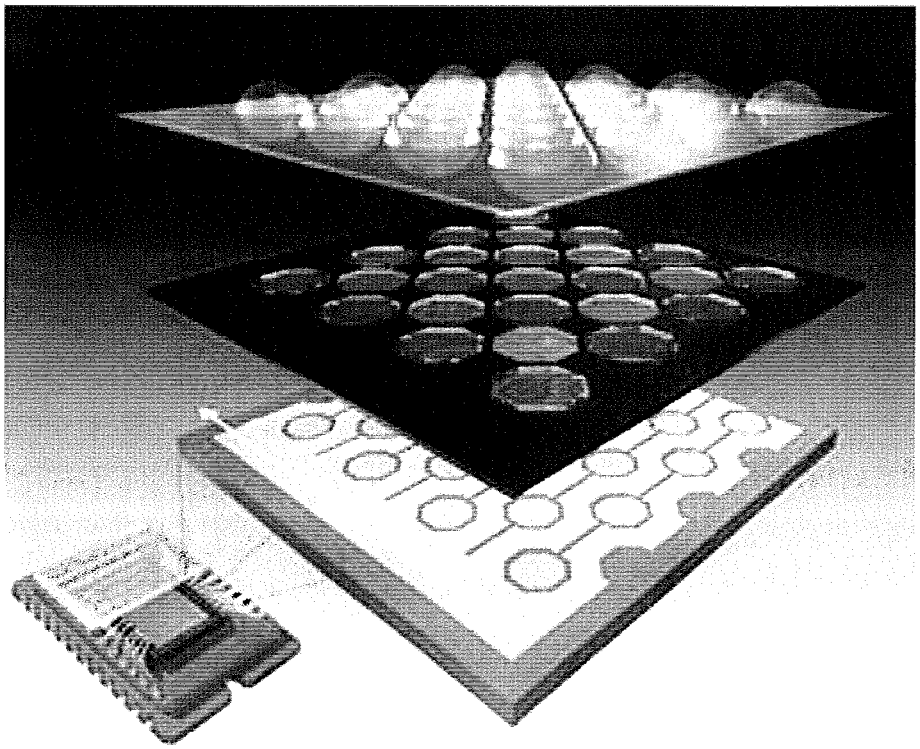
Some digital cameras (and scanners) can capture images using 48 bits. The number of possible colors for these images is astronomical—281 trillion. These extra colors are not used in JPEG images because that format doesn't support 48 bit color. However, there are image formats such as RAW and TIFF which you'll learn about later that can preserve all of these colors—not so much to display or print them, but to give really fine gradations when editing and adjusting the images into their final form.

Here's a table to show you some other possibilities.

NAME	BITS PER PIXEL	FORMULA	NUMBER OF COLORS
Black and white	1	2^1	2
Windows display	4	2^4	16
Gray scale	8	2^8	256
256 color	8	2^8	256
High color	16	2^{16}	65 thousand
True color	24	2^{24}	16 million

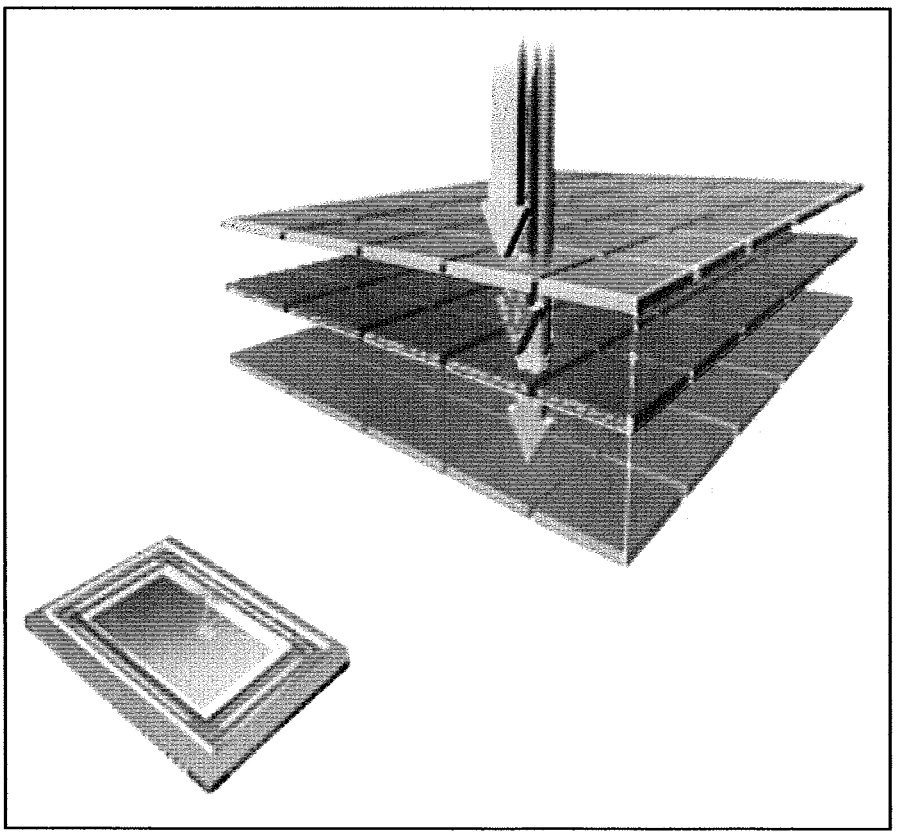
TIP: CHECKING YOUR SYSTEM

You may have to set your system to full-color, it doesn't happen automatically. To see if your Windows system supports True Color, display Window's *Start* menu, click *Settings*, and then click *Control Panel*. Double-click the *Display* command to open the Display properties dialog box. Click the *Settings* tab on the dialog box and check the *Colors* setting.



A CCD is like a three-decker sandwich. The bottom layer contains the photosites. Above them is a layer of colored filters that determines which color each site records. Finally, the top layer contains microlenses that gather light. Courtesy of Fujifilm.

Unlike traditional image sensors that record just one color per pixel Foveon's X3 can capture red, green and blue light at each and every pixel. The X3 features three layers of photodetectors embedded in silicon that take advantage of the fact that red, green and blue light penetrate silicon to different depths—forming a full-color image sensor.



A Foveon X3 image sensor has three layers of photodetectors to take advantage of the fact that red, green and blue light penetrate silicon to different depths. Courtesy of Foveon (www.foveon.com).

Selecting an Image Size

TIP

Images sizes are discussed in detail in Chapter 12 "Pixels and Images."

When shooting photos, the image size you use to capture it has a big effect on how large it can be displayed on the screen or printed. Generally, the best approach is to shoot at the largest available size. You can always make an image smaller in a photo-editing program, but you can never make it larger and retain the original quality.

The relative size of a digital image is determined by the device used to display it. However, the absolute size of the image is determined by the number of pixels used to create it (sometimes referred to as *resolution* or *image size*). More pixels in an image add detail and sharpen edges.

The size of a digital image is specified in one of two ways—by its dimensions in pixels or by the total number of pixels it contains. For example, the same image can be said to have 3072 × 2048 pixels (where "×" is pronounced "by" as in "3072 by 2048), or to contain 6.29 million pixels (3072 multiplied by 2048). Since the term "megapixel" is used to indicate 1 million pixels, an image with 6 million pixels can also be referred to as a 6 megapixel image.

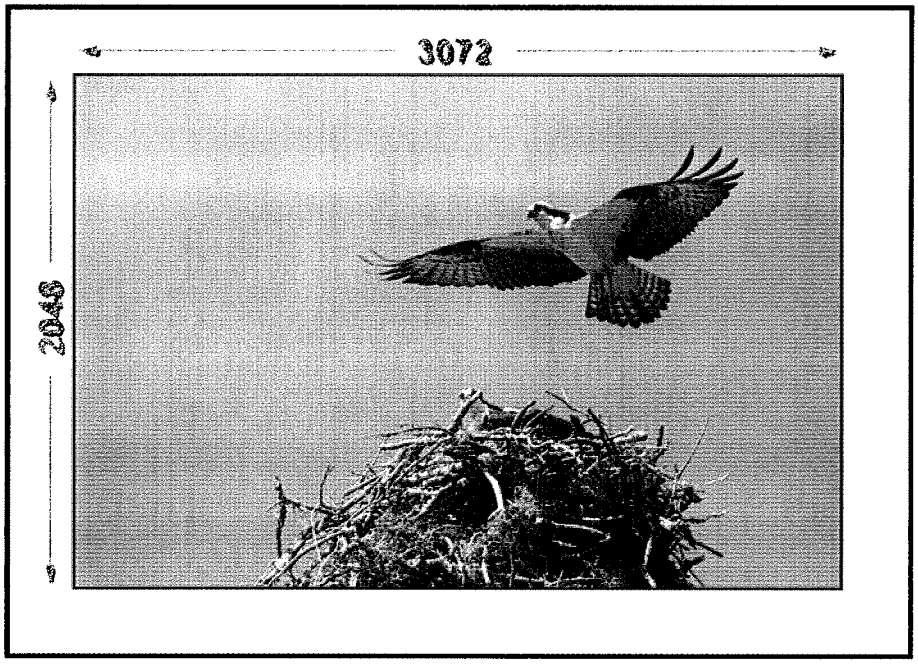


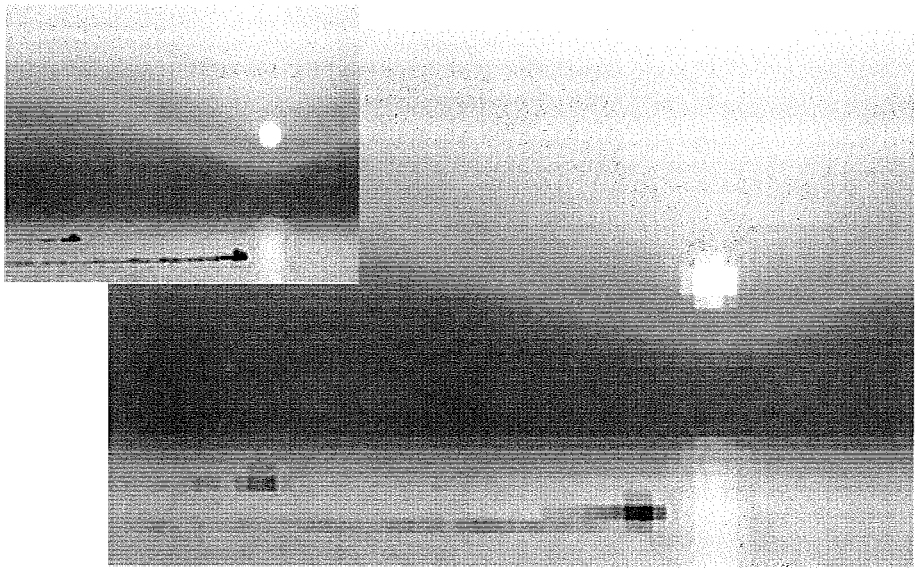
Image sizes are expressed as dimensions in pixels (3072 × 2048) or by the total number of pixels (6,291,456).

TIP

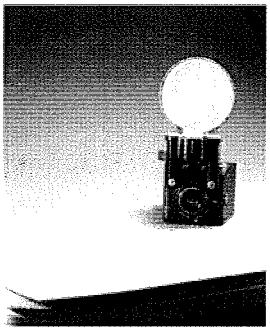
Enlarging digital images is usually avoided because the results are not that good. However, there are now programs available that do a very good job at this single task. One of the leaders in this area is pxl SmartScale from Extensis.

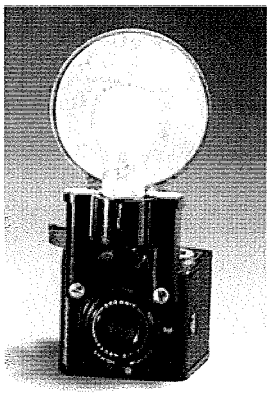
The number of pixels in a digital image is important because if you enlarge an image enough, it begins to loose sharpness and eventually the pixels begin to show—an effect called *pixelization*. This is not unlike traditional silver-based prints where grain begins to show when prints are enlarged past a certain point. The larger the image is to begin with—the more pixels that it contains—the larger it can be displayed or printed before pixelization occurs. However, with even inexpensive cameras capturing 2 and 3 megapixel images, most images will never bump up against this limit.

One advantage of larger images is seen when editing. Changes to such aspects as color balance, hue, saturation, contrast, and brightness are more effective on larger images because there is more image data to work form. After making these adjustments, you can reduce the file to the needed size.



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





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.

As you might expect, all other things being equal, costs rise with a camera's image size. Although larger image sizes can give you sharper and better enlargements, they can also create problems. For example, more pixels means larger image files. Not only are larger files harder to store, they take longer to transfer, process, and edit and are often far too large to e-mail or post on a Web site. Smaller image sizes such as 640 x 480 are perfect for Web publishing, e-mail attachments, small prints, or as illustrations in your own documents and presentations. For these uses, higher resolutions just increase file sizes without significantly improving the images.

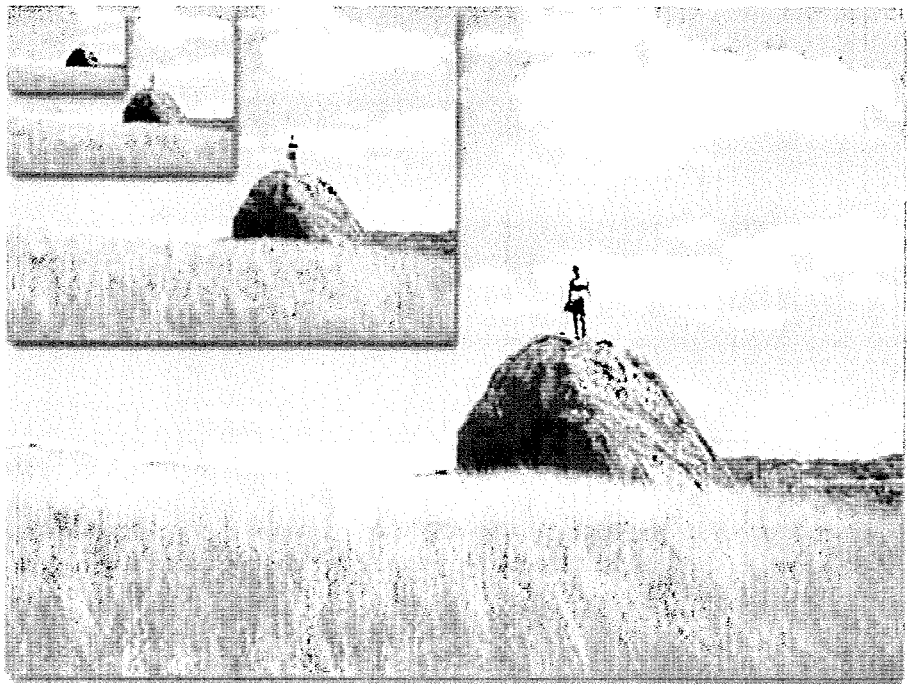
Here are some rules of thumb about what image sizes you need for certain outputs.

■ *On the Web*, images are displayed on screens that have resolutions of 1280 x 1024, 1152 x 864, 1024 x 768, 800 x 600, or 640 x 480. A few years ago, a 1024 x 768 monitor was unusual so most people in the industry settled on assuming that the lowest common denominator for screen sizes was 640 x 480 or, at best 800 x 600. For this reason, images should be of similar or smaller sizes—no more than 800 pixels wide (on eBay's Picture Services the maximum allowable size is 800 pixels wide). This ensures that images will display correctly on the vast majority of computers. If an image is too large, users will not be able to see it all at once and will be forced to scroll around it. If too small, details will be lost. Size also affects the speed with which images travel over the Web. Smaller (and more compressed) images travel faster so people see them more quickly.

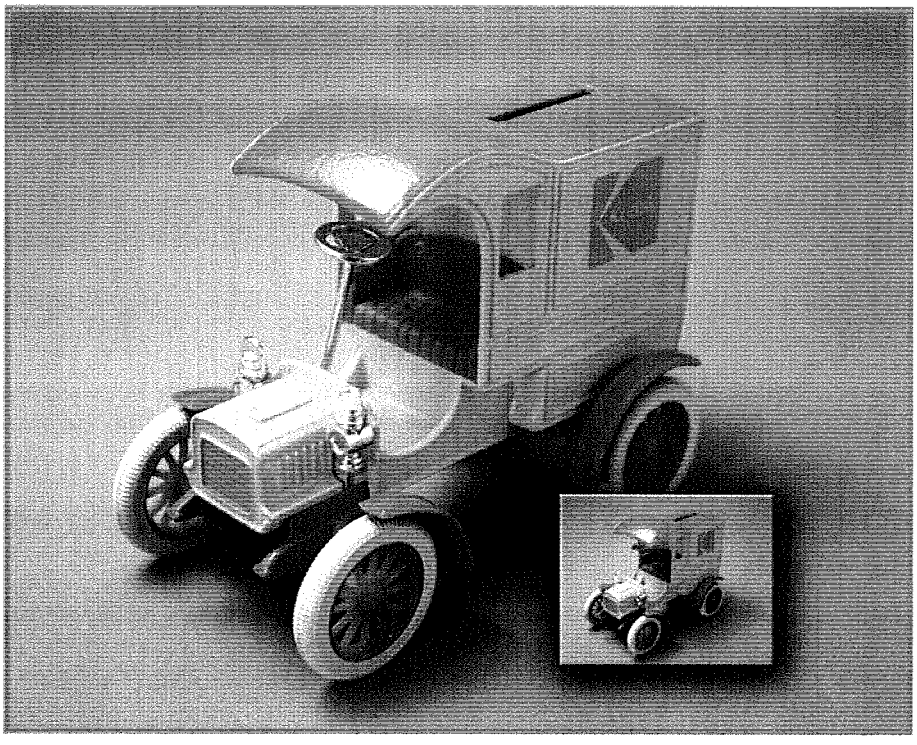
■ *For laser and inkjet printers* you need between 200–300 pixels or dots per inch. If your camera can capture images that are 2400 pixels wide, you can expect good results when prints are between 8 and 12 inches wide.

■ *When images are printed on a printing press*, as they might be for a catalog, the pixels in the image are printed as dots on the page. Photographic prints that are to be printed on a press are first "screened." To do this, a clear glass plate with scribed grid lines is laid on the photograph and then a picture is taken of the photograph through the screen. The scribed lines on the glass plate break the image up into dots called a "halftone." The negative is then

used to create a printing plate used on the press. Today this process is usually done digitally, but it has the same result. The fineness of the screen used determines the quality of the printed image. Most photographs are screened with somewhere between 85 lines per inch (lpi) in newspapers to 200 lpi in high quality art books. For the best results, your images need to have 1.5 times as many pixels per inch as the screen's lpi (confirm with your printer). For example, if the printer is using a 150 lpi screen, your image must have at least 225 pixels per inch. This means to print a 4-inch wide image in a catalog, you need to have an image width of at least 900 pixels.

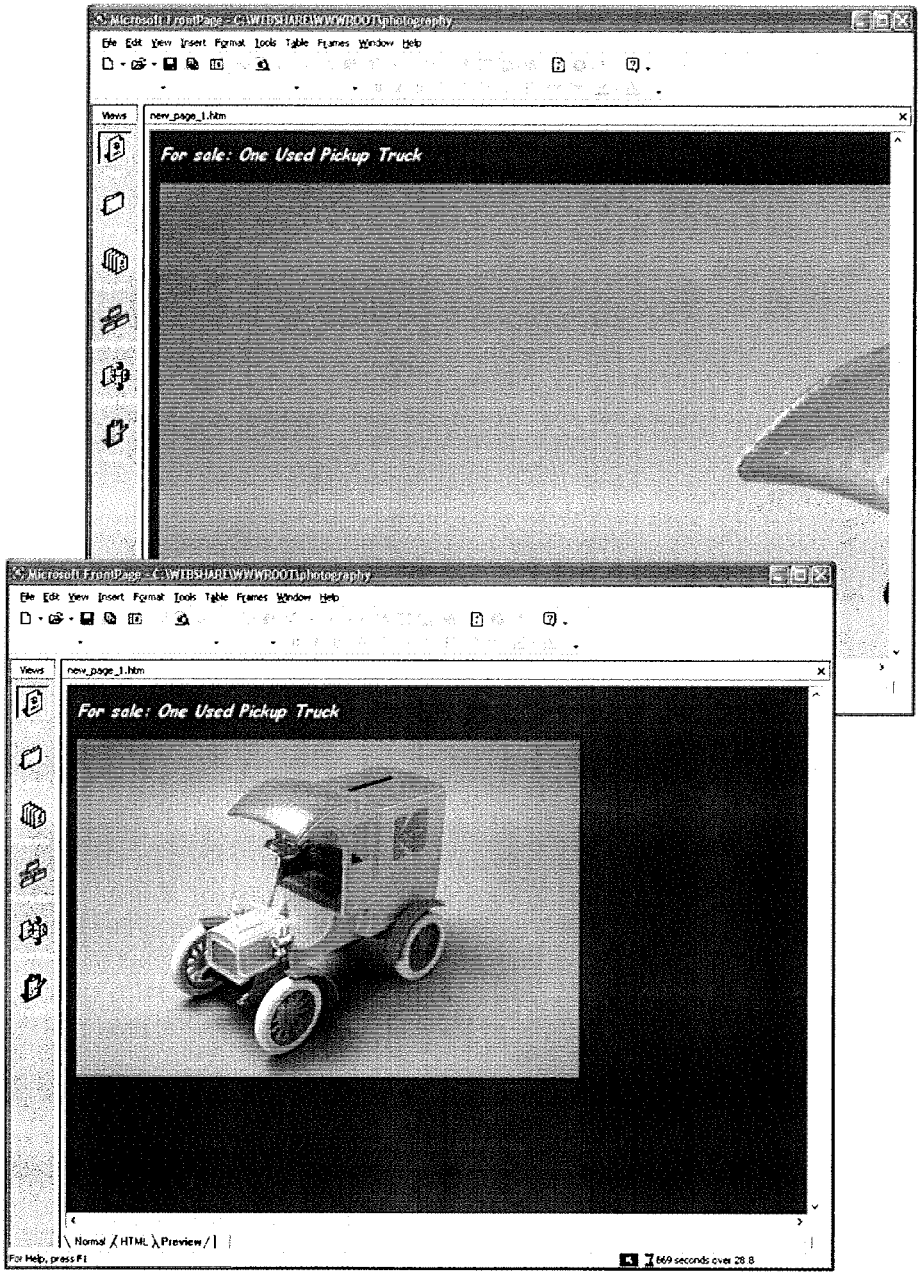


The number of pixels in an image, sometimes referred to as its resolution, determines the size of the image when it's displayed on the screen or how large a print can be made that is still sharp.



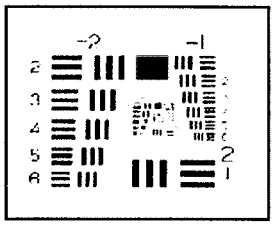
Here are the relative sizes of two images sized to be printed or displayed at 4 x 5 inches. The larger image (1500 x 1200 pixels) will print at 300 dots per inch. The smaller one (360 x 288) will be displayed on the screen at 72 dpi. Although greatly different in the number of pixels they contain, the different output devices will render them the same size.

If an image is too large for a screen (top-right), the viewer will have to scroll around it to see it. When sized correctly (bottom-left) they can see the entire image.



SCREEN RESOLUTIONS

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
QUXGA 3200 x 2400
WQUXGA—3840 x 2400

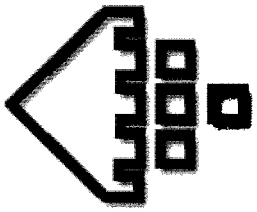


Test charts have pairs of lines at various spacings

THE COLLISION OF TWO WORLDS

The term "resolution" was introduced in the computer world as a way to describe screen displays. In the early days, a screen would have a CGA or VGA resolution. Later, other names were introduced to describe even higher resolutions. The terms were used to describe the number of pixels on the screen. For example, the VGA screen had 640 pixels across the screen and 480 down (640 x 480). No one was concerned about the use of the term "resolution" at the time it was introduced. It's only when photography became digital that another group of people entered the scene with a totally different use of the term. To photographers, or anyone in optics, resolution describes the ability of a camera system to resolve pairs of fine lines such as those found on a test chart. It's an indicator of sharpness, not image size

Selecting an Image Quality



The almost universally recognized icon for image quality.

When capturing images, there are a number of choices you can make about compression ratios and file formats. Your choices determine image quality and the size of the files you create.

File Compression

Image files are huge compared to many other types of computer files. For example, a low-resolution 640 x 480 image has 307,200 pixels. Since each pixel requires 24 bits (3 bytes) to store color information, a single image takes up about a megabyte of storage space. As the resolution increases, so does the file size. At a resolution of 1600 x 1200, each 24-bit picture takes up over 5.7 megabytes. To make image files smaller and more manageable, digital cameras use a process called *compression*. Compressing images not only let's you save more images on a camera's storage device, it also allows you to download and transmit them more quickly.

During compression, data that is duplicated or that has no value is eliminated or saved in a shorter form, greatly reducing a file's size. For example, if large areas of the sky are the same shade of blue, only the value for one pixel needs to be saved along with the locations of the other pixels with the same color. When the image is then edited or displayed, the compression process is reversed. There are two forms of compression—*lossless* and *lossy*—and digital cameras use both forms.

■ *Lossless compression.* When an image compressed with lossless compression is uncompressed, its image quality matches the original source—nothing is lost. Although lossless compression sounds ideal, it doesn't provide much compression and files remain quite large. For this reason, lossless compression is used mainly where detail is extremely important, as it is when planning to make large prints or use high-quality printing. Lossless compression is offered by some digital cameras in the form of TIFF and RAW file formats.

■ *Lossy compression.* Because lossless compression isn't practical in many cases, all popular digital cameras offer a lossy compression (rhymes with "*bossy*"). This process degrades images to some degree and the more they're compressed, the more degraded they become. In many situations, such as posting images on the Web or making small to medium sized prints, the image degradation isn't obvious. However, if you enlarge an image enough, it will show. The most common lossy file format is JPEG.

File Formats

You have a number of choices when it comes to file formats. All digital cameras store still images in the JPEG format, but some also let you select TIFF or CCD RAW. A forth format, GIF, has limited uses. Let's look at all four formats.

■ *JPEG*, named after the Joint Photographic Experts Group and pronounced "*jay-peg*," is by far the most popular format for photographic images. In fact, most cameras save their images in this format unless you specify otherwise.

A JPEG image is stored using lossy compression and you can vary the amount of compression—perhaps to reduce files to 1/4, 1/8, or 1/16 their original size. This allows you to choose between lower compression and higher image quality or greater compression and poorer quality. Most cameras give you

two or three choices equivalent to good, better, best although the names vary. JPEG compression is performed on blocks of pixels eight on a side. You can see these blocks when you use the highest levels of compression and then greatly enlarge the image.

■ *TIFF* (Tag Image File Format) has been widely accepted as an image format. Because of its popularity in digital photography, the format has been revised to TIFF/EP (Tag Image File Format—Electronic Photography). TIFF/EP may be stored by the camera in uncompressed form, or using JPEG compression. TIFF/EP image files are often stored in a "read-only" fashion to prevent accidental loss of important information contained within the file. This is why you sometimes can't delete them once they are on your computer without first turning off the file's read-only attribute.

■ *CCD RAW* format stores the data directly from the image sensor without first processing it. This data contains everything captured by the camera. In addition to the digitized raw sensor data, the RAW format also records color and other information that is applied during processing to enhance color accuracy and other aspects of image quality. Instead of being processed in the camera, where computing power and work space is limited (imagine Scarlett O'Hara trying to change into a Civil War era ball gown in a small closet), the raw data is processed into a final image on a powerful desktop 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.

In addition to image quality, RAW files have other advantages. Their files are approximately 60% smaller than uncompressed TIFF files with the same number of pixels, and the time you have to wait between shots is shorter since processing time in the camera is shorter.

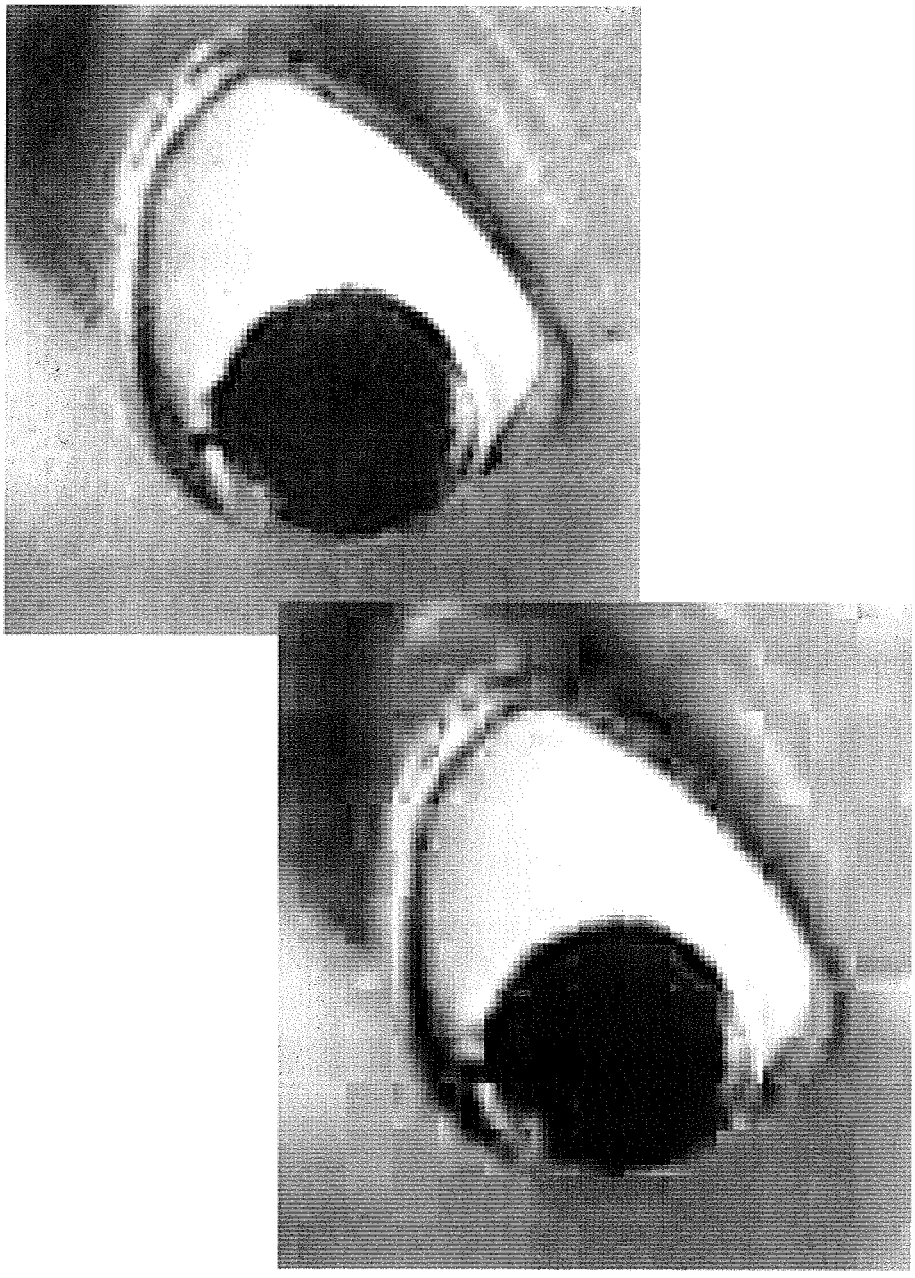
CHOOSING A FORMAT

If your camera lets you choose a file format and compression ratio you should always choose those that give you the highest quality. If you decide later that you can use a smaller image or greater compression, you can do so to a copy of the image using a photo-editing program. If you shoot the image at a lower quality setting, you can never really improve it much or get a large, sharp print if you want one. The only problem with this approach has to do with file sizes. The highest quality images can be 15 or more megabytes in size. These are almost impossible to send to anyone by e-mail and are slow to open, edit, and save on even a powerful desktop computer. In addition, when you shoot images of this quality you often have to wait a long time between shots because the camera is tied up processing the last image you took. Most photographers use a compromise and shoot in the highest quality JPEG format. Even these image files can be 2–5 megabytes in size on the latest cameras.

When you open an image to work on it, you should first save it so you are working on a copy and preserving the original image unchanged. Save it in a loss-free format such as TIFF. Even better, your photo-editing program may have its own native format that preserves information that no other format will. Use this format while editing. If you want a specific format for the finished image, save a copy of it in that format as the final step. In particular,

don't repeatedly close, open, and resave JPEG original images. Every time you open one of these files, and then save it again, the image is compressed. As you go through a series of saves and reopens, the image becomes more and more degraded—an image quality death spiral. (An image is compressed only once during a single session, no matter how many times you save it, so save it frequently to avoid losing your edits.) Also, when you save an image as a JPEG, the image on the screen won't show the effects of compression unless you close the file and then open the saved version.

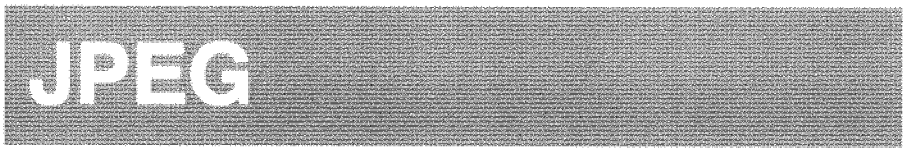
Many digital photos end up on the Web or attached to e-mail, so they are viewed on the screen. For these purposes, small, heavily compressed JPEG files that are easy to view or send over the Internet are favored. For the highest quality printed images, TIFF or RAW formats should be used. RAW is especially useful when accurate color rendition is essential.



The top photo is a TIFF image that hasn't been compressed. The bottom image is a JPEG image that has been repeatedly compressed.

5 common File Types in Photography

Source: Petapixel.com
https://petapixel.com/2015/09/23/5-common-file-types-in-photography-and-when-you-should-use-each-one/

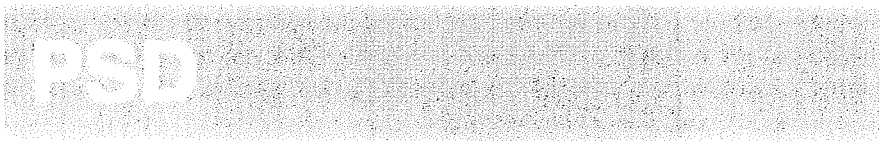


The well-known JPEG format is the standard for compatibility. No matter how you wish to share your photographs, whether on a social network or to a print shop, the JPEG is likely to be supported. JPEG is great for sharing photos because you know there won't be any trouble reading the format.

There are downsides to saving as a JPEG, though. For starters, the file format doesn't support transparency within images. Debatable compression quality also means you may not get the desired standards you are seeking when you hit the save button. Some users suggest that saving a JPEG with maximum quality will produce acceptable results, but others have yet to be convinced.

Best For: Sharing Images online with friends or family.

JPEG (.jpg) LOSSY FILE FORMAT

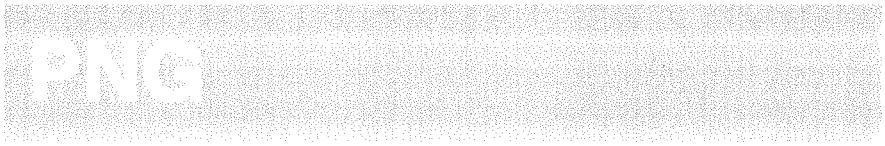


The Photoshop format, also referred to by its 'PSD' file extension, is the default format for saving your work. It provides compatibility across a number of Adobe products including Illustrator, InDesign Premiere, and After Effects. It is one of the only formats that can save a file with all Photoshop features accounted for, such as layers and applied effects.

Despite being an excellent way to preserve every adjustment you have made in Photoshop, the PSD file is not generally accepted when sharing images since your client must be in the Adobe ecosystem in order to open it. PSD is useful for saving your work so you can easily return to the file to resume work. In most cases, PSD should be confined to your workspace.

Best For: Saving files on your workspace so you can return and edit later.

PHOTOSHOP (.psd) LOSSLESS FILE FORMAT, PRESERVES LAYERS



The PNG format is a lossless file type, which means it can preserve your images without any loss in image quality. The format itself was based on the GIF file type, but allows for higher bit rate pictures and can preserve background transparency while minimizing jagged edges. PNG is an excellent format for displaying images on the web that require transparent elements.

Downsides to the PNG format typically include a large file size; this means that while PNG is excellent for the web, it should be used sparingly and only when needed for transparency purposes. Overusing PNG images on a web server could result in a slower experience for end users and increased bandwidth costs for the site owner.

Best For: Preserving transparency for images on the web.

PNG (.png) LOSSLESS FILE FORMAT, PRESERVES TRANSPARENCY

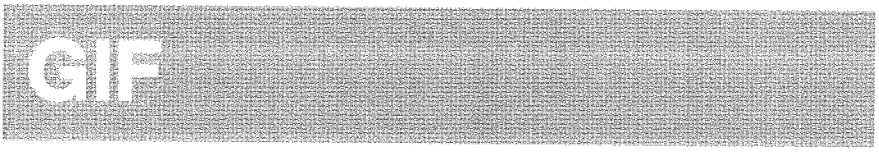
The Tagged-Image File Format (TIFF) is an extremely flexible format that is one of the best for saving your prized images on your Mac or PC. TIFF is compatible with almost all image-editing and graphics applications currently available. In addition, TIFF supports a large number of color standards including CMYK, RGB, Lab, Indexed Color, and Grayscale Images.

Similar to PNG, TIFF is also able to preserve transparency with the bonus of including alpha channels, which dictate the specific degree of transparence. TIFF files can also save Photoshop layers so they can be edited or rearranged at a later time. If you are saving an HDR image with immense dynamic range, TIFF can save images at a rate of up to 32-bits-per-channel.

TIFF files can pack a lot of information, but can also become quite large due to this fact. In addition, while TIFF is compatible with various image-editing programs, not every social networking site or device will be able to properly display the files. TIFF is best reserved for archiving images on your PC to preserve quality or for high-quality printing.

Best For: Archival purposes and retaining maximum quality.

TIFF (.tif) LOSSLESS FORMAT, COMPATIBLE WITH MANY COLOR AND IMAGE TYPES



The Graphics Interchange Format (GIF) has been included on this list simply so that we can tell you to avoid it. GIF images are extremely compressed files specifically designed to increase transfer speed over the internet. PNG was developed as an alternative to the GIF while maintaining quality far beyond what the GIF is capable of storing.

The only time a GIF image should generally be used is for low-quality web graphics that feature animation. GIF feature a limited color range and are not suited for reproducing high-quality images in today's world. An animated GIF of a silly cat, however, is acceptable.

Best For: Low-resolution animated images for the web.

GIF (.gif) LOSSLESS FORMAT, CAN BE SHORT ANIMATED CLIPS, LOW QUALITY

Digital Photo & Graphics Checklist: Unit 1

Assignments:

1. Textbook Reading: Chapter 1 Digital Images and Digital Cameras" 10 Points
   - Take notes and use active reading techniques such as highlighting or underlining text that you may need to refer back to. (questions, important topics, worksheet answers, etc.)
   - Turn this packet in completely with your chapter notes (I use the margins). It is completely ok to write on this text.
   - Don't worry about reading the entire chapter in one sitting. Take your time and carefully read 5-7 pages per day for reading comprehension and understanding.

2. Chapter 1 Worksheet Quiz Chapter 1 25 Points
   - Complete this quiz/ worksheet as you like. You can choose to fill in the blanks as you read or after you have finished.

3. Week 1 Photo Journal 25 Points
   - I am not looking to have you print your photos at this point. I am looking for this to be a narration of your time spent on coursework and other photos you have taken throughout the week.
   - On our weekly call, this is what I'm most interested in discussing!

4. Take a photo of yourself (so that I can remember faces & names together.) 10 Points
   - I forget... A Lot. What I don't want to forget are your faces and names. I miss being at school and I hope to see you all soon.

Top 3 Things I Learned in this Lesson. 5 Points

_____

_____

_____

_____

_____

_____

_____

Total / 75 Points

Name:_____ Section _____ Date:_____

HHS Digital Photography Unit 1. Worksheet

Directions: Please put your answers on the attached answer sheet. Answers may be used more than once.

1. For consumers, digital photography first appeared on the scene around the year ____**1**_____.
2. The _____ ____**2**_____ _____ was invented at Bell Labs by George Smith & Willard Boyle.
3. Increasingly, _____ ____**3**_____ _____ cameras are being integrated into mobile devices.
4. Advanced amatuer and professional cameras are often designed to work with traditional _____ ____**4**_____ _____ lenses.
5. Using the camera's ____**5**_____ will help to reduce battery drain and conserve battery life.
6. The first delay, from when the shutter button is pressed to image capture, is called ____**6**_____ rate.
7. The ____**7**_____ is a hole that can be made smaller or larger to control the amount of light that enters the camera.
8. The ___**8**_____ is a device that is opened/ shut to control the length of time light is allowed to enter the camera.
9. RGB (red, green, blue) used the ____**9**_____ color system. All three of these colors together equals white.
10. Digital photographs are made up of hundreds of thousands or millions of tiny colored dots forming _____ **10** _____ commonly known as pixels.
11. Digital images are sometimes called _____ **11** _____ images.
12. Instead of film, digital cameras use a solid-state device called a (an) _____ **12** _____.
13. The human eye can distinguish about 16 million colors. This is similar to _____ **13** _____ 24-bit
14. Generally, the best approach is to capture pictures is at a ___ **14** _____ size.
15. More pixels in an image add detail and ___ **15** _____ edges.
16. If you enlarge an image enough, it begins to lose sharpness and image quality is lost. This is an effect called ___ **16** _____.
17. Lossy file compression often results in ___ **17** ____ image size.
18. ___ **18** _____ file compression doesn't provide much compression and files remain quite large.
19. JPEG (.jpg) images are an example of ___ **19** _____ file compression
20. ___ **20** _____ images store the data directly from the image sensor without first processing it.
21. Photoshop (.psd) format is used to preserve ____ **21** ____ and to transfer files between other Adobe software products.
22. PNG images are an example of ___ **22** _____ file compression.
23. TIFF images are an example of ___ **23** _____ file compression.
24. ___ **24** _____ image size in an advantage of using RAW file format.
25. The most common file format for web and email attachments is ____ **25** _____.

Name:_____ Section _____ Date:_____

HHS Digital Photography Unit 1. Answer Sheet

Directions: Please put your answers on this attached answer sheet. Answers may be used more than once.

1.	_____	Additive
2.	_____	Aperature
3.	_____	Bit Mapped
4.	_____	Charge-Coupled Device (CCD)
5.	_____	GIF
6.	_____	Image Sensor
7.	_____	JPEG (.jpg)
8.	_____	JPEG 2000
9.	_____	Larger
10.	_____	Layers
11.	_____	Lossless
12.	_____	Lossy
13.	_____	Photoshop (.psd)
14.	_____	Picture Elements
15.	_____	Pixelization
16.	_____	PNG (.png)
17.	_____	Point and Shoot
18.	_____	RAW (CCD RAW)
19.	_____	Refresh Rate
20.	_____	Sharper
21.	_____	Shutter
22.	_____	Single Lens Reflex (SLR)
23.	_____	Smaller
24.	_____	TIFF (.tif)
25.	_____	True Color
		Viewfinder
		1995

Digital Photo & Graphics Photo Journal

Day & Date	Journal Entry

Week 2

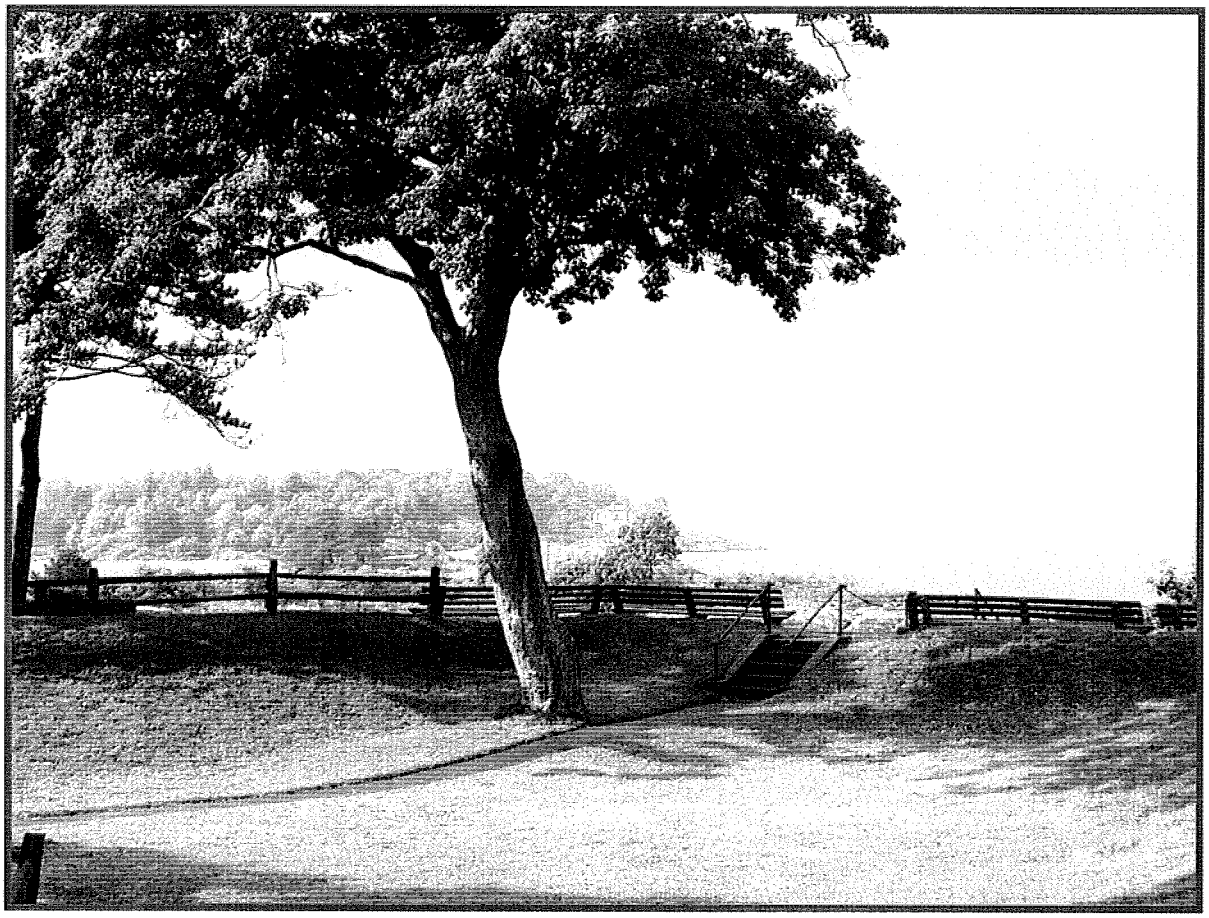
Name:_____ Section _____ Date:_____

HHS Digital Photography Unit 2. Reading Packet

Directions: Read and use an active reading strategy to take notes, write down questions, note important terms or ideas. You may write, underline or highlight on this page or the text!

Contents: **Textbook of Digital Photography, Chapter 5- Capturing Light & Color**
Supplemental Reading: How to Instantly Improve your Images by Ray Salisbury

Chapter 5
Capturing Light & Color



CONTENTS

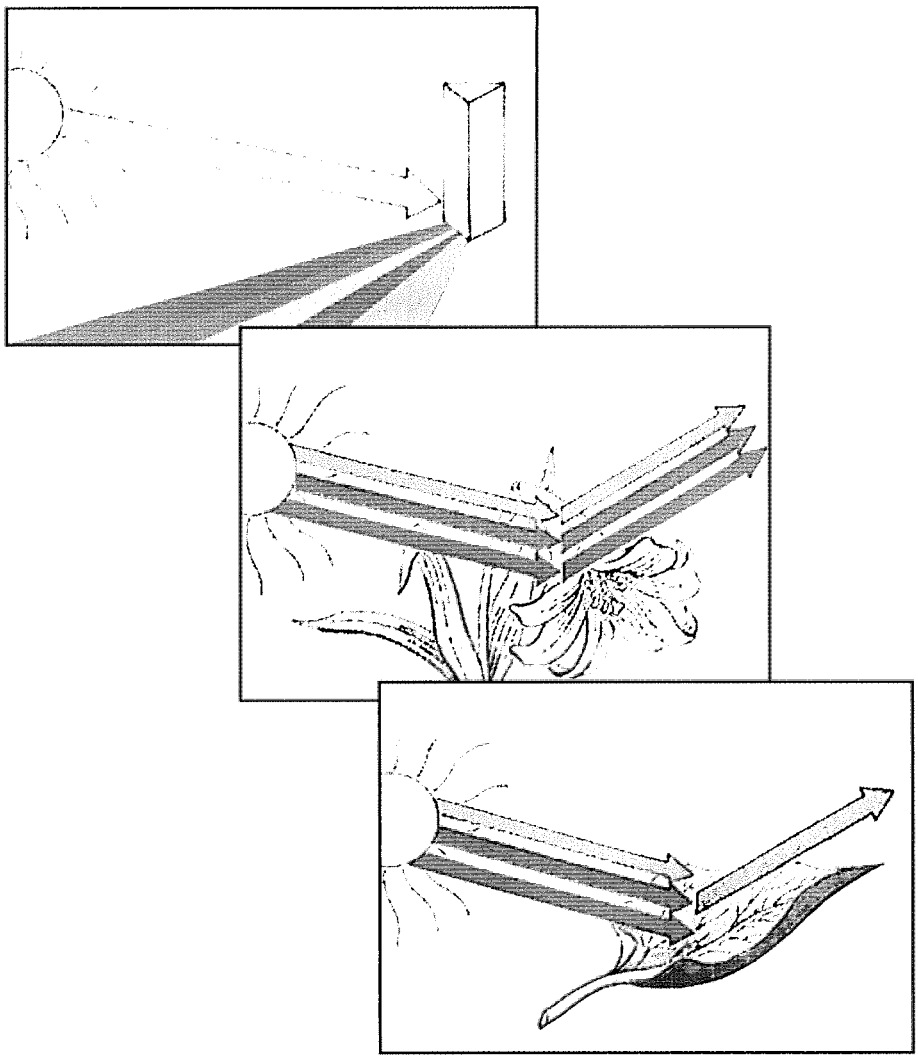
Image sensors in digital cameras are designed to produce colors that match those in the original scene. However, there is a lot of variation among sensors, circuits, and software that process raw images into final photographs. The results you get depend, in part, on the accuracy with which you expose the image and how the camera handles color balance.

With film cameras, photographers usually explore a wide variety of films before settling on the one or two they like best. This is because each film type has its own unique characteristics. In some the grain is small, in others it's large. A film may have colors that are warmer than other films, or slightly colder. These subtle variations among films are what make photographers gravitate to one or the other. With digital cameras, you don't have this choice. The "film" in the form of an image sensor is built into your camera. Whatever its characteristics are, they are the characteristics you have to live with until you buy another camera.

In this chapter, we explore the world of light and color and how you manage them in your photos.

WHERE DOES COLOR COME FROM?

Why do we see colors? Light from the sun or from a lamp seems to have no particular color of its own. It appears simply to be "white" light. However, if you pass the light through a prism, you can see that it actually contains all colors, the same effect that occurs when water droplets in the atmosphere separate light into a rainbow. A colorful object such as a leaf appears green because when white light strikes it, the leaf reflects only the green wavelengths of light and absorbs the others. A white object such as a white flower appears white because it reflects most of the wavelengths that strike it, absorbing relatively few. Inks, dyes, or pigments in color prints also selectively absorb and reflect certain wavelengths of light and so produce the effect of color.



Although light from the sun appears colorless or "white," (top) 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 (middle) reflect most of the wavelengths of light that strike them. When all of these wavelengths are combined, we see white. When all of them are absorbed, and none reflected, we see black.

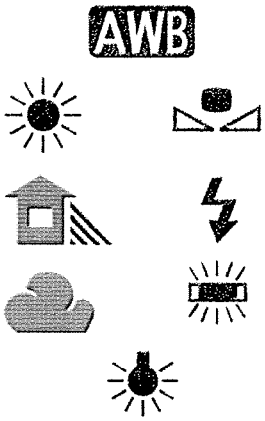
A green object (bottom) such as a leaf reflects only those wavelengths that create the visual effect of green. Other colors in the light are absorbed by the leaf.

To identify colors, digital images assign values to each following the rules spelled out in what called a *color model* or *color space*. Many digital cameras have adopted a color space called sRGB that is more suitable for color displays than it is for photographs because photos can capture many more colors than the sRGB model defines. A model that can define more colors—called a wider color gamut—is Adobe RGB. With the Pro 1 you can choose which of these color models to use.

WHITE BALANCE

TIPS

- If you like the warm glow of incandescent lights, you can capture that look when shooting under them by setting white balance to *Daylight*.
- The image on the camera's monitor is displayed using the current white balance setting. Use it as a guide, but also check the captured image.
- The color temperature of most light bulbs changes over time and as they warm up. Be sure to check white balance each time you take pictures, or periodically during a long session.



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

Although light from the sun and a light bulb looks the same to us, they actually contain different mixtures of colors that affect the color of any scene they illuminate. The color of the light is specified by its *color temperature* in degrees Kelvin, somewhat like the room temperature is specified in degrees Fahrenheit or Centigrade. As color temperature increases it moves through the colors red, orange, yellow, white, and blue white in that order. Daylight contains proportionately more light toward the blue end of the spectrum. Incandescent light contains more toward the red end. (Despite the fact that blue light has a higher color temperature than red light, we refer to blue as colder and red as warmer.) Here are the approximate color temperatures of lighting sources you are likely to encounter in your photography.

- Incandescent—3,000° K
- Fluorescent—4,200° K
- Direct Sunlight— 5,200° K
- Flash—5,400° K
- Cloudy—6,000° K
- Shade—8,000° K

To capture images with colors that look like they were shot at midday, you can use flash with the same color temperature as daylight. Alternatively, you can take advantage of our digital camera's unique *white balance* system. This system adjusts the image so its colors appear the way they would look if shot in daylight. For example, the fluorescent setting compensates for the greenish light from fluorescent lamps and the tungsten setting compensates for the warmer, more reddish color of tungsten lights.

As you change the camera's white balance setting you can preview color balance by looking at a scene or captured image on the monitor. If you examine an image closely you may notice that white areas in particular have some color cast to them. If so, you may want to adjust white balance for subsequent shots. Many digital cameras offer a number of white balance settings, including the following:

- *Auto* works in a wide variety of lighting conditions and is the default setting that you should try first. If it doesn't work you can try other settings such as flash or tungsten, or manually set white balance if your camera lets you.
- *Manual* (also called "preset") lets you set white balance manually while aiming the camera at a piece of white paper, neutral gray paper, or other evenly lit neutral surface, under the same light you'll be using to take the picture. This is the best setting when photographing under mixed lighting (any combination of daylight, tungsten, and florescent), as you often are in the home or office.
- *Flash* is best when photographing with flash.
- *Daylight* is best when photographing outdoors in bright sunlight.
- *Fluorescent* is best when photographing indoors under fluorescent lights. Often there is more than one fluorescent setting because there is more than one kind of fluorescent bulb.
- *Incandescent* or *tungsten* is best when photographing indoors under incandescent lights.

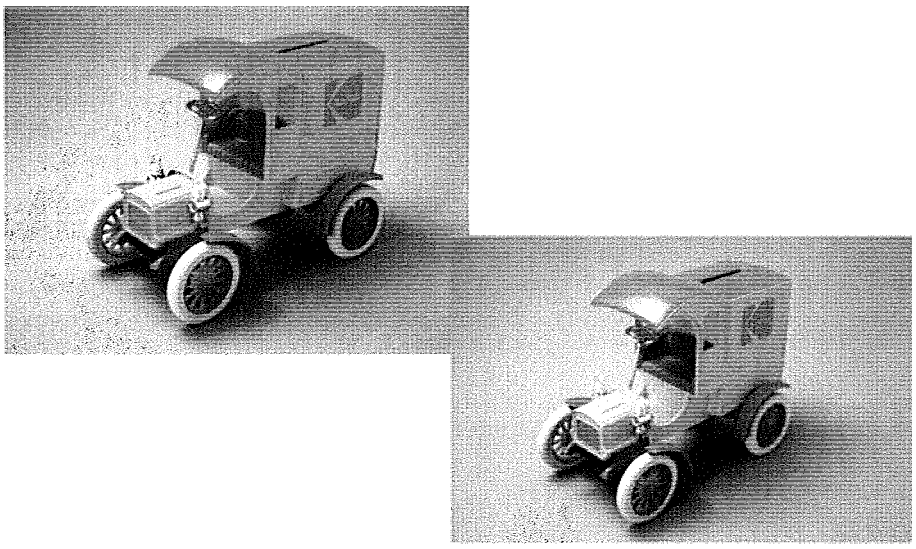
■ *Cloudy* is best when photographing outdoors in cloudy or overcast conditions.

■ *Shade* is used in open shade such as under a tree where the only light is the blue reflected from a clear sky.

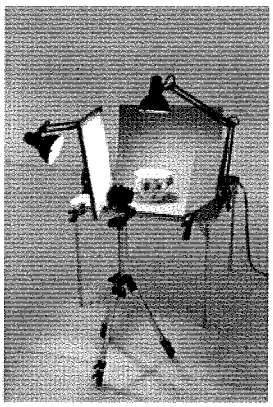
■ *Daylight* is best in direct sunlight.

Ideally, every light source illuminating a subject would have the same color temperature so the camera's white balance system could capture perfect

White balance settings on your camera can have a huge effect on the colors you get. Here the same subject has been photographed with two different settings—daylight (top left) gives it a warm look, and auto or tungsten (bottom right) renders the colors more realistically.



These two photos were taken under the exact same light, but with different cameras. Both the gray background and yellow colors differ significantly.



The tungsten lights create a pool of light that white balance can capture accurately. However, light coming through the windows will make everything else blue.

colors. This is how it is done in a studio. However, in other settings mixed light is more often the case. For example, indoors there is usually ambient light streaming in windows and direct light from tungsten lamps or maybe fluorescent fixtures. Outdoors the subject may be lit on one side by direct sunlight, and on the other by light reflecting off a colored wall. When you set white balance, it can only be set for part of the subject. Other parts will have some color shifts to them, especially shadow areas or parts of the subject farthest from the brightest source of light. These areas are more likely to be illuminated primarily by light from another source. If light reflected from the blue sky is illuminating shadow areas, these areas will appear blue.

In addition to selecting a white balance setting, some cameras give you others ways to ensure you get the colors you want.

■ *White balance bracketing* takes a photo and then processes it using a series of white balance adjustments. At least one image is at the setting you've specified, one is redder, and the other bluer.

■ *Fine tuning controls* let you manually adjust the selected white balance setting to make it slightly redder or bluer.

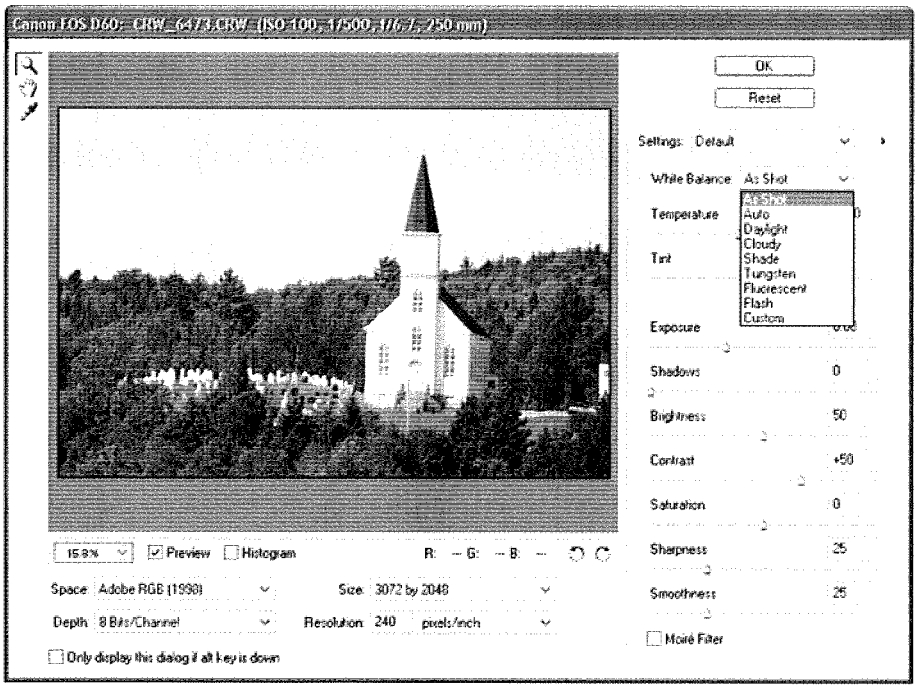
■ *Saturation* controls the intensity of color in an image and some cameras let you increase or decrease it.

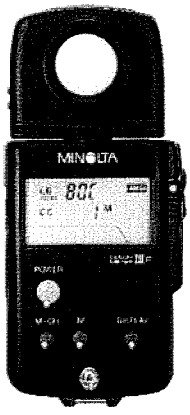
■ *RAW mode* doesn't use a white balance setting. You select one later, while editing the image on your computer. This is the ideal situation since you can change the white balance while looking at the image on the screen and seeing the effect your change has. If you don't like the result, you can undo it and try another setting.

■ *Color temperature settings* let you set the camera to a specific color temperature. If you want to get really serious, you use a color temperature meter to determine the exact color temperature of the light, then use this setting to match it.

The almost universally recognized manual white balance icon.

Using a program such as Photoshop you can set the white balance of a RAW image after you've taken it.





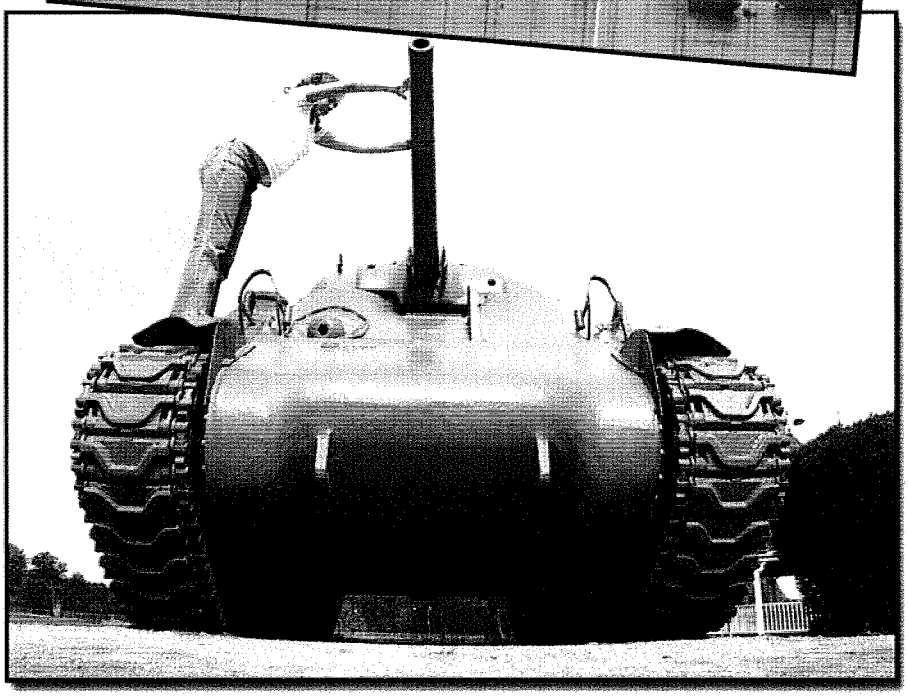
One way to ensure you get perfect color is to use a color meter that measures the exact color temperature of a scene.

Color Balance and Time of Day

In photography, there is a color of light called "daylight." However, this type of light occurs only at a specific time of day. Over the course of the day, the light can change from a warm red at sunrise, to a cold blue at noon, and then back to a warm red or orange at sunset. "Daylight" on the color temperature scale is really set for midday sun between 10 A.M. and 2 P.M on a clear day. During these hours, colors appear clear, bright, and accurate in a photo.

Before and after midday, light from the sun is modified by the extra distance it travels through the Earth's atmosphere. Some of the blue light is filtered out, leaving the light with a more reddish cast than at midday. This is easily seen very early or late in the day when the light is often quite red-orange in tone. The change in color will affect your pictures strongly, and this reddish cast is a wonderful light to photograph in.

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

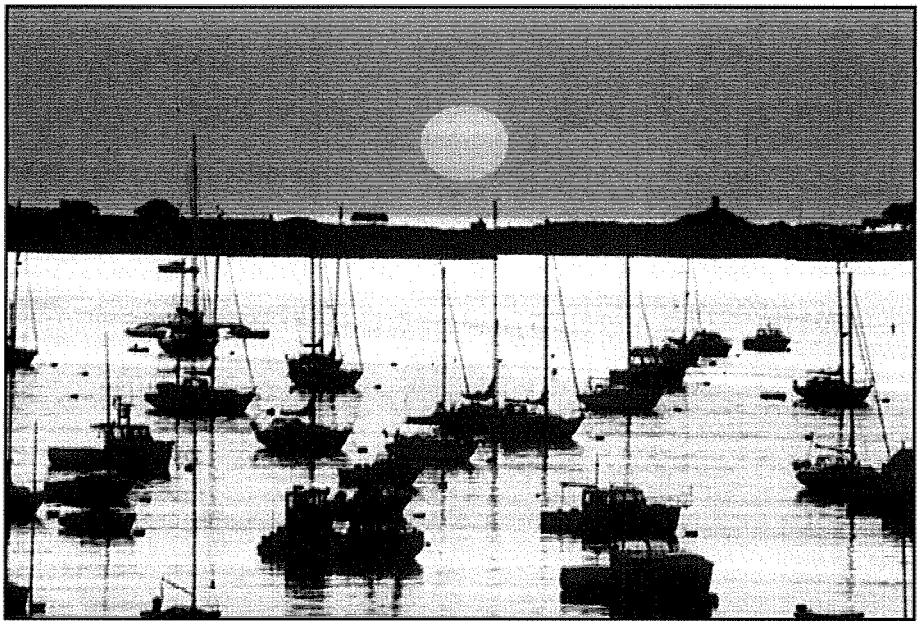


Midday light on a sunny day produces colors that appear natural and accurately rendered.

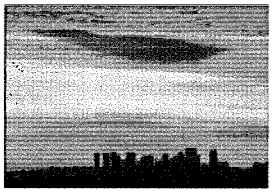
Early morning and late afternoon light produces a more reddish color balance than you get at midday.

SUNSETS AND SUNRISES

Sunsets and sunrises are relatively easy to photograph because the exposure is not as critical as it is with some other scenes. If you underexpose the scene slightly, the colors will simply be a bit richer and darker. Slight overexposure will make the same scene slightly lighter.



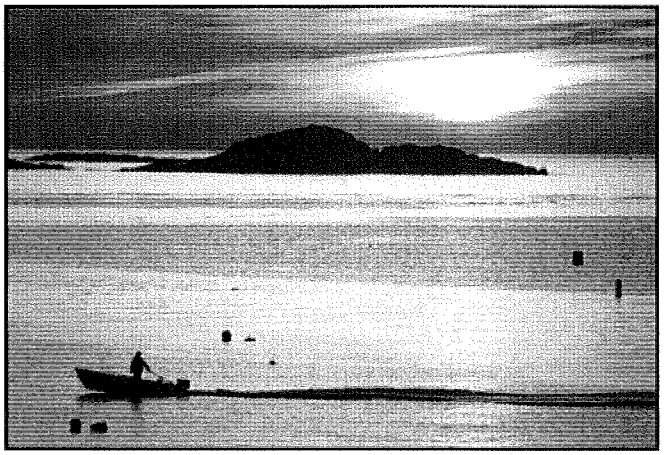
The sun often takes on a flattened appearance as it rises above the horizon. When partially obscured and softened by a haze, its warm, red glow illuminates the foreground.



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.

The colors in the sky are often richest in the half hour before the sun rises and the half hour after it sets. It pays to be patient as you watch the sky change during these periods. For one thing, the sun itself is below the horizon and not in the image so exposure problems are greatly reduced. Also, clouds in the sky often light up dramatically and in some cases, reflect the light to other clouds until you find yourself under a wonderful canopy of reflected color.

Every sunrise and sunset is unique and the variations can be truly amazing. It's certainly not true that "if you've seen one sunrise or sunset, you've seen them all." If you want the sun in the photo, it has to be softened and partly obscured by a mist or haze. If it rises or sets as a hot white or yellow ball, find another subject, or turn around and photograph the scene it's illuminating.

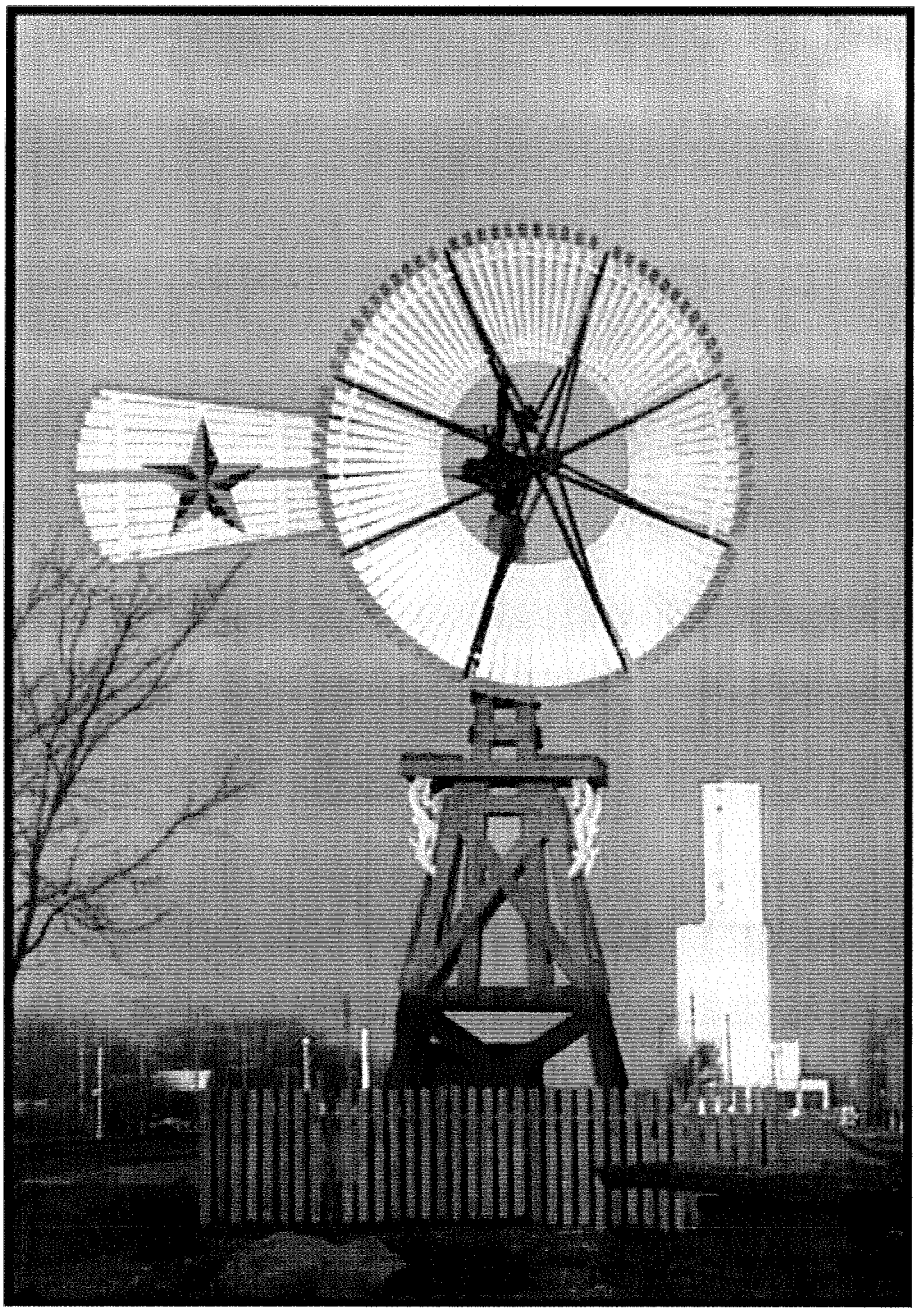


With the bright disk of the sun included in a sunset or sunrise, your picture may come out somewhat underexposed and darker than you expected it to be unless you increase exposure 1 or 2 stops.

WARNING!

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

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.



Instead of shooting into the sun at sunrise or sunset, shoot with it behind you to capture rich, warm colors of scenes bathed in the sun's light.

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, can also add interest.

Here the camera was positioned so the rising sun was behind one of the grain elevators and wouldn't burn out the image with its glare.

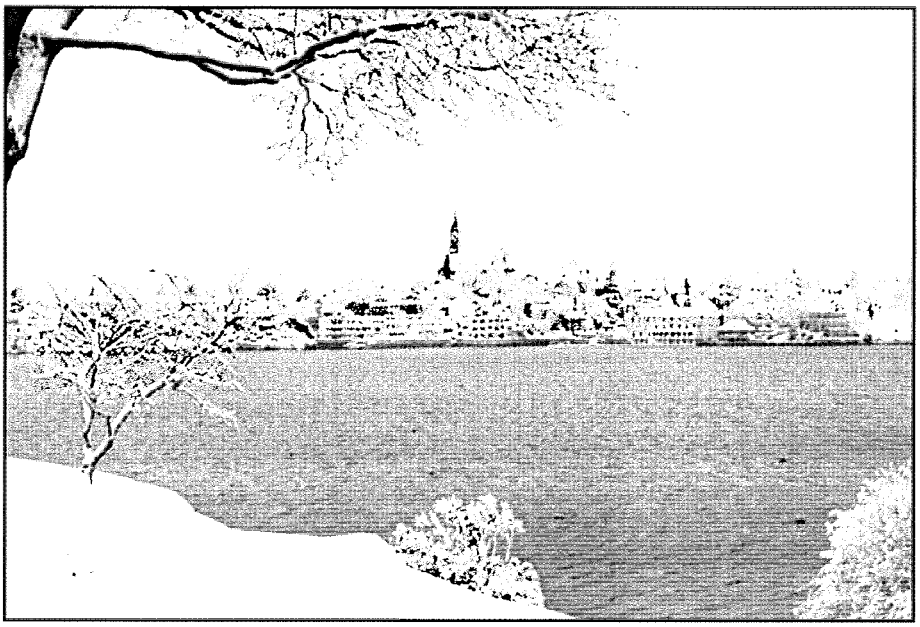
ANTICIPATING THE SUN AND MOON

When planning to integrate the sun or moon into an image it helps to know when it rises or sets and what phase the moon is. This information is available in almanacs and on the Web at the U.S. Naval Observatory (http://www.usno.navy.mil).

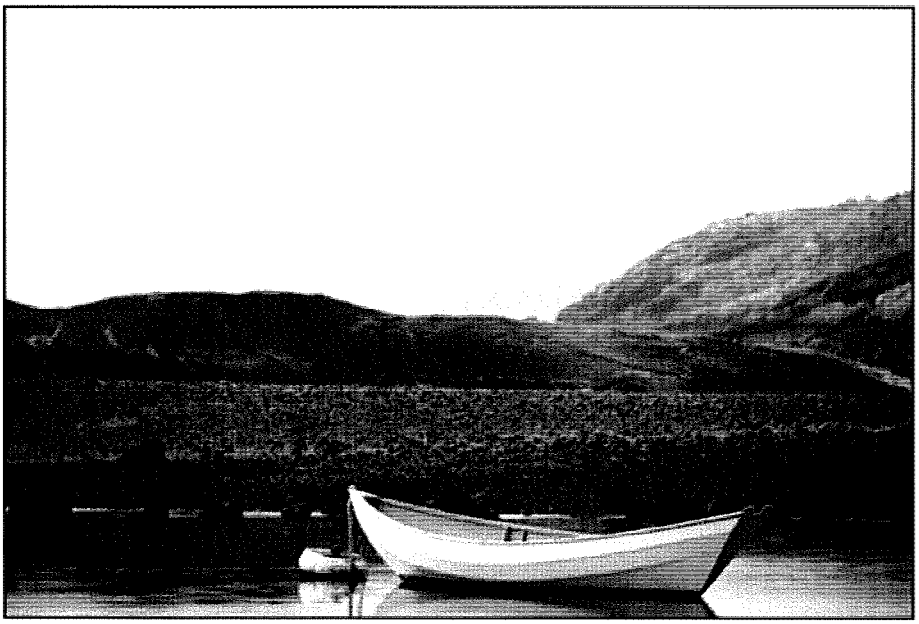
Weather

There's no need to leave your camera home just because the sun hasn't come out. In fact, rain, snow, fog, and mist can add interest to your pictures. Objects at a distance often appear diffused and gray in such weather, with foreground objects brighter than normal because they are seen against a muted background. Remember to take a little extra care in bad weather to protect your camera against excessive exposure to dampness.

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



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

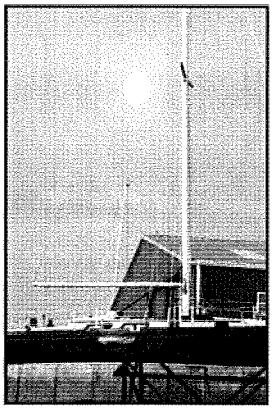


CAMERA CARE

In the cold, the monitor may be slow to come on or suddenly change color. Batteries also run down a lot faster. To reduce these problems, keep the camera or battery under your coat.

Rainbows always make good pictures. The problem is, you rarely find them where or when you want them. To get better at capturing them, you should know something about how they form so you can anticipate them. Rainbows are formed by sunlight being refracted by raindrops. You'll usually find the combination of rain and sun at the leading or trailing edge of a summer storm. You can't see rainbows at all times of the day. To understand why, visualize the way the rainbow works. If you stand with your back to the sun while looking at a rainbow, imagine a line from the sun passing through your eye, through the Earth, and out into space. (This is called the antisolar point.) The rainbow forms a complete circle around this imaginary line, however from ground level part of it is always 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 half, will be below the horizon where you can't see it.

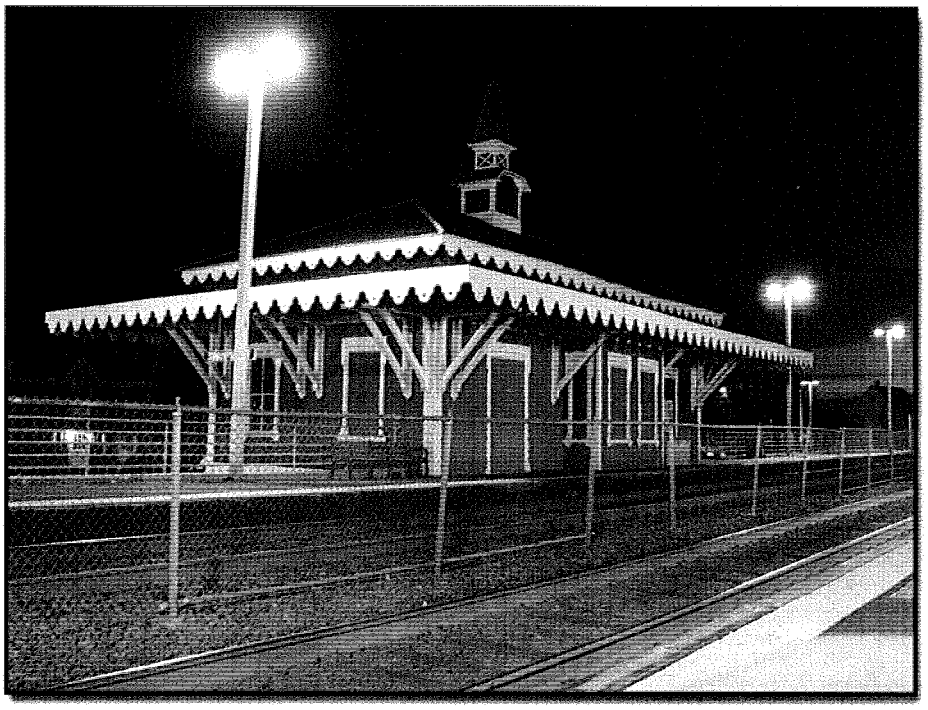
From a plane you can sometimes see all 360 degrees of a rainbow. Here you see a section of one shot through an airliner window.



A very light mist can dim the sun enough to include it in a photograph. If it weren't partially obscured by the fog, it would appear as a white dot against a very dark background.

PHOTOGRAPHING AT NIGHT

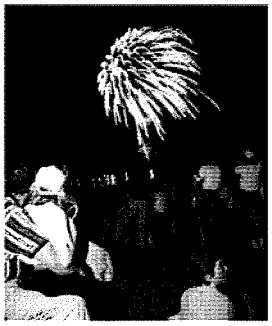
You can photograph many different things outdoors at night, so don't put your camera away just because the sun is gone for the day. Light sources (street lights, automobile lights, neon signs, or fires) or brightly lit areas (illuminated buildings or areas under street lights) will dominate pictures 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.



This old train station was shot at night with just illumination from lights on the platform.

TIPS

At night, turn off the flash unless you want to illuminate nearby subjects. Leaving it on may throw off your exposure.



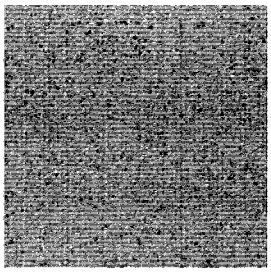
Fireworks can be dramatic, but are difficult to capture. You need to experiment and a digital camera is perfect for that because you can instantly review your results.

To capture interesting images of fireworks, put people or water in the foreground. It also helps if there are identifiable objects in the image such as an illuminated building or monument to give the viewer a sense of place. Get upwind from the show since fireworks generate a lot of smoke that can become a problem if you are downwind. If you are upwind, the smoke will also become part of the image, illuminated by the fireworks. Automatic exposure doesn't work well with fireworks. If you can, set your exposure by switching to aperture-priority, shutter-priority, flexible program, or manual mode and choosing the largest aperture and a shutter speed of 1/30 second or bulb. Try a series of exposures of different bursts because there is a certain amount of luck involved. You might also use flash to illuminate foreground figures or one of the continuous modes to capture a series of images.

You might try increasing the ISO, use exposure compensation or autoexposure bracketing, and try different combinations of aperture and shutter speed. For example, a very slow shutter speed might let you capture more than one burst. For special but hard to predict effects, you might try slow-sync flash if there is a foreground subject that can be illuminated.

The moon, especially when full, adds a lot to an image. The best time to capture the moon is when it's near the horizon. Because it is close to foreground objects at that time, it looks much larger than when it's higher in the sky. Keep in mind that the moon is relatively dim and usually requires long exposures. Since it's moving relative to the Earth, longer exposures can actually blur it, giving it a slightly oblong shape. To reduce the chances of this happening, shoot just before sunrise or just after sunset when there is still some light in the atmosphere from the recently set sun. (It bends around the Earth's curvature due to refraction in the atmosphere.)

The rising full moon, and the trail of light it leaves across the water adds a lot to this photo of an old-fashioned coal-burning power plant on Salem Harbor.

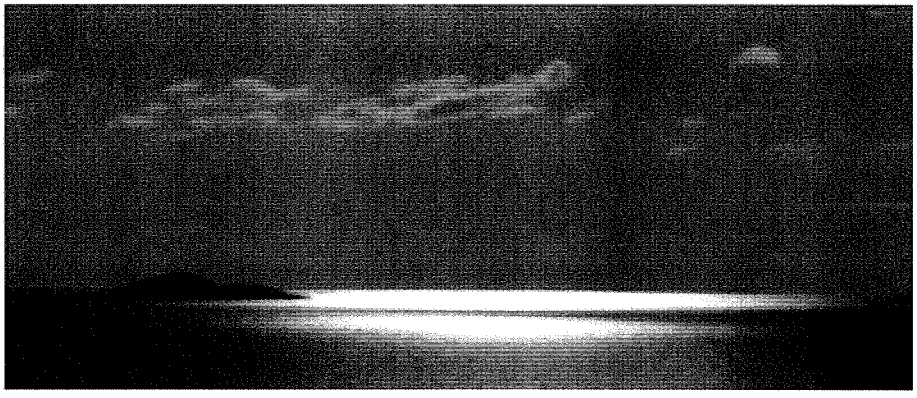


Noise appears in an image as grain or multicolored random pixels.

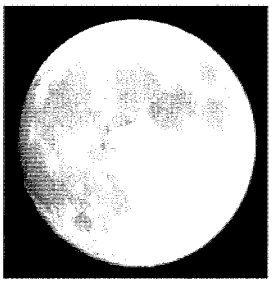
When you photograph with long shutter speeds, usually above one second, the image sensor collects noise along with image pixels. The noise appears as grain in the image, reducing its sharpness and making it fuzzy. To eliminate this noise, some cameras have a noise reduction mode that cancels out the noise for better images.

USING BULB

In addition to your normal shutter speed settings, you can choose *bulb*. This cancels the flash and keeps the shutter open as long as you hold down the shutter button. To avoid blur in your images due to camera shake, use a tripod and the self-timer, remote control, or cable release so you don't move the camera when you press the shutter button.



Resting the camera on a bench for this picture captured a soft, romantic image of the moon's reflection on the sea.



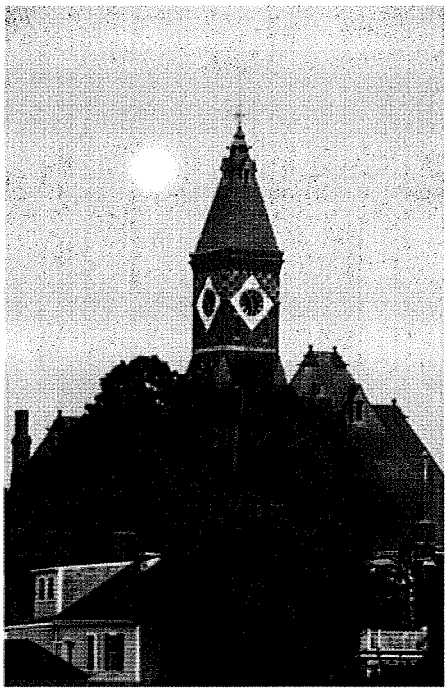
The full moon taken with a telephoto lens on a digital camera.

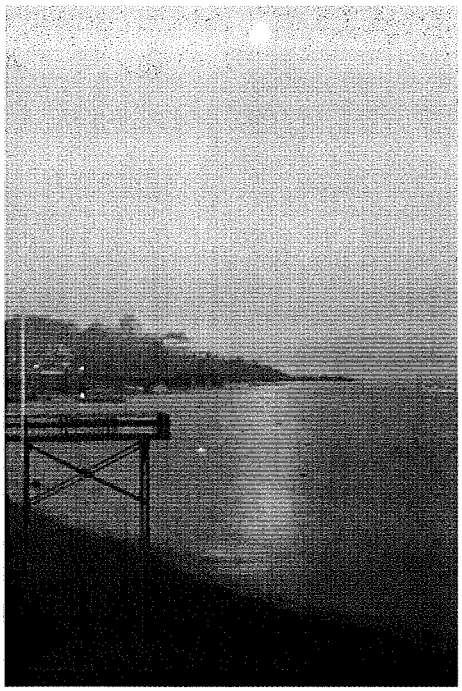
TIPS

At night, here are some things you may want to explore:

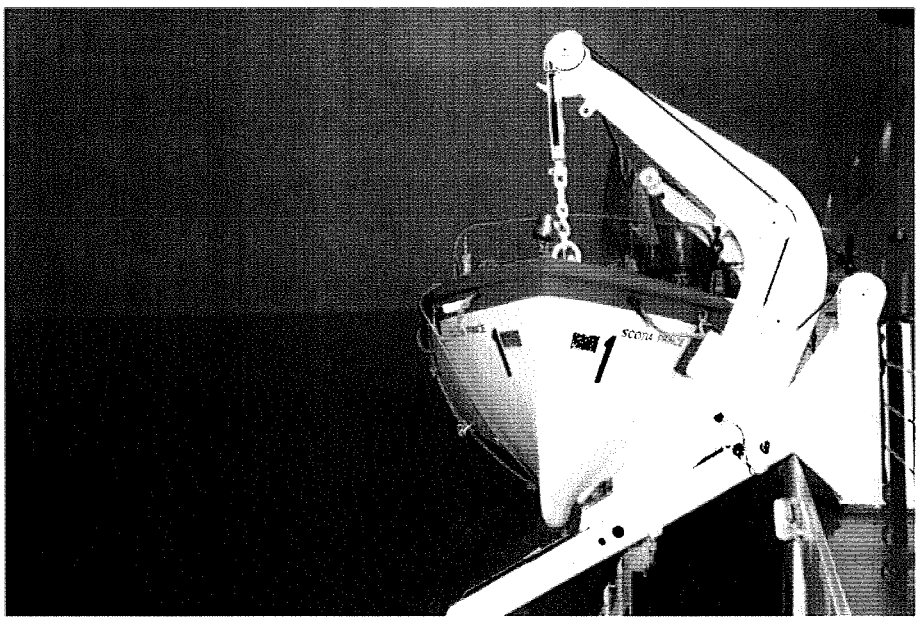
- Use noise reduction mode to reduce noise in the dark areas of the image.
- Switch to manual exposure mode and use bulb.
- Try slow sync flash for unusual lighting effects.
- Increase the ISO.
- If focus is a problem, switch to infinity or manual focus.
- Use the self-timer, remote control or cable release to trigger the shutter without moving the camera.

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





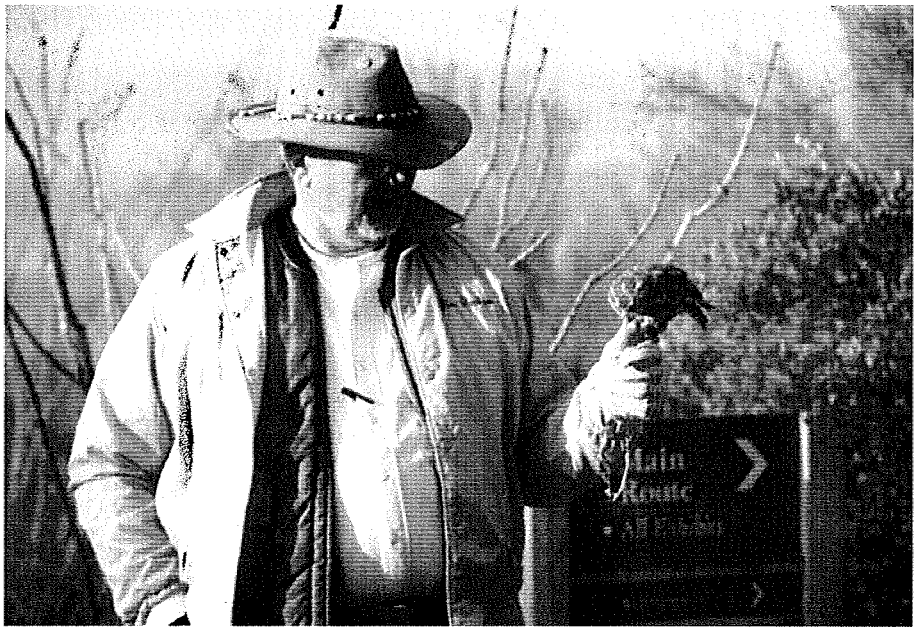
Slow sync flash lets you lighten what would otherwise be a black background when you use flash at night.



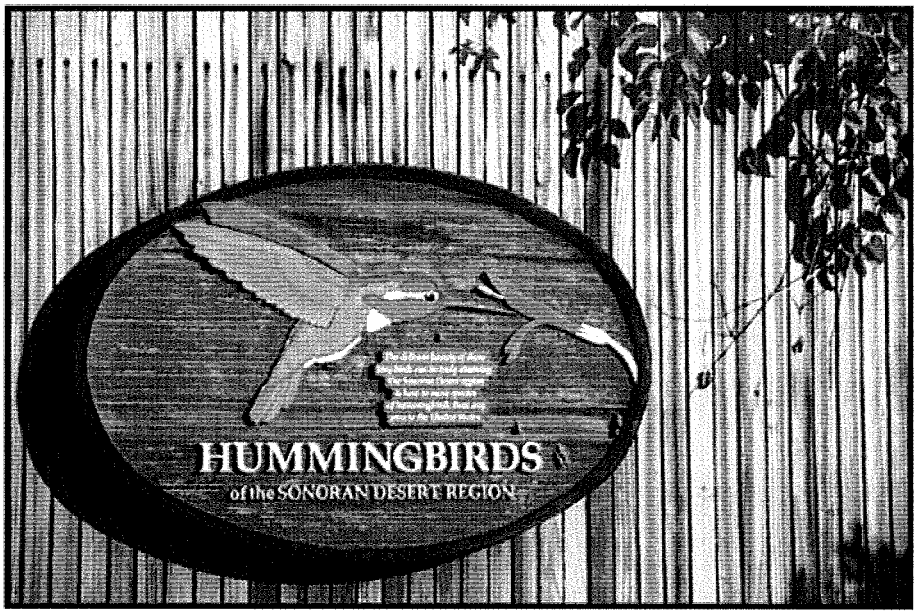
THE DIRECTION OF LIGHT

The direction that light is coming from relative to your camera's position is important because it affects the shadows that will be visible in your picture. Four main types of lighting are illustrated here: front-lighting, side-lighting, backlighting, and top-lighting. Notice the position of the shadows in these photographs and how they affect the subjects.

The direction of light can affect your automatic exposure. Backlighting, for example, can leave your subject silhouetted against a background so bright that your automatic exposure system will underexpose the scene and make the subject even darker. This is fine, if you want a silhouette. If you don't, you should use exposure compensation to lighten the image.

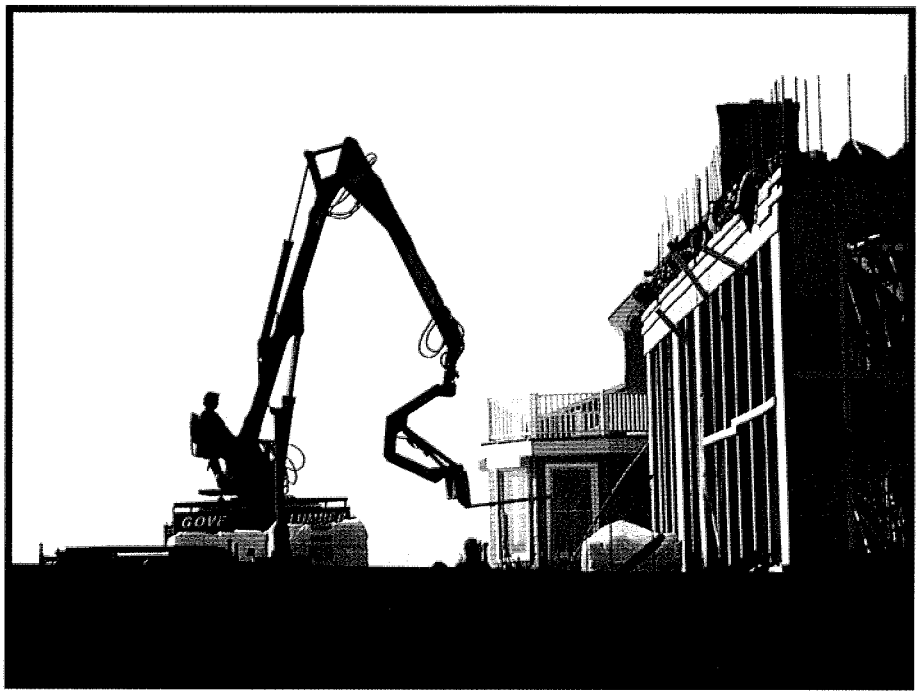


Side-lighting increases the sense of texture and volume because such cross-lighting casts shadows visible from the camera's position that emphasize surface details. Landscape photographers often prefer to work early in the morning or late in the day because the low sun sidelights scenes and adds interesting surface textures.

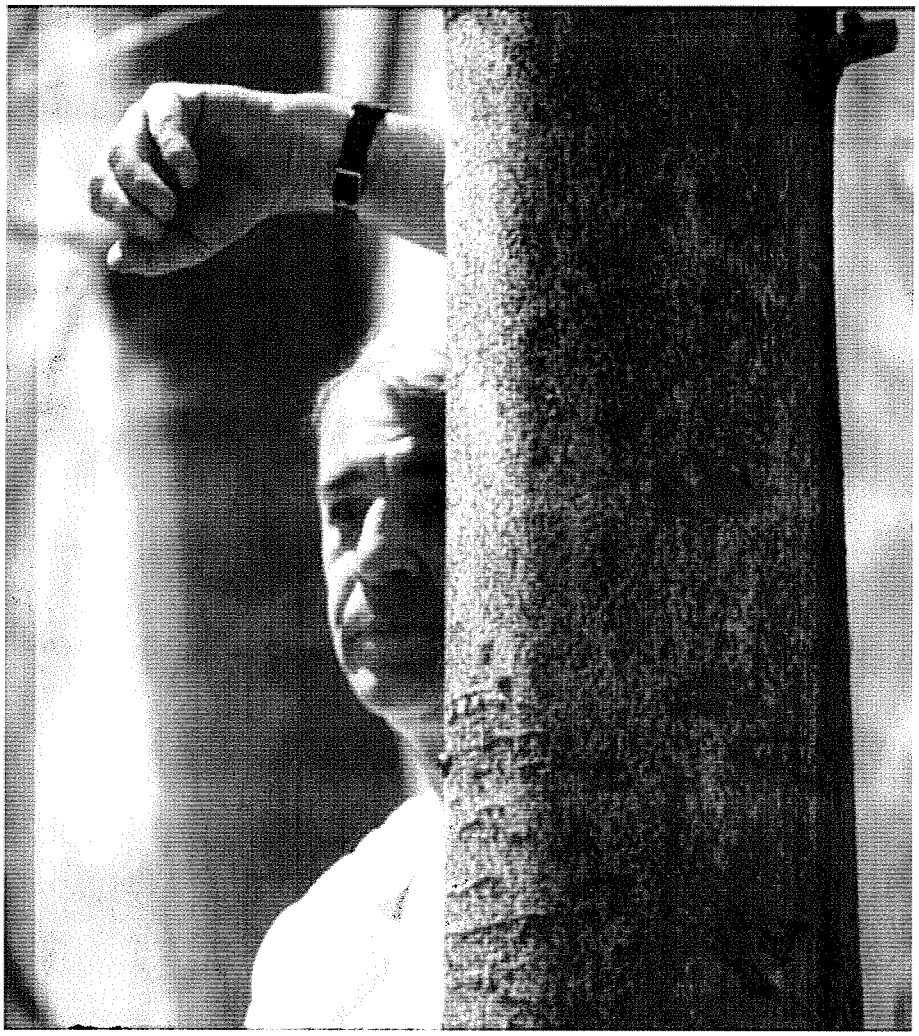


Front-lighting more or less from the camera's position decreases visible shadows and so minimizes surface details such as skin texture. Front-lighting also tends to minimize the apparent roundness or volume of the subject

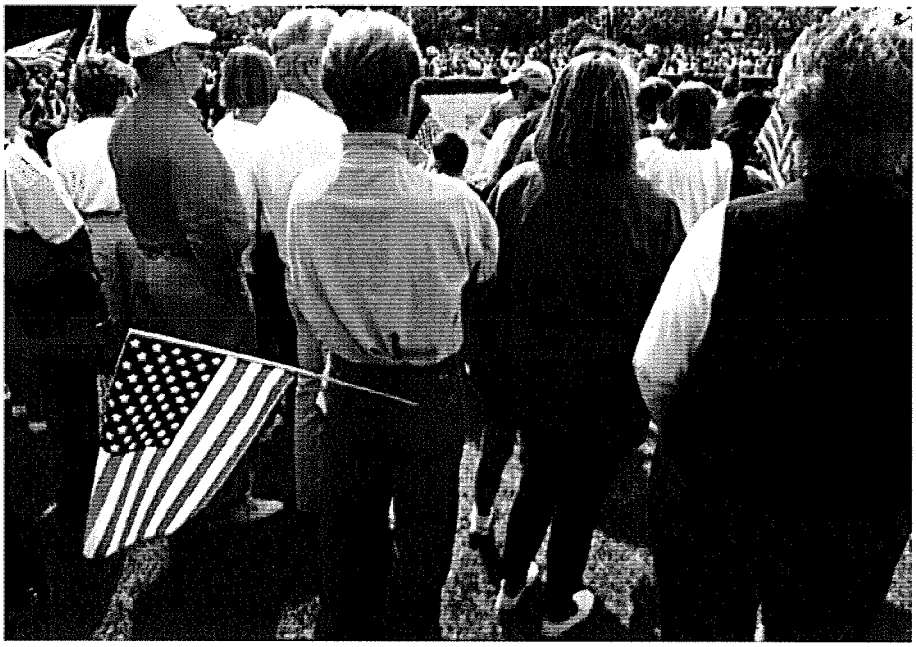
Backlighting puts the side of the subject that is facing the camera in shade. Automatic exposure tends to make backlit scenes too dark. You can use this effect creatively or add exposure to lighten the picture, especially those parts that are in shade.



Top-lighting can occur outdoors at noon or indoors where ceiling lights predominate. If you are photographing a person, you will notice that top-lighting tends to cast shadows in eye-sockets and illuminates the top of the nose brightly. To avoid this effect, you might try moving the person into the shade.



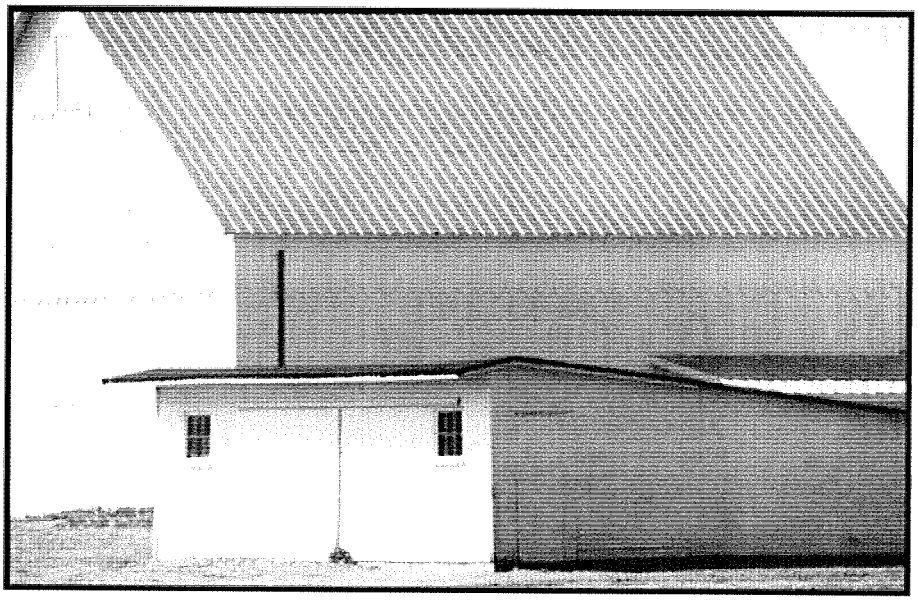
Top-lighting can selectively illuminate things, such as this flag in the man's back pocket, that would be in shadow with light coming from a lower angle.



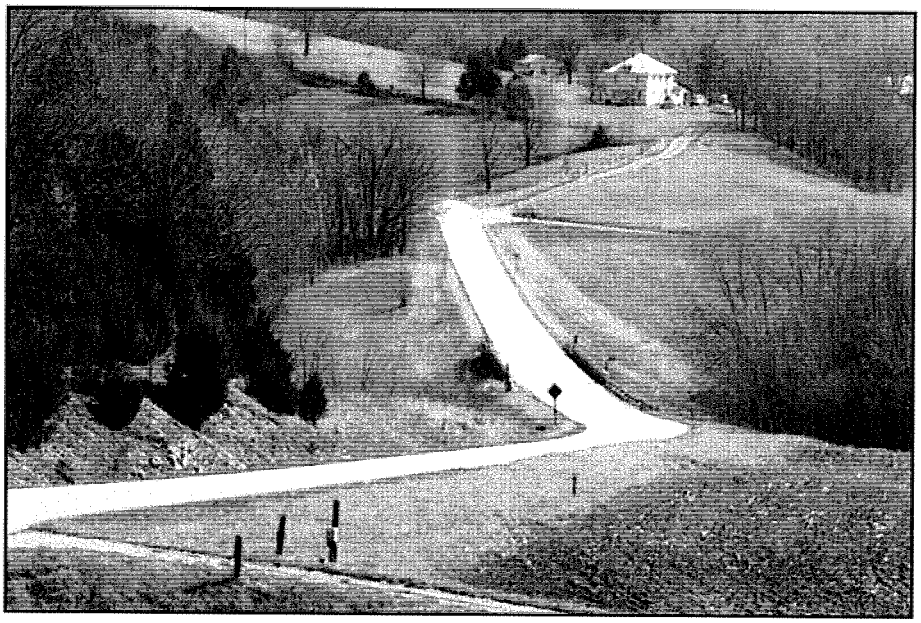
THE QUALITY OF LIGHT

Light not only has direction, it can be direct or diffused. Direct light coming mainly from one direction, produces relatively high contrast between bright highlights and dark shadows. 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 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. If this creates a problem because both highlights and shadowed areas are important, you can sometimes add fill light to lighten shadows and decrease contrast and some cameras let you adjust a contrast setting. In diffused light, colors tend to be softer than in direct light and textures are also softened because shadow edges are indistinct.



Direct light comes from a point source, such as the sun on a clear day. Direct light produces dark, hard-edged shadows that crisply outline details. Here the light and shadows almost form an abstraction.



Diffused light comes from a light source that is so large relative to the subject that it illuminates from several directions. On a hazy or overcast day, illumination comes from the entire dome of the sky, not from the brighter, but smaller, sun. Indoors, light bounced into an umbrella reflector or onto a wall or ceiling creates a broad source of light that wraps around the subject.

instantly IMPROVE your IMAGES

by Ray Salisbury

hotpixels PHOTOGRAPHY

Sounds too good to be true? But it is. You *can* improve your photos quickly:

- while shooting on Auto settings
- without intensive academic study
- without spending $1,000s on workshops

Here's four ways to get better photos:

1 Buy a better camera

A smart photographer famously remarked that **'the best camera is the one that's with you.'** Even better, if that camera happens to have a huge mega-pixel count, and can handle low light.

Smartphone cameras *do* appear to take stunning images - at least when you view them digitally on a screen. However, if you wish to print your pictures at a large size, or even sell them for commercial use in the future, then **you really need a DSLR**, (or high level mirrorless camera).

One of the big advantages of the bigger cameras are **interchangeable lenses**. Sharp lenses make sharp images. The tiny lens on your phone is fixed, and extremely limited in function.

Simple. Invest in a DSLR with quality lenses, and you'll see the difference in your images.

2 Go to a better location

'Location, location, location' is the catchcry with real estate, and it's also vital in landscape photography.

Another truism is: **'if you always do what you've always done, you'll always get what you've always got.'**

If your landscapes are lacklustre, perhaps it's the **subject matter** that's at fault? Maybe it's time to plan a mission to a new location?

This usually involves planning, organising transport and booking accommodation. But be asured, the extra money and effort expended will be worthwhile.

Try a weekend trip away to a scenic spot... **a national park** with lakes, waterfalls, and hilltop lookouts. Or, go coastal... **somewhere with spectacular seascapes**, rugged rock stacks, towering cliff faces and gorgeous sunsets.

Regular road trips are the way pro photographers accumulate enough remarkable images to sell to calendars, magazines and stock image libraries.

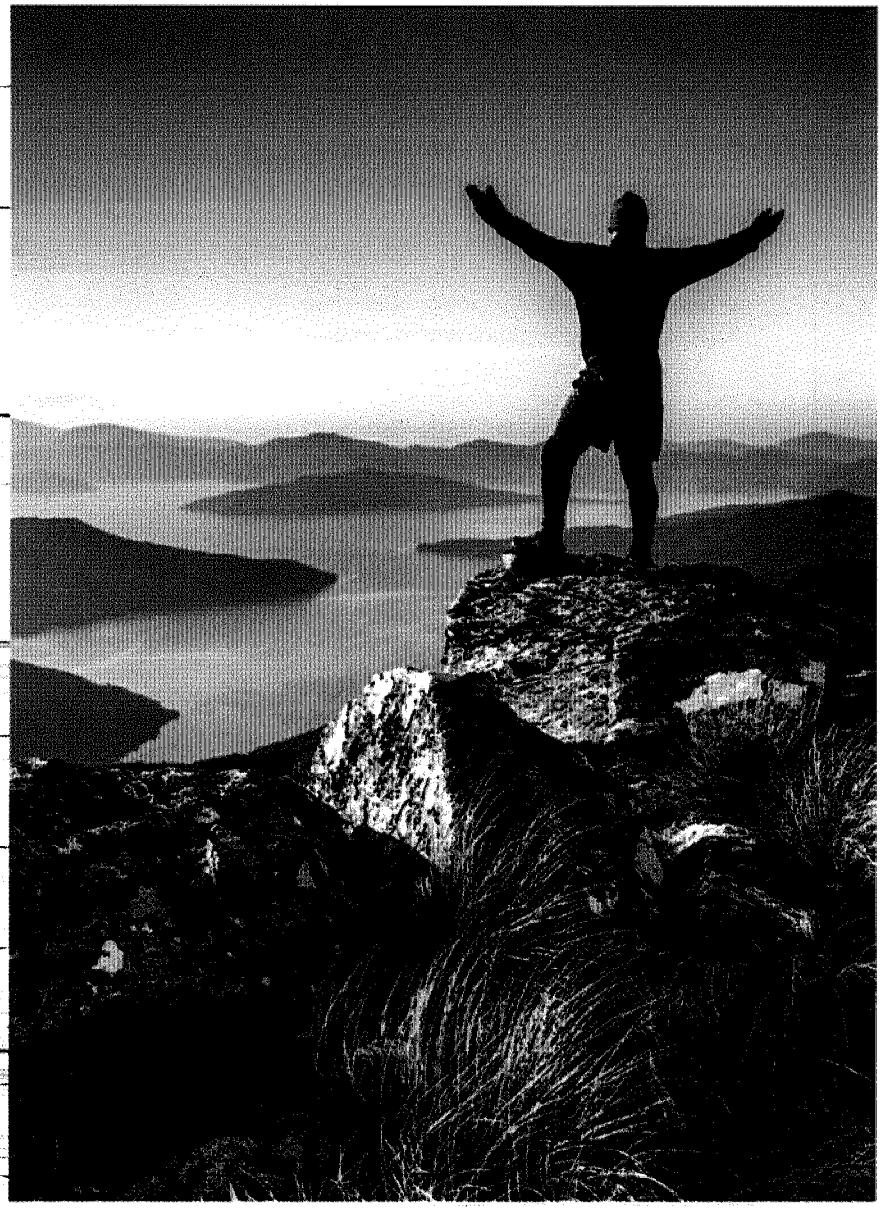
Be warned: you might find these seasonal 'missions' to be addictive!

Here's three tips to bombproof your photography holiday, and mitigate the chances of failure:

■ SCOUT THE LOCATION
Estimate the driving and walking times, so you arrive on location before sunrise. Ideally, you should scout a new location the previous day, or arrive an hour early.

■ FIND INSPIRATION ONLINE
Do internet search for images of this location, either on Google, Instagram or Flickr. Look out for professional-looking shots you'd like to emulate, and find out from what exact spot the photos were taken from. Look at topographic maps.

■ CHECK TIDE, WEATHER, & SUN INFO
Use The Photographer's Ephemeris or Photo Pills app on your phone. Decide where on the horizon the sun will rise or set.



3 Shoot in better light

Just like in comedy, **timing is everything.** Contrary to popular practice, shooting under the midday summer sun is unlikely to produce inspiring results; the overhead sun creates short shadows, which are harsh. Therefore, landscapes lack three-dimensional form and appear flat and lack-lustre. People have unflattering shadows under their facial features. Blue-sky days are great for exploring outside, but make for boring photos.

For quality light, try shooting in the **Golden Hour** - that magical time of day before sunset (or after dawn) when the light is softer and diffused, the hills are bathed in a golden glow (and when your companions are most likely heading home for dinner.)

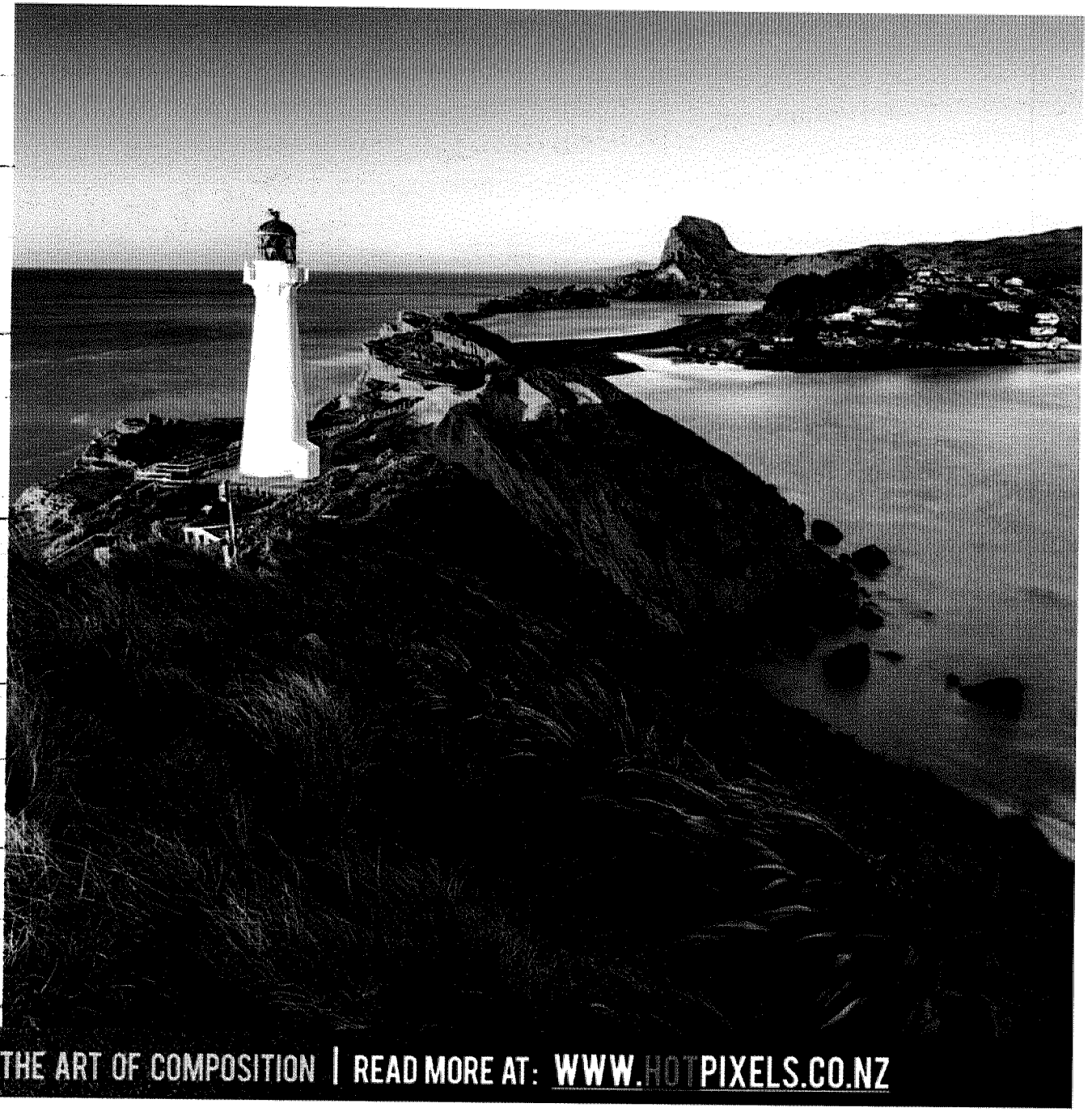
Also try shooting in the **Blue Hour**; half an hour after sundown, when the colours of the sky can become brilliantly intense. Alternatively, brave the elements and shoot immediately **after a storm**, waiting for the moment when a shaft of light penetrates the moody sky.

4 Get better at composition

You can own the most expensive camera, understand all the technical jargon about apertures, shutter speeds, exposure and hyperfocal distance, yet your photographs can look lifeless.

Photography is, first and foremost, an artform. While it utilises sophisticated modern technology, the joy of creating something new, of self expression, is at the heart of this hobby.

Even if you operate your camera on **Auto mode**, you can quickly learn to frame your photos in an aesthetically pleasing way that captures the viewer's eye.
This is a little-known short-cut to fast-track your photographic journey. You just need to focus (ah, another pun!) on studying the basic principles of composition.
Click below to check out the popular on-line courses by Ray Salisbury.



DO AN ONLINE COURSE : MASTER THE ART OF COMPOSITION | READ MORE AT: WWW.HOTPIXELS.CO.NZ

Digital Photo & Graphics Checklist: Unit 2

Assignments:

1. Textbook Reading: Chapter 5- Capturing Light & Color 10 Points
   Supplemental Reading: Instantly Improve Your Images- Ray Salisbury
   - Take notes and use active reading techniques such as highlighting or underlining text that you may need to refer back to. (questions, important topics, worksheet answers, etc.)
   - Turn this packet in completely with your chapter notes (I use the margins). It is completely ok to write on this text.
   - Don't worry about reading the entire chapter in one sitting. Take your time and carefully read 5-7 pages per day for reading comprehension and understanding.
2. Chapter 5 Worksheet Quiz 15 Points
   - Complete this quiz/ worksheet as you like. You can choose to fill in the blanks as you read or after you have finished.
3. Week 2 Photo Journal 25 Points
   - Practice incorporating the concepts from the textbook into your photos.
   - Save all of your photos. This week I am looking for you to be active in taking photos and working on capturing light and color!
   - Don't forget to enter a written journal daily.
4. Choose a photo subject category from the provided list. The assignment details are listed here: 20 Points
   - Select a single category.
   - Take several photos of items, people, etc. that fit into the category.
   - Turn in the original unfiltered photograph. (Or save them.)
   - You may edit the photos if you have the availability. (please don't go wild with edits at this point) You can also turn in (or save) the edited photos.

Top 3 Things I Learned in this Unit. 5 Points

_____

_____

_____

_____

_____

_____

_____

Total / 75 Points

Name:_____ Section _____ Date:_____

HHS Digital Photography Unit 2. Worksheet

Directions: Please put your answers on the attached answer sheet. Answers may be used more than once.

1. A colorful object such as a leaf appears green because when white light strikes it the green _____(1)_____ are the only ones reflected.
2. A Light's color is specified by its _____(2)_____.
3. _____(3)_____ Doesn't use a white balance setting. It simply records the information from the image sensor.
4. _____(4)_____ on the temperature scale is set for midday sun from 10 am to 2 pm on a clear day.
5. The colors in the sky are often the richest ½ hour _____(5)_____ sunrise.
6. Taking a photo with the sunrise or sunset behind the photographer gives a _____(6)_____ tone that can't be found any other time of the day.
7. During Rain, Snow, Fog, and Overcast skies, _____(7)_____ helps to make photos soft and reduces harsh shadows..
8. Rainbows are formed by sunlight _____(8)_____ raindrops in the sky.
9. To Capture Interesting images of fireworks, put people or buildings in the _____(9)_____.
10. The best time to capture the moon is when it's near the _____(10)_____.
11. The _____(11)_____ light is coming from is important because it affects the shadows cast on your subject.
12. _____(12)_____ puts the side of the subject facing the camera in the shadows creating a shilouette.
13. _____(13)_____ can selectively illuminate part of your image to create a focal point.
14. _____(14)_____ produces crisp, dark, hard-edged shadows.
15. _____(15)_____ illuminates a subject from several directions and leads to softer, more subtle shadows.

Name:_____ Section _____ Date:_____

HHS Digital Photography Unit 2. Answer Sheet

Directions: **Please put your answers on this attached answer sheet. <u>Answers may be used more than once.</u>**

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____

A. After
B. Backlighting
C. Before
D. Cool
E. Daylight
F. Direct Light
G. Direction
H. Foreground
I. Horizon
J. RAW
K. Refracting
L. Temperature
M. Top-Lighting
N. Wavelengths
O. Warm

Photo Subject Categories- Digital Photography & Graphics Weeks 2-6

Each week you will submit 5 "magazine quality" photos in a particular category or subject area. There is a list below, or you may propose your own category. Each week I would like you to try something new, so please do not duplicate your photo category from one week to the next.

It will be important for you to take more than 5 photos. A good rule of thumb is to take 50-100 photos and select the best shots for your final submission.

Original Work:
I understand you may already have that purrrrrrrfect photo in your camera roll that is made for this assignment and ready to turn in. **DO NOT** turn that one in... My goal is for you to take photos with the intention of improving your skills and knowledge. I love to see those great shots you have--- but I will not grade photos that you have not taken during the course of this course...

Requirements:
There are several choices for your weekly photo category. Each Category you will turn in:

-Five (5) original photos, unfiltered. I prefer these to be in JPEG or some type of RAW format.
-Five (5) edited 5x7 inch final photographs,
-A contact sheet with captions
-An itemized list (by Photo) describing the process and editing tools or settings you used to reach the final image

Photo Category Suggestions:

Nature- Things of the natural world- Trees, Plants, Animals, Mountains, Beaches, Lakes, Rivers, Landscapes, etc. This list could go on for a long time. The important thing is that, by far and away, this is a photo subject that is void of man-made things. A picture of a friend riding his ATV probably fits best in a different category.

Landscapes- Landscape Photography usually takes a larger view of our surroundings. It will still be important to keep image composition in mind. This is not simply pointing a camera in a direction and pressing the shutter button

.

Candid- Candid Photos usually involve people or groups of people doing something or posed informally. When choosing this subject it will be important for you to fill the frame with your subjects and make sure the background of your photo is not distracting to the purpose of the image itself.

Transportation- These are the things, or tasks, that move us. I have seen great student photographs of trains, trucks, planes, and ships. Keep in mind that a great shot of a mountain biker or even a runner lacing up their shoes would fit into this category as well. If you choose this category, Try to use an appropriate camera angle leading lines to express movement or the lack of movement for a more interesting shot.

Architecture- Structures, Details of buildings, bridges, and monuments. Some choose to photograph the entire structure and its relative surroundings, Another photograph may see the same structure and focus on the details, patterns, or textures in close-up.

Pets & Animals- A class favorite by far! This subject can be challenging because once your pet sees the camera they usually stop playing nicely... Keep in mind sometimes it may be easier to get that great shot of your pet while they are distracted by something else. Also... If it takes you 10 seconds to jump the fence and the bull can cross the field in 9, you might find yourself in trouble. The bottom line is to be safe at all times!

Sunrise & Sunset- I love to capture the natural colors that appear in the golden hour. The hour before sunset and the hour after sunrise. Get there about 20-30 minutes early to spot a great location. It may help to be familiar with the area because you may find yourself venturing in or out in the dark! There have been some amazing sunrises in the past few weeks and sunsets as well. I try to find areas that are not cluttered looking to the east or west depending on the time you intend to shoot.

Night & Low Light- This subject can be handled with or without advanced camera equipment. Some camera phones even have a low-light mode to enhance your photos. Either way, Find something to help steady the camera and hold your breath as you take the photo. This will help with clarity in your photo. There are some neat effects with motion in low light as well!

Portraits- If you are interested in taking formal portraits, I have a tutorial that I will send you. Feel free to have your friends and family pose to try it out. I'm interested to see your results!

Sports--For Sports photography, you should be familiar with 2 terms related to photography. ISO and Shutter Speed. Understanding these terms and what they mean will help you capture crisp action or blur for an artistic effect.

Food- YUM!!! One of the best parts of food photography is enjoying the results of your hard work. You may be surprised to learn about some of the tasty and not-so-tasty ways photographers make the food in advertisements look good!

Digital Photo & Graphics Photo Journal

Day & Date	Journal Entry