

**Comparison of Film and Digital Cameras**  
**Which is Right For You?**

Craig

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Professor Sally

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## **ABSTRACT**

### **“Comparison of Film and Digital Cameras: Which is Right For You?”**

**by Craig**

Digital single-lens reflex (SLR) cameras have reached the point where they are capable of competing directly with film SLR cameras. Amateur photographers interested in buying an SLR camera now have another difficult decision to make: film or digital.

This paper examines features different forms of photography benefit from (e.g. sports, portrait, etc.), the differences between film and digital cameras and photographic techniques, and ends with strengths and weaknesses of each format

The objective of this paper is to inform the reader, helping him or her purchase an SLR camera that may be used and enjoyed for years to come.

## INTRODUCTION

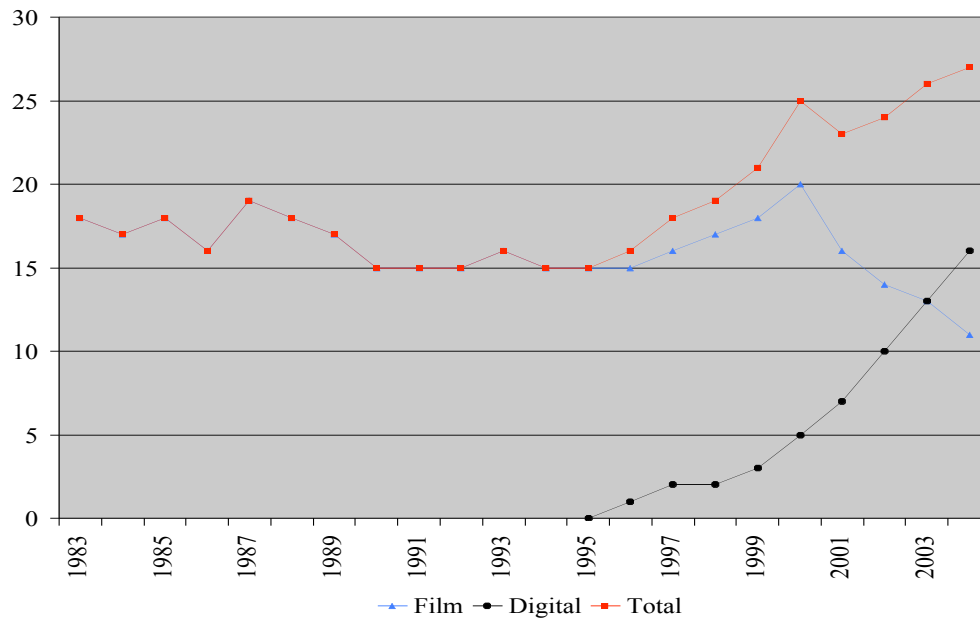
### BACKGROUND

Cameras have been around in one form or another for a long time. Today's modern film cameras can trace their history back to the 19th Century and Nicéphore Niépce's combination of the camera obscura and photosensitive paper (Greenspun, 2003). Film cameras have continually improved and now dominate photography. Consumer digital cameras emerged in 1982 and slowly improved to become film's equal (Greenspun, 2003). How do these two similar, yet very different forms of photography compare, and which is best for your shooting style?

A survey conducted in 2004 by the Photo Marketing Association International (PMAI) report that digital cameras are being used by roughly 42 percent of American households (p. 1). The current trend in the photography market shows a noticeable decline in the sales of film cameras and a steady increase in digital camera sales (PMAI, 2004). Considering the direction the photographic world has turned, should consumers interested in purchasing a camera opt for a digital model or should they take advantage of prices and get a film camera?

Figure 1 shows the current trend in cameras sold in the amateur market. It should be noted that on this figure, "film" includes 35mm, Advanced Photo System (APS), disc, and 110 films. From this figure, we can see that digital camera sales have already surpassed film camera sales as the dominant form of taking pictures.

Figure 1, U.S. Camera Sales (millions of units sold in amateur market) (PMAI, 2004, p. 2)



## PURPOSE

Camera manufacturers introduce new and improved cameras several times a year and deciding on a model to use for the next few years can be a daunting experience.

The purpose of this document is to help amateur photographer purchase a camera they can learn with, grow with, and enjoy, as they become better photographers. This will be accomplished by first giving a general overview of features various forms of photography benefit from. Then, we will explore differences between film and digital cameras. Finally, we will look into some pros and cons of each type of camera.

Making sure you get a camera that suits your skills, style, and needs is essential to enjoying photography. It is also important to anticipate your future needs so you do not outgrow your camera.

## BASIC FEATURES TO CONSIDER

Cameras have improved immensely from the cameras used a decade ago, but cameras are still nothing more than lightproof boxes that hold film and a lens. Modern cameras do not allow us to create better pictures; rather, they allow more of us amateurs to enjoy the hobby of photography.

Each form of photography has features that make it easier to perform. For example, if you were interested in sports photography, you would want a selection of *telephoto lenses* and maybe even *image stabilization*. Once you understand your needs, you can decide on a type (e.g. film or digital), narrow the brands of camera, and finally decide on a particular model.

What follows are brief descriptions of different forms of photography accompanied with some features you would want to make it easier get quality pictures.

### ACTION AND SPORTS PHOTOGRAPHY

Sports and action photography requires a camera that is capable of capturing quickly moving subjects. The following features would help a photographer interested in this form of photography:

Ergonomics. If a camera feels good in your hands and is easy to control, you can concentrate on the action. Lightweight cameras are easier to handhold for long periods of time waiting for the perfect moment of action.

\* This and all subsequent *italicized* entries are defined in the glossary starting on page 21.

Predictive autofocus. Modern cameras usually contain a central-processing unit (CPU) that is capable of detecting how fast and in what direction a subject is moving, then adjusting the focus to the area the subject will be in when the camera is ready to take the next photo.

Multi-zone light metering. This feature means a camera can take *exposure* readings (e.g. how light is the scene) using more than one sensor. With constantly changing backgrounds and lighting, a camera must be able to adjust *aperture* and *shutter speed* to compensate.

Low shutter lag. The time you press the shutter release button to take a picture until the time the picture is taken is called shutter lag and is measured in milliseconds (1,000ths of a second). For quickly moving subjects, this should be as low as possible.

Fast shutter speeds. To effectively stop quickly moving subjects and minimize blurring, a camera must be capable of shutter speeds of  $1/2000^{\text{th}}$  of a second or faster. This usually entails having a lens with a large maximum aperture (e.g. f-stop)

Fast motor drive or fast memory access. Since it is hard to capture just the right moment when things get moving fast, taking several pictures in sequence helps to make sure a good expressive photo is taken. The ability to capture pictures per second (motor drive or memory card) would be the slowest you would want for any camera.

Image stabilization. There are currently two cameras in production (both digital) that have built-in image stabilization and three lens manufacturers that incorporate it into their lenses. This feature detects small vibrations or shaking of the camera and corrects this by either adjusting the *image sensor* or by moving lens elements within the lens itself. This will reduce lens vibrations and allow for sharper images and is particularly helpful at the long focal lengths sports and action photographers use.

Telephoto lenses. Getting close to the action may not be practical. Telephoto lenses allow a photographer to capture an image from a distance. Refer to figure 2 for a comparison of focal lengths.

Figure 2, Comparison of Focal Lengths (Canon, Inc., 2004)

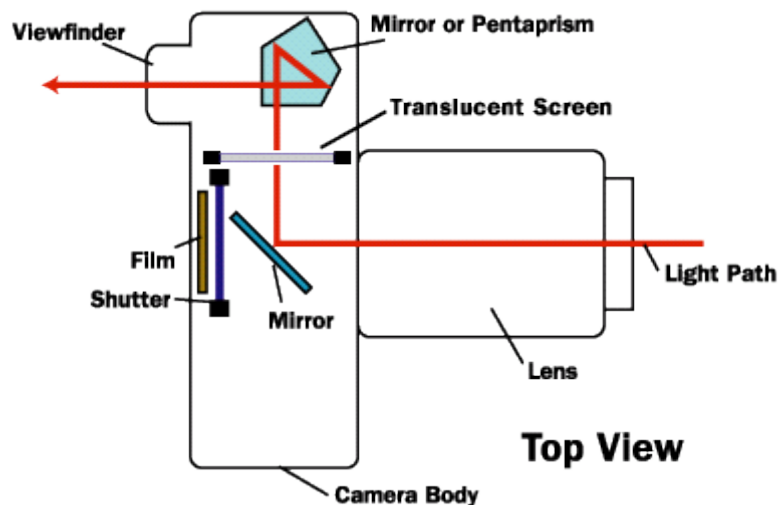


## LANDSCAPE PHOTOGRAPHY

The requirements for landscape photo are quite a bit less than they are for action and sports photography. Landscape photography involves photography of beautiful vistas, flowers, trees, sunsets, sunrises, and weather. Some features to look for when purchasing a camera for landscape photography include the following:

Mirror lock-up. Landscape photographers usually like pictures with a lot of *depth-of-field* (DOF). All film and digital *single-lens reflex* (SLR) cameras contain a mirror (see figure 2). Light enters the camera through the lens and travels to the mirror where it reflects to the viewfinder where you see it. When a picture is taken, the mirror moves out of the way, the shutter opens, and the picture is recorded. The mirror then moves back to its normal position allowing you to see the subject again. All this mirror movement causes vibrations. Mirror lock-up locks the mirror in the up position, eliminating any vibrations caused by the mirror. Mirror lock-up allows a photographer to use small apertures creating the most *DOF*.

Figure 3, Parts of a Camera (Harris, 2004).



Wide-angle lens. The ability to effectively capture a wide field of view is sometimes essential to capturing the entire landscape. Knowing the *focal length multiplier* of a digital camera is crucial to being able to take wide-angle photos. Table 1 lists focal length multipliers for many digital SLRs. If you need a 24mm lens for a landscape, you would really need to use a 16mm lens with a digital SLR that has a focal length multiplier of 1.5x. This would cost more or may not even be available.

Table 1, Digital SLR Focal Length Multipliers (Steve's Digicams, 2004).

Digital SLR Brand/Model	Focal Length Multiplier	Digital SLR Brand/Model	Focal Length Multiplier
Canon EOS 1D	1.3x	Kodak DCS 760	1.3x
Canon EOS 1D Mark II	1.3x	Minolta RD 3000	1.5x
Canon EOS 10D	1.6x	Nikon D1	1.5x
Canon EOS D60	1.6x	Nikon D1H	1.5x
Canon EOS Digital Rebel	1.6x	Nikon D1X	1.5x
Canon EOS D30	1.6x	Nikon D2H	1.5x
Fuji S1 Pro	1.5x	Nikon D70	1.5x
Fuji S2 Pro	1.5x	Nikon D100	1.5x
Kodak DCS 315	2.6x	Olympus E-1	2.0x
Kodak DCS 620	1.5x	Sigma SD9	1.7x
Kodak DCS 620x	1.5x	Sigma SD10	1.7x
Kodak DCS 720x	1.6		

## **PORTRAIT PHOTOGRAPHY**

Portrait photography does not have many specific requirements; any camera that is useable for any other form of photography would be useable for portraiture with one exception: it must be able to use and control flashes (e.g. on camera as well as studio flashes).

Some cameras come with a built-in flash. These flashes are useful, but to get the most out of portrait photography, and to reduce *red-eye*, a flash should be added and used in place of the built-in flash.

## **GENERAL-PURPOSE PHOTOGRAPHY**

For a camera to be useful for general uses such as sightseeing, portraits, and some sports, for example, it must have some form of adjustable settings. Sometimes cameras incorporate a dial with pictograms of a sports figure, a landscape, or some other easy to remember symbol. These settings generally are good for most pictures. There are times where you would need more control. In this case, it would be best to have *aperture priority*, *shutter priority*, *program mode*, and full manual control.

## DIFFERENCES BETWEEN FILM AND DIGITAL

Now that you have an understanding of the basic features you would want have for each form of photography, let’s take a look at the pros and cons of each type of camera.

All the features discussed up this point have been general features of almost every SLR camera.

Table 2 summarizes the pros and cons of each type of film and digital cameras.

Table 2, Film and Digital SLR Pros and Cons

Film SLR Camera		Digital SLR Camera	
Pro	Con	Pro	Con
Film availability and options	Heat sensitive film	Focal length multiplier	Battery life
Higher resolution	Wasted prints	Instant feedback	Cost
Inexpensive		Only keep the good pictures	Focal length multiplier
Shutter lag is short		Organization/storing photos	May promote poor technique
Long exposure capable		Smaller/lighter cameras	Media price
			Print lab availability
			Shutter lag is longer

### FILM CAMERAS PROS AND CONS

Some of the most compelling strengths of today’s film cameras that most digital cameras still cannot match are:

Film availability and options. Film is available for film cameras everywhere in the world and can be developed almost everywhere also. Additionally, there are many options for types of film including black and white, super-saturated color, and extra grainy films.

Long exposures. Due to the heat generated by digital cameras image sensors, they are not capable of producing finely grained long exposure images. Film cameras, on the other hand, are capable of producing images with hour-long exposures.

Film cameras have some weaknesses as well. Some of them are:

Heat sensitive film. Due to the nature of the film emulsion, it is susceptible to damage from heat and radiation (x-ray). Most professional quality films are refrigerated until right before use.

Wasted prints. While most developers will allow the photographer to not pay for bad prints, the film was still paid for to begin with. Every bad shot results in lost money in film.

## **DIGITAL CAMERA PROS AND CONS**

We have seen some of the strengths of film, now let's take a look at some of the strengths of digital photography:

Instant feedback. Digital SLR cameras all have screens on them, which allow the photographer to check the exposure and correct any problems on the spot.

Organization/storing of photos. Most people have a shoebox full of old film photos. A digital photographer is able to store all photos on a computer hard drive or on CDs.

Additionally, these photos can be automatically sorted and cataloged by software programs such as “iView” or “ACDSee”, for example.

Digital cameras have weaknesses as well, some of them are:

Media price. Digital cameras store images on memory cards. A memory card capable of holding roughly 150 high quality images costs \$160 (B&H Photo-Video, 2004). You would need 4 rolls of 36-exposure film to get that number of photos and it would cost \$17.19 for Fuji Velvia 50 (B&H Photo-Video, 2004). Of course, the digital media could be reused over and over while the film would be a recurring expense.

Lab availability. Digital files cannot be printed just anywhere. Photographers may not have the ability to print images while traveling.

There are more strengths and weaknesses to film and digital. In the next section we will look at initial and recurring costs, workflow, and support.

## **INITIAL COSTS**

One of the most obvious difference is the initial price of each camera format. In this section we will look into not only the initial layout of cash for the camera, but we will explore the cost of getting quality prints, film, memory cards, and batteries.

Canon manufactures the EOS Elan 7N, a film-based camera body. They also make the EOS 10D, which is a digital camera body and is actually based on the predecessor to the EOS ELAN 7N. They each have very similar features and specifications. In some regards the EOS Elan 7N is a more capable camera body than the digital EOS D10. However, these two cameras have enough common features and specifications that are close enough to compare directly. The most noticeable difference between these two camera bodies is price. Currently, the EOS Elan 7N sells for \$339 while the EOS 10D sells for \$1499 (B&H Photo-Video, 2004). It should be noted that the EOS Elan 7N was released almost a year after the EOS 10D.

This situation is not unique to Canon's line of camera bodies. Nikon, another highly regarded camera maker, makes the film-based N80 and the digital D70. These two cameras are based on a similar body and have many of the same specifications and features. Again, we see that the digital camera is much more expensive. The film-based N80 costs just \$339 while the digital D70 costs \$1299 (B&H Photo-Video). In this example, the N80 was released several years before the D70.

After purchasing a camera body, lenses are next. Depending on your style of photography (e.g. sports, landscape, portrait, etc.) you would be looking for different focal lengths. Table 3 shows pricing for Canon and Nikon lenses in both wide angle and telephoto focal lengths. The average focal length multiplier in table 1 was 1.58x. Recall that this means a 100mm lens on a 35mm camera would appear and act like a 158 mm lens on a digital camera with a 1.58x multiplier.

Table 3, Film and Digital SLR Lens Comparison (B&amp;H Photo-Video, 2004)

Focal Length Goal	On a 35mm Camera Body		On a Digital Camera Body (1.58x)		Cost Difference
	Camera Lens	Cost	Camera Lens	Cost	
24mm (Wide Angle)	Canon 24mm	\$289	Canon 15mm	\$579	\$290
	Nikon 24mm	\$269	Nikon 16mm	\$749	\$480
300mm (Telephoto)	Canon 300mm	\$1099	Canon 200mm	\$634	\$465
	Nikon 300mm	\$999	Nikon 180mm	\$749	\$250

We can see by looking at table 3 that film has an advantage over the average digital camera when working with wide-angle focal lengths. However, this advantage shifts to digital when working at telephoto focal lengths. The price difference between wide-angle and telephoto is essentially the same with Canon and Nikon lenses. Of course, most photographers will purchase more than one lens, so think about your entire range of focal lengths you will be buying along with the camera's focal length multiplier (if buying digital) and you can save a lot of money.

## RECURRING COSTS

Batteries are needed for almost every modern camera, though there are still a few film cameras that can operate with no batteries at all. Table 4 shows two film and two digital SLR battery test results. The Nikon D70 camera was released in June of 2004 and displays an incredible increase in battery life for a digital camera. The D70 is not typical of digital cameras, however. The average film camera will outlast the average digital camera. Assuming the average replacement battery costs \$9 (CR2 cost at local grocery store), table 4 shows the cost for 5,000 pictures. This does not take into account shooting habits where the average digital photographer takes more pictures than the average film photographer.

Table 4, Film and Digital SLR Battery Life Comparison (Canon, 2004; Nikon, 2004).

Camera Body		Number of Pictures at 20°C Without Flash	Cost for 5,000 Pictures
<b>Film</b>	Canon EOS Elan 7N	1,680	\$26.78
	Nikon N80	2,160	\$20.83
<b>Digital</b>	Canon EOS 10D	650	\$69.23
	Nikon D70	2,000	\$22.50

Other recurring costs include getting prints. Table 5 lists costs from various printing services along with average cost for prints. The difference in price between film and digital prints is negligible.

Table 5, Film and Digital Cost per Print

Developing/Printing Location	Cost per Print		Cost per 5,000 Prints	
	Film	Digital	Film	Digital
Long's Drugs	\$.26	\$.29	\$1,300.00	\$1,450.00
Ritz Camera	.36	.35	1,800.00	1,750.00
Snapfish.com	.08	.15	400.00	750.00
Walgreen's	.29	.29	1,450.00	1,450.00
Wal-Mart	.23	.24	1,150.00	1,200.00
<b>Average Cost per Print</b>	<b>\$.24</b>	<b>\$.26</b>	<b>\$1,220.00</b>	<b>\$1320.00</b>

**WORKFLOW**

The most apparent difference between film and digital cameras is in how they are used. Digital camera users have the benefit of the screen on the back of their camera that is used to review their shots. If something was not quite right, it can be reshot with the same conditions. Film, on the other hand, has to get it right the first time, take several pictures of the same subject with different settings, or plan on a return trip to correct any mistakes.

For learning, digital has an advantage of providing instant feedback, but it may also encourage poor shot planning and execution. Reliance on the ability to redo a bad shot may lead to laziness; this is why a lot of photography classes require students to use an all-manual film camera.

If you intend on selling your photos, some companies have a strong preference towards slides (a type of film) over digital files. Douglas Curran, associate editor at Rizzoli International Publications said, "I encourage all of our authors and photographers to supply us with *transparencies* or flat art, rather than digital art, whenever possible." (Linn, 2004)

**IMAGE QUALITY**

Image quality is a very subjective thing; what is considered a good photo by one photographer may be considered bad by another photographer. There have been a lot of debates over the quality of film versus the quality of digital. The highest resolution on any digital SLR camera is 14 million pixels (dots). Miles Hecker (2004) tested the most popular high-resolution film used today, Velvia 50, and estimates it to have an equivalent resolution of 21.4 million pixels. So digital still has some room to go before it surpasses film in terms of raw resolution.

How many millions of pixels are needed for a particular size print and how large can Velvia 50 camera prints be enlarged? Table 6 shows a comparison of resolution to print size. This is assuming a printout at 300 pixels per inch.

Table 6, Print Sizes (Atkins, 2004)

Type of Print	Maximum Printed Size (Inches)
---------------	-------------------------------

	1 million pixels	3 x 4
	2 million pixels	4 x 6
	3 million pixels	5 x 7
<b>Digital</b>	4 million pixels	6 x 8
	5 million pixels	6.5 x 8.5
	6 million pixels	7 x 9
	14 million pixels	11x 14
<b>Film</b>	Velvia 50	16 x 20

Photographer David Sundberg said, "With digital there is somehow a different overall look or feel to the image. There is often what I would describe as a colder, harder quality to the photograph." (Linn, 2004).

SLR cameras with 6 million pixel image sensors are now commonplace. Table 6 shows us that this would result in a printed photo that is 7 by 9 inches. This could easily be printed out to 8 by 10 inches with no noticeable loss in image quality. The amateur photographer, therefore, does not need a camera with higher resolution than 6 million pixels unless he or she intends on making pictures larger than this.

## CONCLUSION

What has been covered only scratched the surface of the film versus digital camera debate.

Ultimately, it is the photographer who must determine the purpose of the camera, what he or she needs, and his or her patience and workflow.

Actually walking into a store and using both film and digital SLR cameras, then looking at the prints can go a long way to selecting the best camera. Hopefully, you now have an understanding of some of the basic strengths and weaknesses of each format so you may make a better purchase and enjoy it for years to come.

## **GLOSSARY**

### **Aperture**

A user adjustable opening inside the lens that is created by a metal diaphragm to control the amount of light entering the camera. Increasing the size of the aperture allows more light to enter the camera while decreasing the aperture size lets in less light. The photographer can control depth-of-field and shutter speed through the adjustment of the aperture. The size of the aperture is referred to as the f-stop (Foo, 1999).

### **Aperture-priority**

An exposure mode on most cameras that allows the photographer to select the aperture while the camera sets the shutter speed to get a correct exposure. This is a useful mode if depth-of-field is a primary concern.

### **Depth-of-field**

This is a measurement of the amount of the scene that is in focus. For example, if a photograph has shallow depth-of-field (DOF), objects from two to three feet may be in focus. Wide DOF would have everything from two feet to infinity in focus. DOF is affected by the focal length of the lens and the selected aperture. Longer focal lengths and/or large apertures results in less DOF, while short focal lengths and small apertures would provide more DOF.

**Exposure**

This refers to the act of exposing the film or digital sensor to light. The amount of light allowed to illuminate the film or digital sensor is dependant on the aperture size and the shutter speed. Proper exposure means an image is created that very closely resembles the actual scene (Foo, 1999).

**Focal length**

When dealing with lenses, the focal length describes how much the lens magnifies the subject. On a 35mm camera, a lens with 50mm focal length is equal to what the human eye naturally sees. That is, there is no magnification. A 100mm lens on a 35mm camera would provide 2x magnification. Likewise, a 400mm lens supplies 8x magnification and a 25mm lens provides .5x magnification (e.g. images viewed through the lens appear further from you with a 25mm lens when compared to the human eye).

**F-Stop**

The size of the aperture is measured in f-stops. An f-stop of  $f/2.8$  on a lens with a focal length of 100mm means the diameter of the lens opening is  $100 \div 2.8 = 35.7$  mm. A lens with an f-stop of  $f/2.8$  and a lens with a focal length of 24mm would have an aperture size of 8.6 mm (Peterson, 1990).

**Focal length multiplier**

All 35mm film cameras use film with an image capture area that is 24mm x 36mm.

Digital SLRs, on the other hand, typically use image sensors smaller than film cameras.

Lenses may be used on either film or digital SLRs, but lenses designed to provide 200mm of focal length on a film SLR may provide more focal length on a digital SLR due to the smaller sensor size. This is referred to as focal length multiplier and is shown as a value from 0x (same as 35mm film) up to 2.6x. A 200mm film lens used on a camera that has a focal length multiplier of 1.5x will appear to be a 300mm lens (e.g. 200mm × 1.5x).

**Image sensor**

In digital photography, the image sensor is roughly the same as the film. It is the medium that captures the image, which is then saved onto some form of media.

**Program mode**

An exposure mode where the camera selects both the aperture and the shutter speed. This is typically used with a control to select what type of scene to capture (e.g. action, portrait, backlit, etc.).

### **Red eye**

Light reflecting off the back of the subjects retina results in a phenomenon known as “red eye.” In humans, red eye is red due to blood in the retina. Animals may have a green or blue glow to their eyes due to a difference in eye physiology. The easiest way to avoid red eye is to move the flash further away from the lens or to have the subject turn their head (and eyes) slightly away from the camera.

### **Shutter-priority**

An exposure mode on most cameras that allows the photographer to select the shutter speed while the camera sets the aperture to get a correct exposure. This is a useful mode if capturing action or movement is a primary concern.

### **Single-lens reflex**

A type of camera that uses through-the-lens (TTL) exposure metering. It also allows the photographer to view the subject through the lens. This allows both the camera and the photographer to see exactly how the photograph will look, taking into account the characteristics of the lens (e.g. focal length, filters, framing, etc.). Single-lens-reflex (SLR) cameras accept interchangeable lenses for maximum versatility.

### **Telephoto lens**

Any lens with a focal length of 70mm or greater on a 35mm lens or equivalent to this on a digital camera.

### **Transparencies**

A type of film that uses transmitted light instead of the reflected light of consumer film.

This results in pictures with more vibrant colors and requires a slide projector.

### **Wide-angle lens**

This type of lens typically has a focal length of less than 35mm and is very useful for landscape photography or for use in a confined space.

### **Zoom lens**

A camera lens that provides a variable focal length, such as 70-200mm would be considered a zoom lens. A 70-200mm lens may be called a 3x zoom lens (200mm ÷ 70mm). There are two types of zoom, analog and digital. Analog zooms use optics to achieve magnification, while digital zooms take whatever information received and enlarge that information through processing. Digital zooms do not add any more detail; detail is lost when using digital zooms.

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