Nuts and Bolts- *Digital Camera Sensors*

Improvements in digital cameras are coming at a fast pace. In order to understand the marketplace and to make intelligent decisions when buying a digital camera, you should have at least a cursory understanding of the technology involved. Toward that end, this is the first in a series of articles covering various aspects of digital photography.

Digital cameras use either a CCD (charge coupled device), or CMOS chip (complementary metal oxide semiconductor) as an image sensor in place of the film in conventional cameras. When you take a picture, the image sensor measures the light coming through the lens and converts it into electrical signals. These signals are boosted by an amplifier and sent to an analog-to-digital (A-to-D) converter that changes those signals into digits. A computer processes those digits to produce image data, which is stored on the memory card. All this occurs within the cameras computer.

An image sensor measures light thanks to a natural phenomenon called the photoelectric effect in which some substances release electrons when exposed to light. This is the same phenomenon that Einstein used to demonstrate the quantum nature of light. The surface of the chip is covered with a grid of wells containing electrodes called photosites. Each photosite corresponds to a pixel in the image. Prior to taking a picture, the photosites are charged with electrons. When light strikes a photosite, it releases some of its electrons. After the exposure, the camera measures the charge at each site, which is proportional to the amount of exposure.

Add color - Color is meaningless to the photosites. They can only measure the light intensity (luminance) of each color. To get color, requires filtering and interpolation. Just as you can mix primary colors of paint together to make other colors, you can mix the primary colors of light together to create any other color. Each photosite on the image sensor is covered with a colored filter. Cameras use a combination of red, green, and blue filters, with one row alternating between green and blue, and the next row alternating between green and red. There are twice as many green filters because your eye is more sensitive to green than any other color. This filter pattern (the Bayer pattern) is the most commonly used. The process of interpolating the red, green, and blue pixels to a final full-color im-

Meeting Schedule

November

18th **"Are You Ready to Compete?"** presented by *John Brokos*

December

2cd **Competition** judged by *Sherman Paur*
9th **Photoshop Presentation** presented by *Yvonne Bassett Berger & Ilford*
16th **Theme Competition "Trees"**

January 2005

6th **Board Meeting**
13th **Competition** judged by *Leon Hertzson*
20th **Critique Night**
27th **"Compositions"** presented by *Dick Hunt*

February 2005

10th **Competition** judged by *Dick Hunt*
17th "**Black and White and the Digital Darkroom"** presented by *Bill Schmidt*
24th **Program** to be announced

March 2005

3rd **Board Meeting**
10th **Competition** judged by *Bill Rudock*
17th **Critique Night**
24th **"Morocco's Imperial Cities"** presented by *Carol-Ann Rogus*

April 2005

14th **Competition** judged by *Art Inselsberger*
21st **Theme Competition** "Children"
28th **Use of Wide Angle Lenses** presented by *Joe Senazatimore*

Don't forget 8 am Sunday at the Syosset Dinner

age is called "demosaicing." The final color of each pixel is calculated by analyzing the colors of all of the surrounding pixels. At the simplest level, the process goes something like this: "if the pixel to the left is bright red, and the pixels above and below are bright green, and the pixel to the right is bright blue, then I must be a bright white pixel, because red, green, and blue makes white. Because image sensors are particularly sensitive to red frequencies an infrared filter precedes the other color filters.

Fine Tuning

Size counts- image sensors are very small, sometimes as small as 1/4 or 1/6 inch. As more and more photosites are packed onto the same size chip to increase the pixel count, the individual sites have to be made smaller. As each site gets smaller, its ability to collect light gets compromised. This results in a worsening of the chip's signal to noise ratio, resulting in noisier images. Noise refers to unwanted artifacts analogous to static in a radio signal and appears similar to grain in a digital photograph. Noise is more of a problem with small sensors because they produce smaller signals and therefore require more amplification. Digital SLRs have less noise than other digital cameras because they have larger sensors and therefore larger photosites.

Concentrating the light- to improve the light collecting ability of photosites, most chips have a tiny microlens over each site to focus the light more tightly. This improves the signal-to-noise ratio, but may cause artifacts in the image.

Color fidelity- red, blue and green filters over the sensor are pretty standard, but a few makers use a different filter pattern such as cyan, yellow, green, and magenta because they can be physically thinner. With a thinner filter, signal-to-noise ratio is improved. Others augment the traditional red, green, and blue pattern with an additional color such as emerald. Foveon has taken the most innovative step by including a separate red, green, and blue sensor at each photosite.

Processing

Blooming- all image sensors are prone to "blooming," an artifact that occurs when a photosite collects so much light that it overflows into the adjacent photosites. The cameras internal software usually recognizes and eliminates it.

White balance- an imaging sensor has a linear response to light, which is different from the logarithmic response of the human eye. To correct the mismatch the camera software applies a mathematical algorithm to each of the brightness values.

Personal preferences- most cameras provide user configurable settings for contrast, brightness, and color saturation. These adjustments are made to the image before it is recorded.

Noise reduction- noise increases with sensitivity (ISO setting) and exposure time. To correct for this, most cameras employ some sort of noise reduction as needed.

Looking for a new place to take nature photos?

There is a little known nature preserve in Melville, near the Walt Whitman Mall and Walt Whitman's house. It is said that Whitman hiked this area frequently. Carol and I were there recently and found it to be a pleasant outing with lots of photo opportunities.

To get there, follow the signs from route 110 to the Whitman House. When you pass the Whitman parking lot, look for West Hills Road across the way, which becomes Reservoir Road. Take it to the end and park the car at the end of the road. Walk up the blacktop path, which becomes a pebble trail. After only about 5 minutes, you will get to a large boulder at the top of the hill. This is the highest point on Long Island, which is commemorated by a plaque on Jayne's Rock. I am told that when the leaves are gone, there is a good view from there. There is a bench if you would like to relax a moment. You can now continue straight ahead or turn left down a steep hill. There is total of about 8 miles of trails, so you can walk as much or little as you like. Just make sure that that you keep track of where you went so you can get back. A turn-by-turn description of the trails can be found in Fodor's "Short escapes Near New York City."

NOVEMBER COMPETITION RESULTS
Judged by Ed Sambolin

OCTOBER'S BEST
(Photographs of the Month)

B&W Class A
Marty Silverstein

B&W Class B
Robert Glick

Color Class A
Gerald Harrison

Color Class B
Edward Starling

Slides Class A
Ramesh Patwa

Slides Class B
Gerald Harrison

OTHER SCORES

Black & White Prints A

Eight- Alan Agdern, Orrin Edwards, Ramesh Patwa, Bill Schmidt

Black & White Prints B
Nine- Jerome Sax

Eight- Gerald Harrison, Aileen Harrison, Charles Hollander, Loretta Lloyd, Sarah Kleinman, Ira Silverstein, Alan Ross, Ken Eastman

Color Prints Class A
Nine- Alan Agdern, Orrin Edwards, Sy Roth
Eight- Clem Kleinmann

Color Prints Class B
Nine- Alan Ross, Aileen Harrison, Peter Metzger
Eight- Robert Glick, Anita Sax, Ira sunshine, Loretta Lloyd, Maylan Monahan, Ira Scheinerman, Ernst Halpern

Color Slides Class A
Nine- Stan Rothman
Eight- Orrin Edwards

Photo Exhibit

Please bring your framed photos to the next meeting for display at the Jericho Library. The photos will be exhibited during the entire month of December.

- ➢ You may submit up to three photographs.
- ➢ The work must be framed under glass with a wire across the back.
- ➢ Wrap the work securely to protect against breakage.
- ➢ Label <u>both the outside wrapping and the back of the photo</u> with the title of the picture and your name.
- ➢ Include a separate sheet of paper with your name and the titles of your pictures on the outside of the package so Aileen can prepare the catalogue without opening the packages.

Note: Photos must be picked up at the library on December 30. The library is located on Merry Lane in Jericho (Merry Lane is just East of Route 107 off Jericho Turnpike.

Leonard Victor Memorial Awards
Each year PFLI selects the best images of the year from the monthly competitions. They are as follows:

Black And White "B" 1st Place Phyllis Karakis; "Sunrise at the Tetons"	**Color Prints "B" 1st Place** Lee Cooper; "White Lily Camelia"	**Color Slides "B" 1st Place** Jacqueline Dante; "Bryce…"
Black And White "B" 2nd Place Bob Simari "Dreamscape"	**Color Prints "B" 2nd Place** Adolfo Briceno; "Hot Air Balloons…"	**Color Slides "B" 2nd Place** Ron Caldwel; "It's A Bud"
Black And White "B" 3rd Place David Karakis; "Sunrise At Bryce…"	**Color Prints "B" 3rd Place** Bobbi Turner; "Phainopepla"	**Color Slides "B" 3rd Place** Adolfo Briceno; "Lady Slipper Bud"
Black And White "A" 1st Place Dick Hunt; "Eagle"	**Color Prints "A" 1st Place** Dick Hunt; "Jellyfish"	**Color Slides "A" 1st Place** Bob Schmitz; "Great Egret"
Black And White "A" 2nd Place John Dinicola; "Flower #21"	**Color Prints "A" 2nd Place** Ed Sambolin; "… Woodpecker"	**Color Slides "A" 2nd Place** John Brokos; "Inner Space"
Black And White "A" 3rd Place J. K. Bodkin; "Now What?"	**Color Prints "A" 3rd Place** J. K. Bodkin; "Babe In The Woods"	**Color Slides "A" 3rd Place** Joe Senzatimore; "Seafood…"

Artistic Integrity
It started with 35 mm, motor drives and cheap film. Now with digital cameras and no film, it is easier than ever to make lots of exposures and hope that one of them comes out right. Pardon the pun, but what's wrong with this picture? What's wrong is the substitution of chance for talent. Photography can be a much more rewarding endeavor, if each exposure is treated as if it was being taken with a view camera on sheet film, where everything must be perfect before the shutter is tripped. A painter would not think of painting a dozen canvases until one painting came out right- why should a photographer. Try this.
- ✓ Analyze the lighting to make sure that the range of brightness in the scene is within the dynamic range of the camera (no blown-out highlights).
- ✓ Compare the camera's automatic exposure setting to that which is obtained when the meter is set for spot metering on a midtone area of the scene.
- ✓ Determine whether a filter is needed.
- ✓ Adjust the depth of field appropriate to the scene.
- ✓ If using a slow shutter speed, set the self-timer to avoid camera movement.
- ✓ Place the camera on a tripod.
- ✓ Make a final check of the composition and when everything is perfect, take the picture.

The result should be a photograph the way you pre-visualized it.

Call for Articles
The Viewfinder encourages members to submit material for publication. Any of the above bullet points would be good subject matter, but feel free to submit any article relevant to photography or club activities to barryg@gbronline.com.