PATACS Posts

Newsletter of the Potomac Area Technology and Computer Society

PATACS/OPCUG

3rd Saturday, September 15

Osher Lifelong Learning Institute,
4210 Roberts Rd., Fairfax, VA 22032-1028

Meeting 1:30 PM

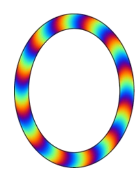
Highlights of a Lifetime of Forecasting, Finding and Photographing Tornadoes

David Hoadley (80), pioneer storm chaser started 62 years ago in Bismark, North Dakota - long before smart phones, laptops, computer models, digital cameras, satellites, the Internet or even the Interstate (construction began mid-50s). Fellow meteorologists believe him to be the **first** "storm chaser" -- someone who prepares his own forecasts and travels interstate to pursue them. Mr. Hoadley, with a liberal arts degree and a Master's in Foreign Affairs, is not a meteorologist, but self taught like most chasers. He will present his tornado photography about early forecasts and chases, show tornado intercepts and their damage, illustrating one close call when he and his daughter dived for a ditch, discuss commercially available chase tours, and summarize how this hobby has grown and evolved. He will also use a few props, including a vintage 8mm, hand-crank movie camera and old facsimile Weather Bureau maps with time at the end for questions.

He began a storm chaser's newsletter, "Storm Track", paper copy in 1977, and it grew from 18 to almost a thousand subscribers by 2001 now on the Internet (stormtrack.org). This is the primary source of tornado information and forecasting in the U.S. for chasers here and around the world.

about.usps.com/postal-bulletin/2004/html/pb22137/kit-text1a.html

One of Mr. Hoadley's storm slides became a U.S. stamp in 2004, along with 14 others in the stamp set, "Cloudscapes." The *Cloudscapes stamps* became available nationwide on October 5, 2004 Photographer: ©*David Hoadley* 1977. The theme for *2004* is "Reach for the Sky and Collect *Stamps*!



Learn in 30

xxJohn Krout

The World's Largest Digital Photo Frames

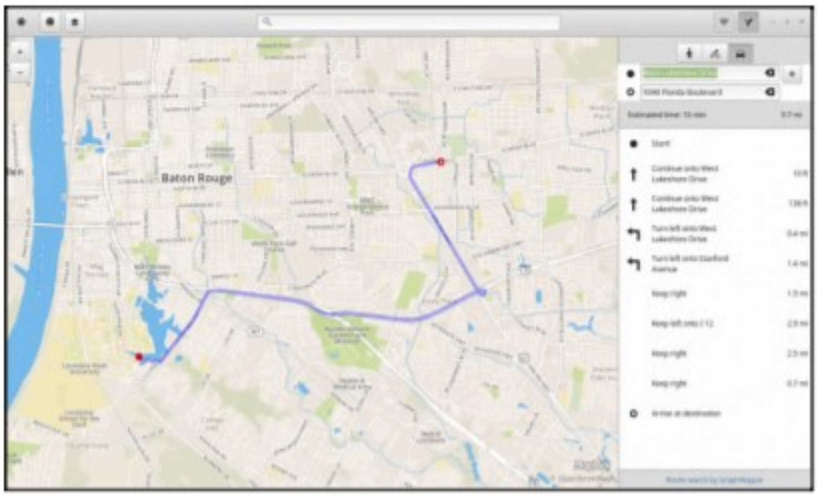
This Photo

This

Gnome Maps

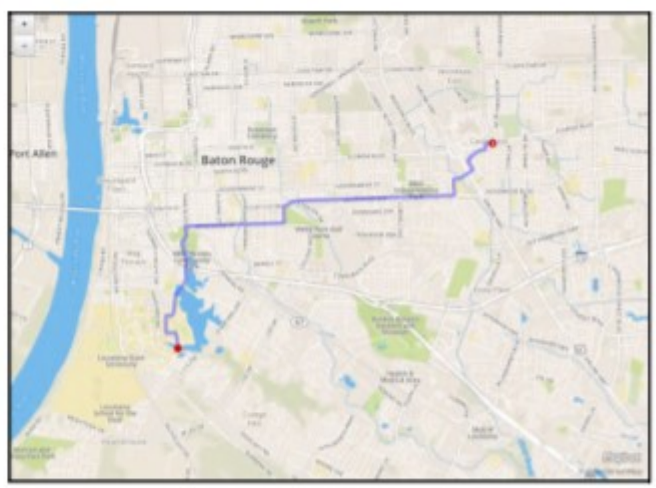
by Cal Esneault, Co-Editor, Workshop and SIG leader
Cajun Clickers Computer News www.clickers.org tsa70785 (at) gmail.com

Anyone who has used Google to search for an item would not be surprised to soon receive numerous advertisements for similar merchandise. For privacy reasons, you could switch to a less invasive search engine, such as DuckDuckGo. To minimize tracking of your travels, an alternative to Google Maps is Gnome Maps (it is based on information from OpenStreetMap). I downloaded the software for my Linux Mint system directly from the Mint Software Manager. It was installed in the "Accessories" group under the "Maps" name.



Left is a screenshot of a section of Baton Rouge as displayed by the Gnome Maps program. Zooming and scrolling around was very smooth. Details emerged as you drill down to smaller and smaller areas. It has an icon which will generate a side panel where you can enter end points of your travel to get a preferred route. It gives the estimated time and distance as well as step-by-step route points. I did not see an easy way to print out the route by itself, so you either have to write it down or crop the path instructions to other software for printing.

You have three choices by which it will choose a route (done by graphhopper): driving, bicycling, or walking. The above route was for driving from LSU to the Cajun Clickers, so it chose a route using the Interstate. When I switched to a route for a bicycle, it gave the map below. This was a less dangerous route, but I think I would make a few adjustments.



Gnome Maps also gives you the option to view the maps in photographic view (see left for the area around our club site).

Continued Page 3

Overall, I found Gnome Maps to be a very simple and clean program that did exactly what I wanted without having to go through Google. Although the OpenStreetMaps application has more options, I found it had many extra features which seemed to make it less responsive than Gnome Maps. Since Google maps are tagged, use of either Gnome Maps or OpenStreetMaps gets you away from issues if you distribute directions to the public and if you are unsure of "fair use" limitations.

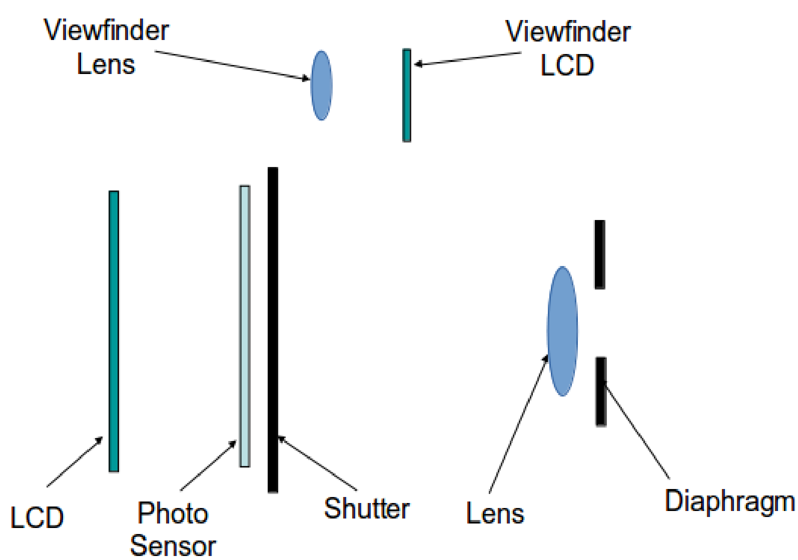
Digital Camera Anatomy

By Dick Maybach, Member, Brookdale Computer Users Group, NJ
April 2018 issue, BCUG Bytes www.bcug.com

Camera Types

Figure 1 shows a simplified view of a consumer digital camera architecture; the lens focuses the incoming light onto the photo sensor, which takes the same roll as photographic film. In all but the simplest cameras, a diaphragm with a variable area limits the amount of light entering the camera. (Notable exceptions are cell-phone cameras.) The shutter opens only when you wish to take a picture. Located as shown, it's called a focal-plane shutter, because it's very near the plane where the lens focuses the light. The shutter can also be near the lens or it can be integrated into the sensor (which is the case for cell-phone cameras). There are thus two ways to control the amount of light striking the sensor, with the diaphragm and with shutter. Although only a simple lens is shown here, more complex ones are common.

Figure 1.
The First Digital Camera.



The liquid crystal display (LCD) shows you where the camera is pointed and lets you look at the pictures you have taken. It also displays the camera status and set-up menus. On higher-end cameras, a second LCD that shows the same information as the one on the rear panel allows for viewing in bright sunlight. The result is called a viewfinder. In older camera the viewfinder was purely optical, with its own lens, but this is rare now. The sensor must operate all the time,

Continued Page 4

whether to provide an image for composing or one for storage, although its resolution is usually reduced for composing. You may have noticed a problem; when the shutter is closed, light can't strike the photo sensor, and the LCD has nothing to display. Cameras with mechanical shutters hold them open to allow a display, close them briefly when you press the button to allow the photo sensor to be reset for picture taking, and open them for the exposure, and perhaps close them while the image is transferred from the sensor.

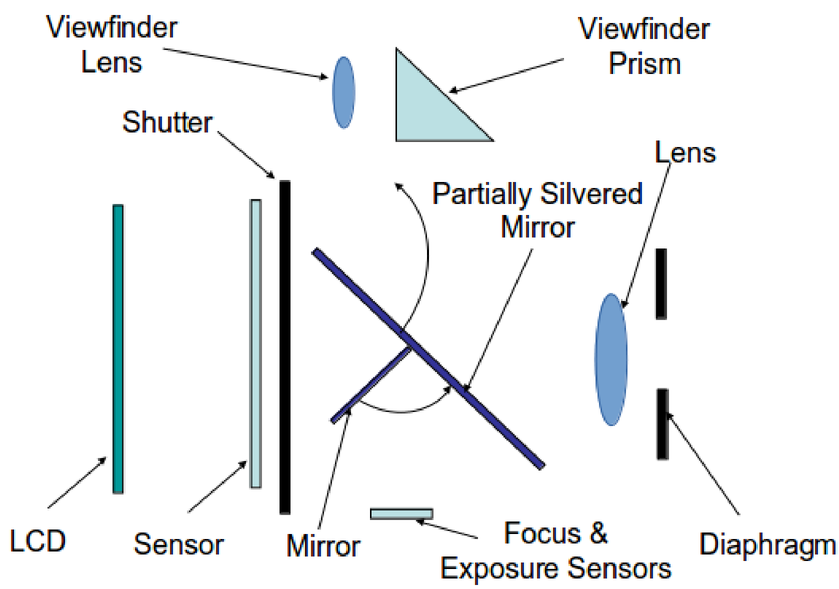
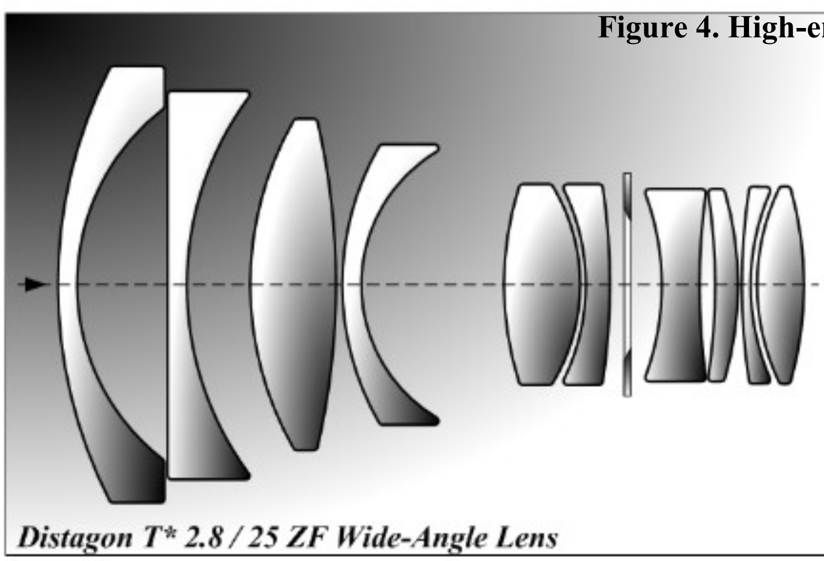


Figure 3. Digital Single Lens Reflex Architecture.

A digital single lens reflex (DSLR), shown in Figure 3, places a mirror in the light path to reflect the light into the optical viewfinder whenever the camera is not taking a picture. To take a picture, both mirrors momentarily flip up. Normally, DSLRs also have focal plane shutters since they must be located out of the way of the mirror. Their high-performance sensors often have both mechanical and electronic shutters.

Because the sensor receives light only when taking a picture, the LCD can display only the pictures already taken. Live viewing requires an auxiliary sensor, often located in the viewfinder, as both the shutter and mirror block light from the main sensor. The main mirror is partially silvered to allow some light to pass through it and be reflected down to the focus and exposure sensors by the second mirror. These sensors are optimized for their particular uses since they aren't used to capture images. This arrangement implies a high price. Besides its mechanical and optical complexity, its lens must be far away from the sensor to clear the mirror. Its main advantages are high-quality pictures and fast operation. Because of its cost, SLR architecture is used only for high-end, interchangeable-lens cameras.

Figure 4. High-end lens.



Lenses

The complexity of Figure 4 is typical of modern lenses, although cell-phone and Webcam lenses often have only a single element. Point-and-shoot lens complexity lies between these extremes. The added lens elements correct distortion keeps the light intensity constant across the sensor and reduce color aberration.

Continued Page 5

Digital Sensors

We will now shift gears to look at how the camera records an image. You may be surprised to learn that its sensor does not use the red-green-blue (RGB) format. A computer in the camera changes the recorded information into the desired output format.

Bayer Color Filter Array

Each pixel on a digital camera sensor contains a light sensitive photo diode which measures the brightness of light. Photo-diodes are monochrome devices, unable to sense color. Therefore, a mosaic pattern of color filters is positioned on top of the sensor to allow only red, green, or blue light to illuminate a single pixel. The most common filter used in digital cameras is the GRGB Bayer Pattern, named after a Kodak engineer. The result is a color filter array, shown in Figure 5. By breaking up the sensor into red, blue and green pixels, it is possible to get enough information in the general vicinity of each sensor to make an accurate estimate of the true color there. By contrast, our eyes contain two types of sensors: rods, which are much more numerous, detect only intensity and are most sensitive to green light, and cones, which detect color

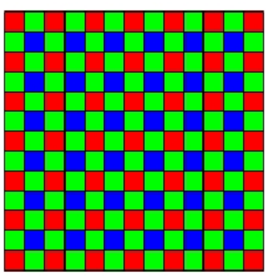


Figure 5. Bayer Filter.

In the Bayer filter pattern, the colors are not evenly divided – there are as many green pixels as there are blue and red combined, because our eyes are more sensitive to green detail than the other colors. The advantages of this method are that only one sensor is required, and all the color information (red, green and blue) is recorded at the same moment. The raw output from a sensor with a Bayer filter is a mosaic of red, green and blue pixels of different intensities. After a raw image has been obtained from a photosensor blanketed by a Bayer pattern of color filters, it must be converted into standard red, green, and blue format, usually sRGB or Adobe RGB. A computer in the digital camera determines the correct color for each pixel in the array by averaging the color values of neighboring pixels. This process is called demosaicing.

CMOS Sensor

The Complementary Metal Oxide Semiconductor (CMOS) sensor, shown in Figure 6, is now the dominant type. This sketch shows one CMOS sensor pixel containing a photosensitive area (photo-diode), busses, microlens, Bayer filter, and three support transistors. Each pixel in a CMOS image sensor contains an amplifier transistor, which converts the charge generated by the photo-diode into a voltage. In addition, the pixel also features a reset transistor to control photon accumulation time, and a row-select transistor that connects the pixel output for readout. All this circuitry reduces the photodiode area.

In operation, the first step is to use the reset transistor to drain the charge from the photosensitive region. Next, the integration period begins, and light interacts with the photo-diode region of the pixel to produce electrons, which are stored in the silicon potential well lying beneath the surface.

After the integration period has finished, the row-select transistor is switched on, connecting the amplifier transistor in the selected pixel to its load, thus converting the electron charge in the photo-diode into a voltage.

The resulting voltage appears on the column bus and can be detected by the sense amplifier. This cycle is then repeated to read out every row in the sensor in order to produce an image. Keep in mind that even simple cell-phone cameras have millions of these cells on their sensors.

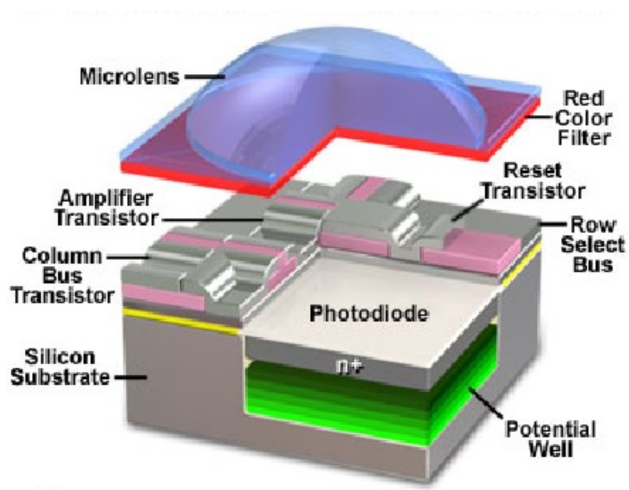


Figure 6. CMOS PixelCell Anatomy.

Continued Page 6

Figure 7 (at right) shows a complete CMOS image sensor that contains an active image area of 640 x 480 pixels. The photo-diode array, located in the large reddish-brown central area of the chip, is covered by a Bayer color filter array and a micro-lens array.
The inset reveals a highly magnified view of the filter and micro-lens array. Also included on the sensor is the analog signal-processing circuitry to collect and interpret the signals.
These then go to the analog-to-digital conversion circuits, located adjacent to the photo-diode array on the upper portion of the chip. You can see the peripheral circuitry located on the edges of the chip.

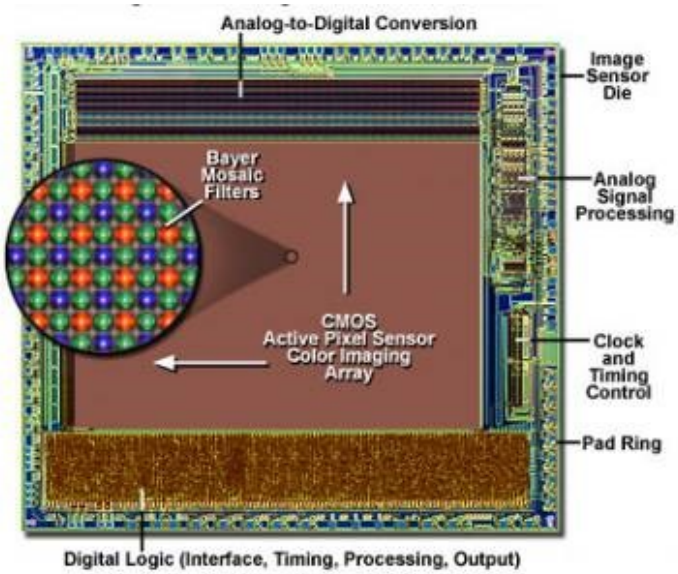


Figure 7. CMOS Image Sensor Integrated Circuit Architecture.

CMOS Functions
In addition to converting photons to electrons and transferring them, the CMOS sensor might also perform image processing, noise reduction, and analog to digital conversion. This functional integration onto a single chip reduces the number of external components needed.
Using such an integrated CMOS sensor allows the digital camera to devote less space to other chips, such as digital signal processors (DSPs) and ADCs. CMOS is the dominant semiconductor technology, so these devices enjoy huge economies of scale. To read out the array, a row is selected, which connects one pixel in each column to the column bus. Each column is then selected in turn, which sends the pixels one at a time to the output amplifier. Figure 8 shows the circuit blocks to accomplish these functions.

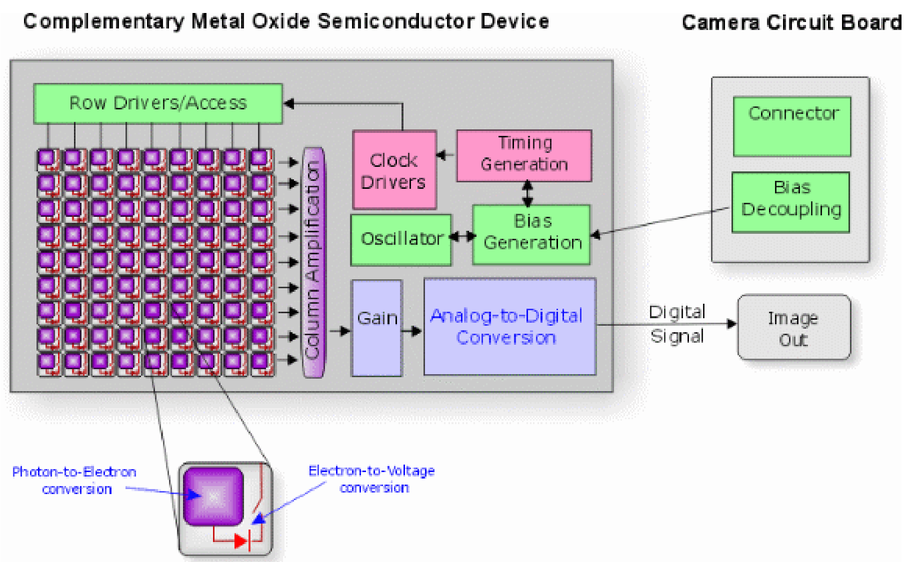


Figure 8. CMOS Functional Diagram

Although this introduction was quite brief, it does show that digital cameras, even the simple ones found in cell-phones are far more complex than you probably suspected. Their optics are relatively simple, about the same as in a consumer film camera of 50 years ago, but their electronics boost their performance far beyond these early devices. Since optics are expensive and circuitry cheap, the result is impressively cost effective.

What is a Word Cloud?

By Dorothy Fitch, Editor,
GVR Computer Club, AZ Green Bytes
www.ccgvaz.org
newsletter (at) ccgvaz.org

A word cloud is a design made of words that you choose. There are several websites that will automatically create a design using the words you enter. All you need to do is type or paste in a list of words and click a button.

The size of each word depends on how many times that word is in the list. The more times the word is in the list, the larger it will appear. Depending on the word cloud generator you use, you may be able to change the angle of the words, pick different colors, and set other options.

I used this website for the General Meeting word cloud: https://www.jasondavies.com/wordcloud/

This is the website I used for the Hot Peppers word cloud: http://www.abcya.com/word_clouds.htm

Just Google "word cloud" to find other websites to make your perfect word cloud.

It's fun to play around with word clouds. Give it a try. (If you are entering the names of grandchildren, however, don't type the name of any one of them more than the others, or it will appear larger. You don't want to be accused of favoritism, do you?)

Websites from WAUC

Found in various WAUC (Wisconsin All-Computer Users Club) Bulletins
www.wauc.us ricejulia (at) hotmail.com

Listen to the Rhythm of the Falling Rain

Welcome to Rainy Mood the internet's most popular rain experience. Millions of people use Rainy Mood while sleeping, studying and relaxing. Enjoy the free web version or try the iOS/Android app with additional features. **http://www.rainymood.com/**

Be a Convert with Your Files
FreeFileConvert provides conversion of files into various formats, supporting 8,337 different conversion combinations of audio, video, image, document, archive, presentation, eBook and font file types. **https://www.freefileconvert.com/**

The Privacy Policy Chatbot PriBot

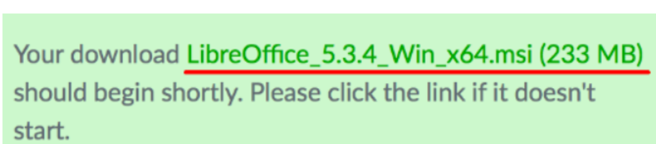
PriBot is basically a chatbot that can answer all your questions about a website or online service's privacy policy. Type in any question and PriBot will find the appropriate passage of a company's privacy policy that should answer your query. PriBot will even give its own thoughts and pieces of advice about the matter. Pretty slick!
https://pribot.org/

Free Sheet Music
Are you a piano player? What about an aspiring violinist? Maybe you are just a music lover. Comforting and steady, back from the day when music composition didn't depend on computer generation. The folks over at IMSLP have put together a massive database of sheet music, complete with thousands of classical scores. Much of the sheet music for piano, violin, trumpet and every other instrument you can imagine is available completely for free, but there are also many more pieces that are available for a nominal fee. **http://imslp.org/**

Setting Libre Options

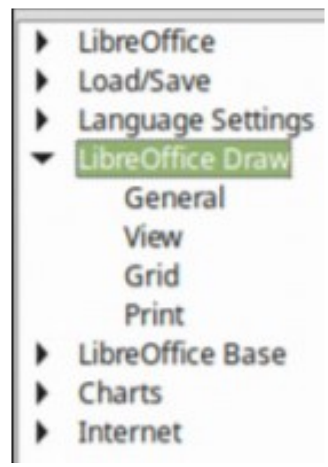
by Cal Esneault, Co-Editor,
Workshop and SIG leader
Cajun Clickers Computer Club
www.clickers.org
tsa70785 (at) gmail.com

LibreOffice is open-source office productivity software from The Document Foundation. It is available for download at no cost. It is cross-platform (Linux, Windows, Mac OS) as an alternative to Microsoft Office (can read from and write to MS Office files). LibreOffice started as a fork of OpenOffice.org, and it has become the standard for most Linux distributions.



After installing LibreOffice, you will have a "default" setup. This is a good time to customize the program to fit your personal needs and tastes. From the main welcome screen (or inside any LibreOffice application), select "Tools" and then "Options". You will see something like the image to the right. Most options are "global", that is the choices will affect all the component apps (Impress, Writer, Calc, Draw, Base). For example, "User Data" will annotate the author of any document, "View" can be used to select from a variety of icon design sets, etc. Other global setting sections include "Load/Save" (file location defaults), "Language Settings", "Charts", and "Internet".

Beside the global sections, each application can have its own option area to change items which are of particular functionality to that program. The illustrations in the next column highlight the choices you will normally encounter. For example, Calc choices include "calculate" and "formula", items which don't appear for Writer. Impress and Draw options are similar since they are both graphic-centric programs which depend upon the same underlying tool kits.



In general, the best way to learn about these options is to take the time to go through each of the lists. Switch some of the more appropriate options back and forth to determine the effects and see if you like the results.

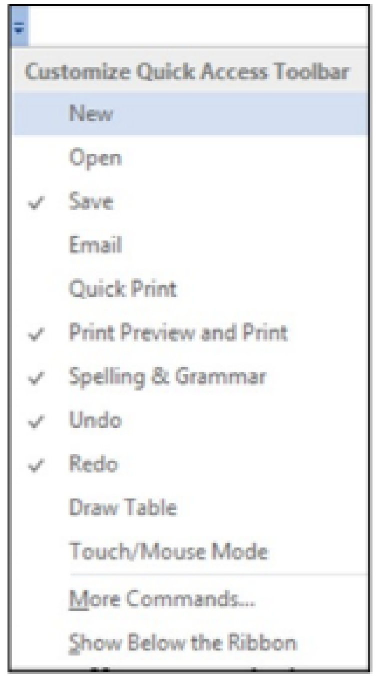
Option lists tend to change little with LibreOffice version. Also, recent editions tend to keep many of your choices as you update versions, but it is still wise to do a quick check. Doing a fresh OS install will certainly wipe out your choices, so knowing how to re-customize your subsequent LibreOffice download will get you back up to speed quickly.

Option results can vary significantly for some items (such as Fonts) depending upon the computer platform (example, Windows vs. Linux installs). Options are a tool often neglected by new users. Be sure to spend some time in this area to familiarize yourself with the power and potential of LibreOffice.

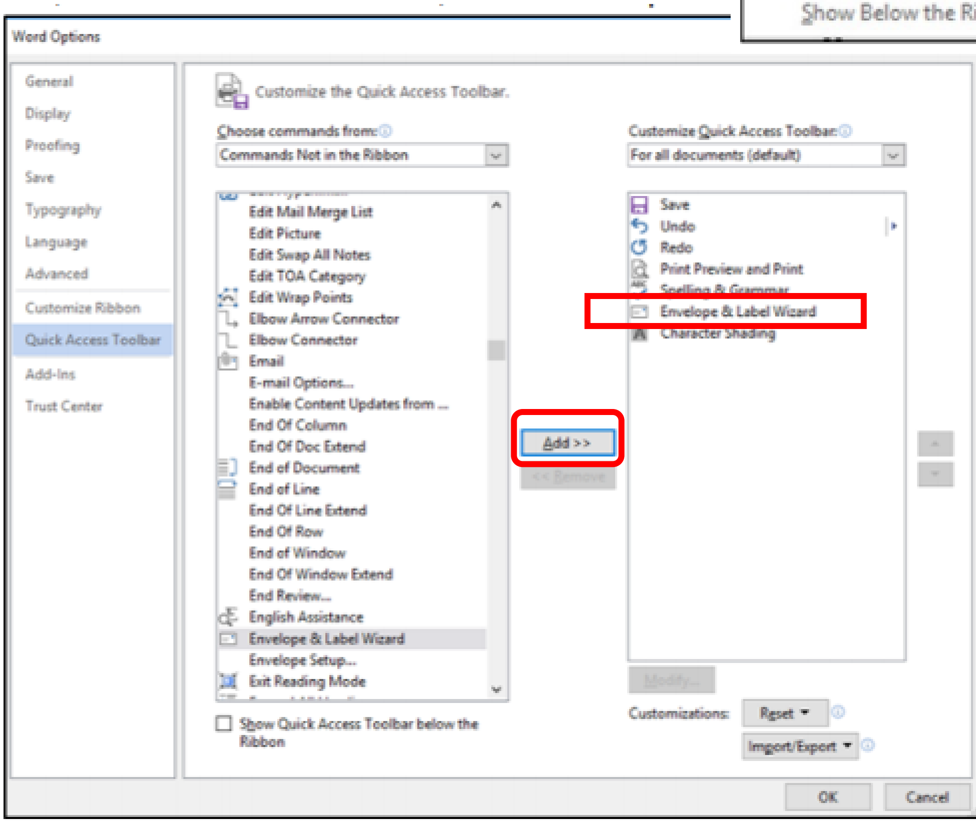
Customizing the Quick Access Toolbar in MS Word

By Mary Phillips, Secretary, ICON, MO
May 2018 issue, THE ICON-Newsletter
www.iconusersgroup.org
Mary(at)iconusersgroup.org

The Quick Access Toolbar in MS Word is located in the Title bar at the far-left side above the Ribbon. You can move it below the Ribbon. Initially it contains only buttons for Save, Undo, and Redo. I like to add more buttons because I use it a lot.



Clicking on the dropdown arrow at the right end of the QAT gives a list of the most common buttons. Checkmarks indicate which items are included. I like to add the Print Preview, Spell Check, and Envelope & Label Wizard. So, I put checkmarks beside Print Preview and Print and Spelling & Grammar. To locate the Envelope & Label Wizard button, click on More Commands, then in the Options window under



Digital Camera Control and Image Capture

By Dick Maybach, Member, Brookdale Computer Users Group, NJ
May 2018 issue, BCUG Bytes www.bcug.com n2nd (at) att.net

My April 2018 article discussed what digital cameras do. Before I left the house, I selected the film, matching its sensitivity to the light levels I expected, and choosing either color or black-and-white. For each picture I had to gauge the brightness, either by guess (with black-and-white film) or with an external light meter (with color) to set the aperture and shutter speed. Then I would estimate the distance to the subject and adjust the focus. At last, I was ready to push the button. Now these adjustments are controlled by the camera's processor and made in a fraction of a second.

Sensor Sensitivity

Conventional film comes in different sensitivities for different purposes, with lower sensitivity providing finer grain but requiring more light. Likewise, digital cameras have an ISO rating indicating their level of sensitivity to light. Here too, lower ISO implies less noise but requires more light. The lowest ISO for most cameras is around 100 and can be increased to as high as several thousand, but very high ISOs often result in unacceptable noise; see Figure 1.

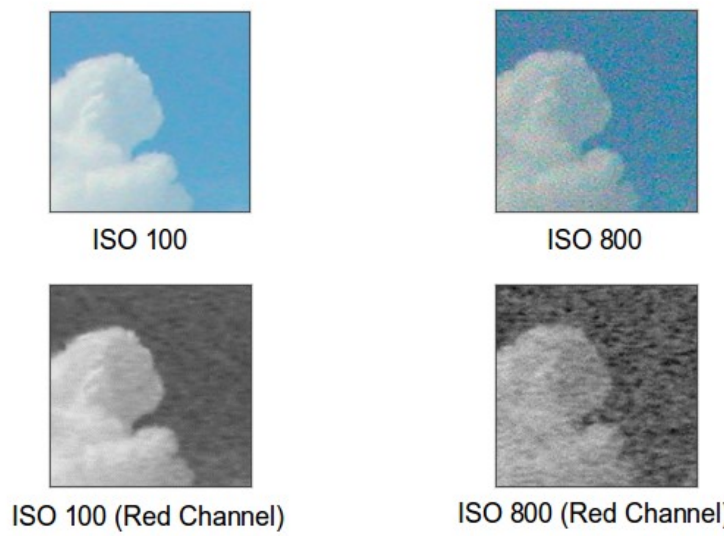


Figure 1. ISO Value and Noise.

Auto-exposure

Auto exposure is the process the camera uses to set its aperture and shutter speed, and most cameras let you select the mode, Figure 2. Matrix looks at the brightness of the entire frame, or at least at samples scattered about it, and is usually the right choice. The algorithms can be quite complex, and some high-end digicams hold databases of thousands of patterns, which they compare to the current image before setting the exposure. In unusual situations, you may wish to limit the area considered, for example if only the subject is brightly lit. In extreme cases, the area considered can be as small as five per cent of the frame area. Using the latter two modes, requires more time and thought, and in my experience often results in a missed pic-

Figure 2. Auto exposure Modes.

Continued Page 11

When using electronic flash, some cameras either measure the amount of light returned from the subject when the flash is on and turn off the flash when they judge the exposure is correct or measure the returned light during a brief pre-flash.

Auto focus

Two common method of adjusting focus are contrast detection and phase detection. Contrast detection determines the distance to the subject by analyzing the image itself. The camera examines a small portion of the scene (shown by the red rectangles in Figure 3) and moves the lens elements, searching for the best focus. The processor in the camera measures the differences in intensity among the adjacent pixels in the strip. If the scene is out of focus, adjacent pixels have very similar intensities. The microprocessor finds the point that produces the maximum intensity difference between adjacent pixels; that's the point of best focus. Look at the difference in the pixels in the two

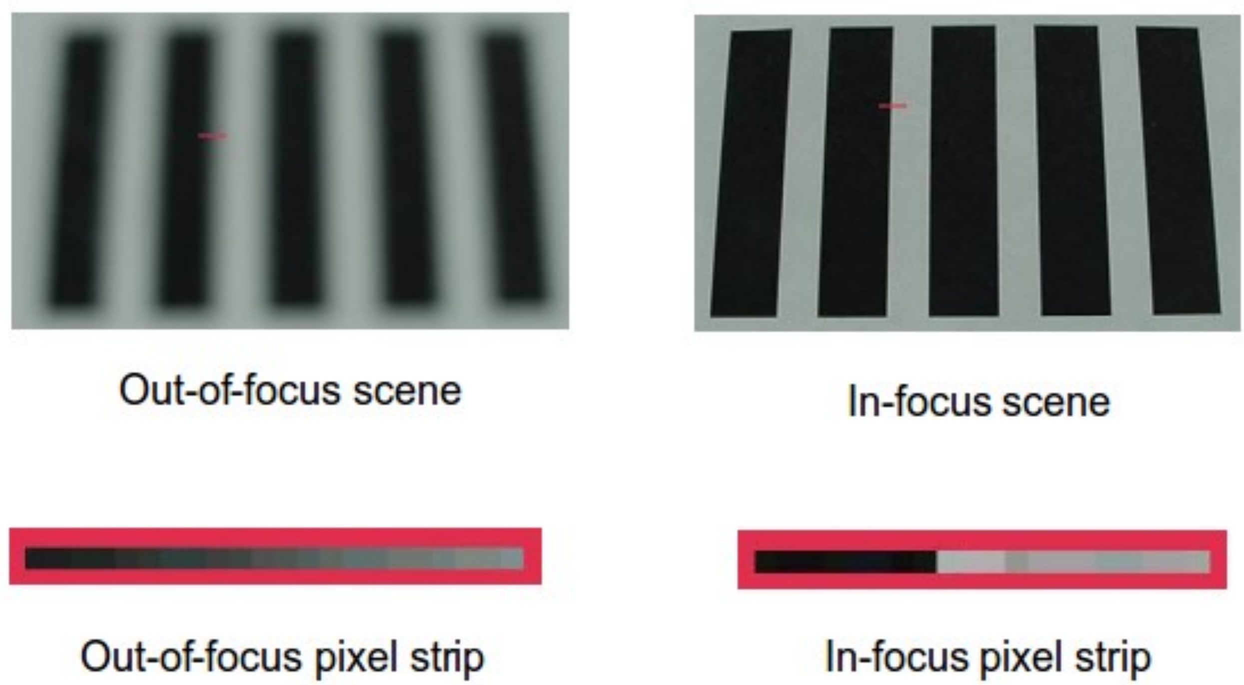


Figure 3. Contrast Detection Auto focus.

The image must have some detail and must be illuminated to provide the contrast that passive auto focus needs. If you try to take a picture of a blank wall or a large object of uniform color, the camera may not be able to find enough difference in adjacent pixels to adjust the focus. Although some systems react only to vertical or horizontal detail, newer designs use combinations of vertical and horizontal sensor strips.

This method is used on compact and mirrorless digital cameras. Early implementations were fairly slow, since the camera must search for the correct focus by moving the lens, but recent versions are much faster. Contrast detection requires no added hardware, since the input is from the existing photo-sensor (assuming of course that the sensor is not blocked by a shutter or mirror).

Years ago, some cameras used active auto focus, which bounced sound from the subject and used transit time to judge distance. This worked well for subjects within 20 feet or so but required additional hardware. These techniques were more popular in film cameras; Polaroid in particular was fond of it.

Continued Page 12

Most single-lens reflex cameras use an auto focus method called phase detection, shown in Figure 4. (If you have an engineering background, be careful here; this method is not related to the one of the same name used in radio receivers.) There are two light paths, shown by the red and green lines. Using optics to separate the two, this system produces two images, one from the right and one from the left side of the lens. It then measures the distance between those two images and detects the defocus amount. As the subject moves closer or farther, the angles of these two beams change, causing the distance between the images to change. If the camera knows the lens characteristics, it can calculate exactly how far to move the lens to achieve correct focus from the separation of the images, making focusing extremely fast.

This method judges distance the same way you do with your two eyes, but the separation in the camera is limited by the lens diameter. Hence, it's less effective with small lenses. Traditionally this method requires dedicated focus sensors. Initially, it was practical only for SLRs, but recently manufacturers have integrated phase detection into the main sensor, allowing its use in other architectures.

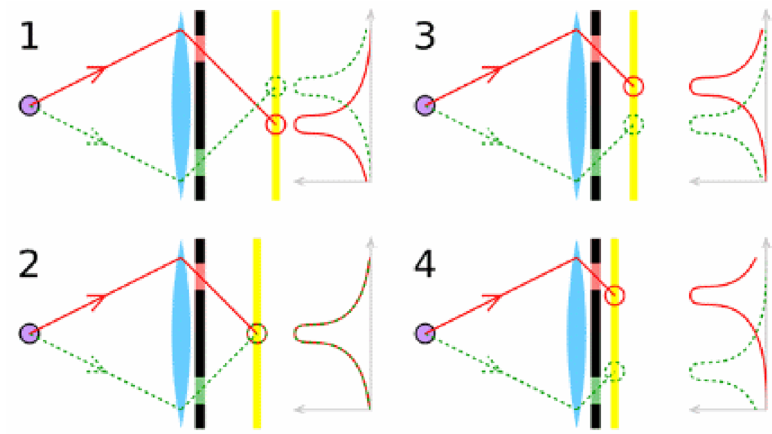


Figure 4. Phase Detection Auto focus

Figure 5 shows a traditional SLR phase detection sensor. It contains element pairs, some separated horizontally, some vertically, and some diagonally.

There are optics between it and the lens so that each member of the pair sees the same portion of the image, but from a different position. Think of them as pairs of eyes, each looking at the same area. It's important to remember that you can't determine from its position on the sensor what portion of the image each pair sees.

Here we see 10 pairs separated vertically, 10 diagonally, and 16 horizontally. Those separated horizontally look for vertical edges, and those separated vertically look for horizontal ones.

We could use the sensor of Figure 5 to look for horizontal, vertical, or diagonal edges at 10 different areas in an image, and for vertical ones at an additional 6 areas.

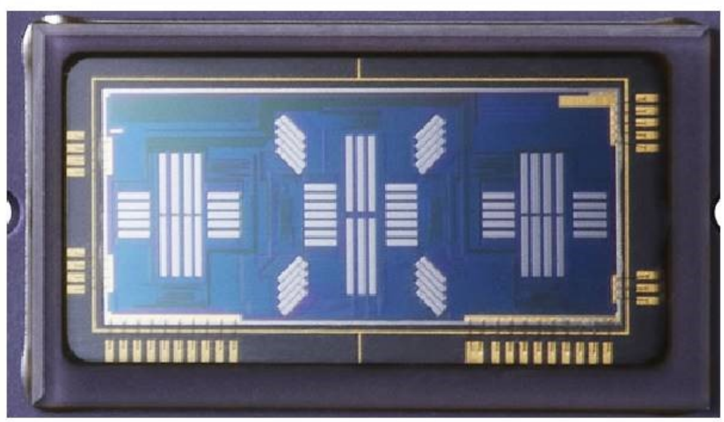


Figure 5. Phase Detection Sensor.

Continued Page 13

Figure 6 shows a complete phase detection auto focus system as implemented by an SLR.
1 is the object and the red lines show the light from it.
2 is the main SLR mirror, which is partially silvered to allow some light to pass through.
3 is the secondary mirror, which directs light to the focus system.
4 is the image sensor and shutter.
5 and 6 are mirror adjustment points.
7 is the phase detection sensor assembly, with the sensor itself at the bottom. The assembly contains masks and lenses to select and focus the light seen by each element of the sensor.
8 is the pentaprism that orients the viewfinder image. Without this the image would be upside down or reversed left-to-right.
9 is the viewfinder window.

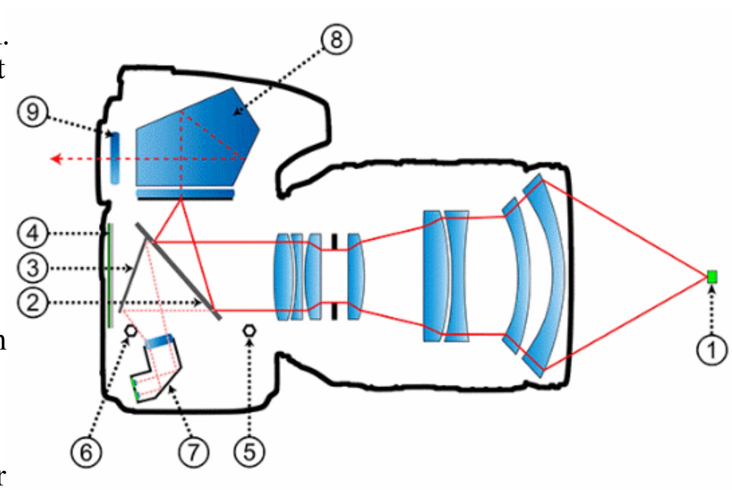


Figure 6. Complete SLR Phase Detection Auto Focus System.

The details aren't important. What is important is the concept of comparing an image as seen from two separated points to judge its distance. In the graphic, the top light path views the object from the top of the lens, and the bottom path from its bottom. This doesn't show the exposure system, which could be located at the bottom or in the viewfinder.

Image Capture

Once the camera has completed its exposure and focus adjustments it is ready to capture an image, which it does using a format designed to make the sensor's job easier. Modern digital cameras contain more CPU power than desktop PCs of just a few years ago, and they have the power to convert these two forms that portray images correctly.

Digitizing

An Analog to Digital Converter (ADC) converts analog voltages to digital numbers. A one-bit ADC would classify the pixel values as either black (0) or white (1). A two-bit ADC would categorize them into four groups: black (00), white (11), and two gray levels in between (01 and 10). Most consumer digital cameras use 8-bit ADCs, allowing up to 256 distinct values for the brightness of a single pixel. Digital SLR cameras have sensors with a higher dynamic range and are usually equipped with 12-bit or higher ADCs. In each case, level 0 represents black, while the top (all ones) level represents white, and each intermediate level is a different shade of gray. These black, white, and gray brightness levels are all combined in what constitutes the gray-scale or brightness range of the image. A higher number of gray levels corresponds to greater bit depth and the ability to accurately represent a greater signal dynamic range, as shown in Figure 7.

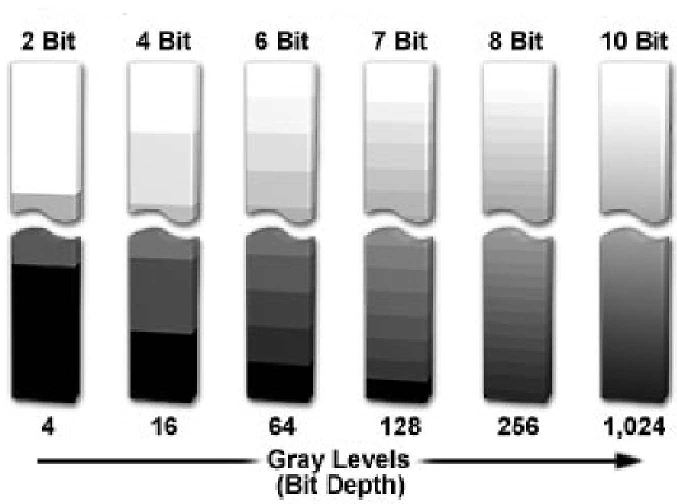


Figure 7. Bit Depth and Gray Levels in Digital Images.

Continued Page 14

Figure 8 shows the same black and white image using three different bit depths. The first uses just one bit to describe each sample, so each pixel is either black or white. Four bits per sample in the second image provide sixteen different shades of gray. This does not give a high-quality image, note the banding in the sky area. The third image uses eight bits to describe each sample. This allows each sample to take one of 256 possible gray values.

But what about color? Recall from the March 2018 article that the sensor is covered by a Bayer filter, which means that some pixels see only green, some only red, and some only blue. As a result, the camera can estimate not only the light intensity, but also the color at each pixel by using information from adjacent ones

The processes we've discussed so far capture images that are properly focused and exposed, converts them to an array of digital numbers, and stores them. However, there is much to be done before they can be viewed, and I'll discuss that next month.

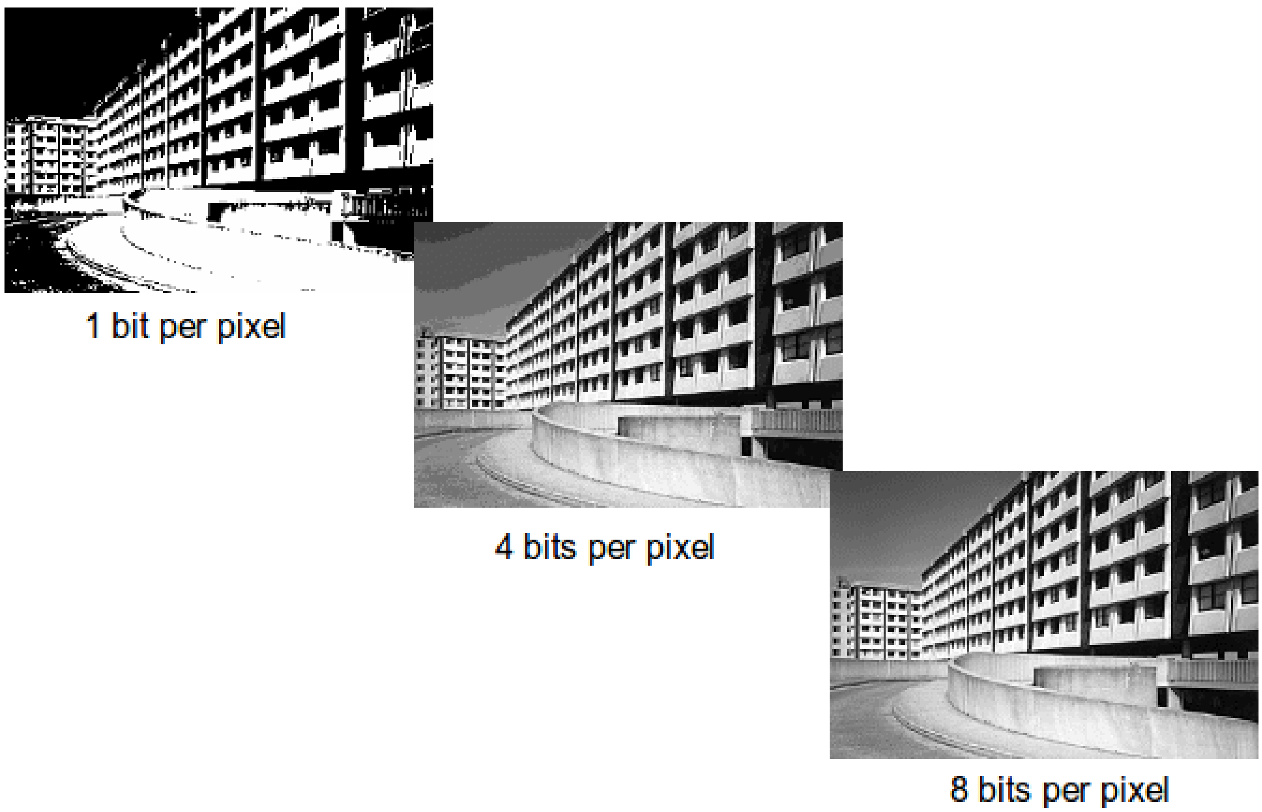


Figure 8. Gray Levels.

Great Discovery!!!
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