

# Photography Basics for Technical Communicators

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*In small companies, the technical communicator may wear many hats, including staff photographer. This article reviews the difficulties a fledgling photographer must surmount to take publication-quality photographs in a technical or scientific environment. Specific issues discussed in the article include selecting photography equipment, film, exposure, depth of field, close-ups, and special circumstances such as photographing cathode ray tubes, reflective objects, and objects in fluorescent lighting.*

## Introduction

Many companies have small—sometimes one-person—publication departments, where the publication manager must wear many hats: writer, editor, layout designer, illustrator, and so on. Some of these duties are contracted out, especially when the demands of a project outstrip the skills of a one- or few-person operation. Among the project tasks that are often contracted out is photography.

Photography is generally considered an exotic element in a technical communication project, yet many projects require photographs of some sort. Sometimes stock photographs, sold for hundreds of dollars apiece in stock photography catalogs, are used to compensate for a lack of photographic wherewithal. But when a *particular* photograph is required, a professional photographer is called upon, and professional photographers can be quite expensive.

Black-and-white or color, on-site or off, photographers charge as much as two hundred dollars per hour and as much as ten dollars for each processed photograph. The quality of such photographs may be excellent, but such a quality is not beyond the capacity of a small publication department. Some pre-press services, such as scanning images from a negative or slide, can also be done efficiently in-house. Here's how you can prepare your publication department to handle photographic and pre-press tasks in-house, and save your company significant money in the process.

## Setting It Up

To handle photographic tasks in-house, you need some basic equipment and the skills to use the equipment. Most colleges and universities offer classes in basic photography. For a few hundred dollars and a few hours a week, you can learn enough in one semester to skillfully use photographic equipment and develop the repertoire of special skills needed to take photographs in a technical environment, such as a laboratory. Many companies will pay for tuition and books without a flinch. However, the real cost of setting up a photography and pre-press element in a publication department is the investment in equipment. Selecting the right equipment without busting your budget is perhaps more challenging than acquiring the skills needed to use the equipment.



## Selecting the Right Camera

The first step in equipping a small publication department for photographic and pre-press services is selecting the right camera. There are four main types of cameras to choose from: view camera, rangefinder/viewfinder, single-lens reflex (SLR), and twin-lens reflex (TLR). By far, the most popular type of camera is the rangefinder/viewfinder, often called the point-and-shoot camera. This ubiquitous camera type is really not suitable for producing professional-quality photographs. View cameras are ideal for studio work, but are difficult to master and are not easily moved or poised for motion shots. The TLR is more expensive, more cumbersome, and more difficult to use at eye level than the SLR, but it has a quiet shutter release, which is ideal for wildlife or other situations where noise abatement is essential to getting the right shot.

For professional photographers, the mobility, versatility, and affordability of the SLR make it an ideal choice. Plus, there is a greater variety of lenses and accessories available for the SLR than for any other type of camera. The market for these cameras is keen, so you can get more camera for less than the cost of a view or TLR camera.

The format of the camera is your next decision. For most situations, a 35mm camera format is sufficient. A sharp image on a 35mm negative can easily be enlarged to a full page. If you need images larger than a full page, then you may want to consider a larger format, such as a medium-format SLR, which can use a negative up to 6 x 9 cm. However, once you commit yourself to a larger format, you lose all the advantages of a 35mm negative that result from its popularity. For instance, many of the affordable slide scanners in the market can scan only 35mm negatives or slides. Film and processing are also less expensive for smaller negatives.

The numerous bells and whistles a camera sports can confuse the novice photographer, but there are a few features required for professional quality and versatility. First, make sure that the camera can be set on manual so that you can precisely control exposure. Automatic exposure is a good feature, but a camera's meter cannot always be trusted. Also make sure that the camera has either a spot or center-weighted meter in addition to a matrix meter (used for automatic exposure). Finally, the camera you select should have a hot shoe to connect external devices such as an off-camera flash. Other desirable but not essential features include auto-focus, built-in flash, depth-of-field preview, and auto film advance. For a comparison of SLRs, refer to the *Photo Handbook of Information*, published annually by *Popular Photography Magazine*.

## Selecting the Right Lenses

Essentially, a camera is just a fancy way of controlling a shutter and accessories. Once a shutter opens, the only thing between your subject and the film is the lens connected to the front of the camera. Needless to say, the quality of the lenses you connect to your camera is critical to the quality of photographs. Clarity, focus, and depth of field are all image qualities controlled by the lens and its settings.

For most situations, two lenses will be sufficient: a 24-to-70mm zoom and a 70-to-210mm zoom. With these two lenses, you have a range of 24mm (for very wide angles) to 210mm (for far-away shots). Getting a lens with a “macro” feature will allow you to get very close to your subject, but this feature increases the price of the lens. Also, get the fastest lens your budget will allow. The “speed” of a lens refers to its widest aperture setting. The wider the aperture, the less available light you need to take photographs and therefore the faster you can set your shutter speed. Lens speeds for zooms are listed in a range, such as 3.5–5.6 (slow) and 2.8–3.5 (fast). But the faster the lens, the more it costs.

## **Selecting the Right Accessories**

The cost of accessories can be greater than the cost of the camera itself, so an impulse to buy gadgets that promise better photographs or scintillating special effects can explode a budget. But some accessories are essential to routinely taking good photographs. A tripod is a must. The sturdier the tripod, the better chance of taking a sharp photograph. Especially when you are shooting with a slow shutter speed, such as in low light, the camera must be held by something other than your hands. To further increase the chances of taking a sharp photograph, use a cable release with a camera mounted on a tripod. Releasing the shutter with a cable instead of pressing on the camera insures that a fat finger doesn’t jar the camera when the shutter is released.

Even if your camera has a built-in flash, you will need a powerful flash and flash cable so that you can illuminate subjects at various angles and distances. A cheap light stand and umbrella (to soften the light) further increases your lighting repertoire. Some lens filters, which screw onto the end of the lens, are essential to good photography, but most create too fanciful effects for sober technical photography. Every lens should have a skylight or UV filter to protect it from scratches. These filters have relatively little effect on exposure.

Other essential accessories include a cleaning kit for lenses and camera, a reputable reference book, a gray card (discussed later in “Getting the Right Exposure”), lens caps, extra batteries, an indelible pen, and a spacious bag to put it all in.

## **Getting Photos into Your Computer**

### **Hardware**

A slide scanner, many of which will also scan negatives, can save hundreds or even thousands of dollars per year in pre-press costs. Additionally, you don’t have to be so frugal with your imaging options. Getting an image into a publication can take as little as five minutes—no footwork, no vendors.

The performance of a slide scanner is determined by its maximum resolution (measured in dots per inch, or dpi), color accuracy (measured in bits per color—red, blue, and green), optical density, and scanning speed. For images that will be printed at 150 lines per inch, which is a common resolution for offset presses, the final digital image should be 300 dpi. Scanning a 35mm slide or negative at 300 dpi will yield an acceptably

resolved image the size of the slide or negative, about one by one and a half inches in area. That's pretty small. To yield a 300-dpi image about the size of a full page, you need a scanner with a resolution of at least 2400 dpi.

To yield a digital image with accurate color information, get a scanner with at least eight bits of information per color, for a total of 24 bits. Some slide scanners have 30 bits or more. The more bits, the greater the color fidelity and the cost of the scanner. Also, get the highest optical density you can. Optical density is the range of light—from highlights to shadows—that the scanner can extract detail. Think of it as “How much does the scanner contract the light in the image? The higher the optical density, the more detail the scanner can extract from an image. An optical density of 2.7 to 3.0 is typical. Some scanners have an optical density greater than 3.5. Finally, consider your scanning volume before you select a scanner. If you anticipate a large volume of scans, then select a scanner with a fast scan time (less than two minutes). For a low volume, the scan time is not a very important criterion.

## **Software**

Once you have scanned a slide or negative, you will need to touch it up. With an image processor such as Adobe Photoshop, you can adjust the color balance (such as getting rid of a green cast), adjust brightness and contrast, touch up specks and scratches, and export the image as a file type you can place in a page-layout program.

## **Selecting the Right Film**

The most important options for film include black-and-white or color, slide or print, and speed. I suggest that you always use color film because the color in an image can always be digitally discarded to leave only information about light intensity (gray-scale information), but color can be added to a black-and-white photograph by only the greatest contrivance. By scanning a color slide or negative in gray-scale mode, you render a black-and-white image whose brightness and contrast can be adjusted to taste.

Whether to use slide or print film depends upon what you are going to do with the film. Slide film (sometimes called reversal or positive film) is versatile. It can be used in slide presentations and also scanned in for publications. However, it is sensitive to the temperature of light and must therefore be matched to the type of light exposed on the film. For daylight and flash light, use a daylight slide film. When your subject is illuminated with incandescent bulbs, a tungsten-balanced slide film is required. Fluorescent light poses a unique problem insurmountable by film selection. As discussed later, the problem with fluorescent lamps, which cast a greenish light, can be partially solved by installing a magenta filter on the camera lens or balancing the color in an image processor. The problem can be fully solved only by supplying your own light source.

For most photographs, print film is the way to go. While prints cost more than slides, processing print film costs far less than processing slide film. If you have a negative

scanner, you can process print film without making prints, inspect the negatives with a 4x or 8x loupe, select the images you want, and then scan in the images for digital processing. Another advantage of print film is that it is not as sensitive to the green cast of fluorescent light as slide film.

Next, you must select the film speed. The rule of thumb for selecting the film speed is to get the slowest speed your lighting situation will allow. The higher the speed of the film (called ISO rating), the less light required to properly expose the film but the more grainy the image. Slow film, ISO 50 or less, is best for detail and sharpness. A flash can be used if the lighting is not sufficient and the subject is small enough. If the subject is not in motion or the subject is in motion and your project can tolerate blurred motion, then you can use the slow film with a slow shutter speed to let in more light. Otherwise, you can use a medium-speed film (ISO 100 to 200) or even a fast film (ISO 400 or so) to compensate for low light.

## **Getting the Right Exposure**

Exposure is the amount of light that reaches the film inside your camera. Imagine that the amount of exposure is equal to the amount of water in a bucket, the aperture is a hose, and the shutter is an on/off valve. You can increase the amount of water by increasing the volume supplied by the hose or by increasing the amount of time the hose is on. Likewise, the larger the aperture of the lens and the longer the shutter is open, the greater the exposure. Doubling the aperture size *or* the shutter time increases the exposure by one “stop,” which is the unit of measure for exposure. For example, increasing the shutter time from 1/60 of a second to 1/30 will double the amount of light exposed on the film.

Aperture settings are a bit more difficult to calculate. Basically, aperture settings, called f-stops, are inversely proportional to the diameter of the aperture. The standard aperture settings are 1.4, 2.0, 2.8, 4.0, 5.6, 8, 11, 16, 22, and 32. Each decrease in f-stop doubles the amount of light exposed on the film.

Most cameras automatically adjust the exposure level to match the speed of the film (doubling the speed decreases the amount of light the film needs by half). But for manual cameras, correct exposure can only be achieved if you set the ISO dial to the ISO rating of your film.

Almost all SLRs have a built-in exposure meter, so purchasing a hand-held exposure meter is not necessary. Your camera’s meter measures the amount of light reflecting off the subject and passing through your lens. If you use the center-weighted setting on your camera’s meter, then the meter will favor the light passing through a moderate portion of the lens center. If you use the spot setting, the meter registers only the light passing through a small circle at the center of the lens. Many SLRs also have a multi-segment setting, or matrix meter, used to make complex calculations about the light reflected from the subject for automatic exposure.

For most shots, the matrix or center-weighted settings will yield a good exposure. But to be accurate, it is best to use spot metering and a gray card. Available at photo suppliers, a gray card is a piece of gray cardboard that reflects 18 percent of the light that falls on it. Built-in light meters are calibrated at 18 percent before they leave the factory, so using a gray card will yield a very accurate exposure for any subject. In fact, I use a gray card for many non-flash shots. If you find yourself in a shooting situation without a gray card, you can take a substitute exposure reading by metering your hand (if your skin has an average tone), concrete, or other mid-tone areas.

One way to hedge your chances for a correct exposure is to bracket your shots. Bracketing is when you take one shot with less exposure suggested by the meter, one shot according to the meter, and one shot with more exposure suggested by the meter. I usually bracket in 1-stop increments (-1, 0, +1). For critical shots, I take many shots, such as -2, -1, 0, +1, and +2. Wasted film costs much less than redoing a photography shoot.

## **Composing with Purpose**

### **Depth of Field**

The distance of acceptable sharpness in front of and behind the point of focus is called the depth of field. For illustration, imagine taking a photograph of a crowd of people. If you focus on someone in the middle of the crowd, some people in front of and behind that point of focus will also be in focus. The distance between the last person in focus and the first is the depth of field.

You can control depth of field with the aperture. The larger the aperture, the more shallow the depth of field. Unless you have a depth-of-field preview feature on your camera, the depth of field you see in your viewfinder is the depth of field at the largest aperture of your lens (smallest f-stop setting), which is the most shallow depth of field possible. Without a depth-of-field preview, you have to imagine the depth of field. The distance between you and your subject also affects depth of field. The closer you get to your subject, the more shallow the depth of field.

When you compose a photograph, consider how depth of field affects the composition. Do you want the viewer to notice foreground and background elements? If not, then set a shallow depth of field. If in-focus background and foreground elements are important to the composition, then set a deep depth of field. Sometimes your composition will require a moderate depth of field. For example, I once composed a shot of an engineer holding an electronic component in front of him. I wanted the component to be in focus but the engineer's face to be somewhat out of focus so that he was anonymous. This "fuzzy" technique can be used in many dramatic ways to highlight some elements and mystify others.

### **Close-Ups**

Many camera lenses are able to focus down to a few inches away from the subject. Called macro lenses (short for photomacrography), they allow you to focus images anywhere from 1/10 life size to a few times life size, depending on how close you get. Supplementary lenses, sometimes called diopters, can be added to an ordinary camera lens to magnify the subject. To maintain good resolution and sharpness, use only diopters with multi-elements. With a regular lens and a diopter, you can focus images as large as twenty times life size.

One warning must be heeded when you bring the lens close to your subject for a close-up photograph: Depth of field will decrease to millimeters, even if the aperture is closed to its minimum diameter. Because depth of field decreases as the lens gets closer to the subject, depth of field may be so narrow that if the raised letters on a coin are in focus, the scratches on the coin's background will not be. Therefore, close-up photography is difficult for three-dimensional subjects. It's best to experiment with various angles, focal lengths, diopter strengths, and aperture (f-stop) settings.

## **Special Circumstances**

### **CRTs**

Most televisions, computer monitors, and oscilloscopes display information via cathode ray tubes (CRTs), most of which re-form images 30 to 60 times per second. When photographing one of these appliances, the shutter speed must be set equal to or less than the re-form rate (also called the scan or refresh rate). If you don't know the re-form rate, set the shutter speed at 1/30 of a second or less to be safe. Otherwise, only a portion of the image may be properly captured on film. However, the lower you set the shutter speed, the more likely that moving images will blur.

Photographing static images on a CRT makes the job easier, but you still have to worry about proper exposure, which is determined by both shutter speed and aperture setting (f-stop). Because CRTs are sources of light, properly exposing both the image on the CRT and the rest of the scene can be difficult. In too light a room, the CRT image may be under-exposed. In too dark a room, it may be over-exposed (called blooming). When the CRT is the subject, I have had the best results shooting in low-light with a slow shutter speed, metering off the CRT itself, and bracketing like crazy. When the CRT is just part of the scene and not the main subject, then I use moderate light and meter a gray card placed close to the subject.

Another complication of photographing CRTs is that it limits your options for using a flash. When a CRT is illuminated by the powerful strobe of a flash, the flash illuminates the CRT glass screen and washes out the image. Even if you use a flash and set a long exposure, the resulting image may have a glare from the burst of light, unless you use a polarizing filter, discussed below. In any event, it's certainly easier to predict the results when you use existing light with CRTs.

### **Reflective Objects**

Reflections on glass, water, and other nonmetallic objects can be reduced or eliminated with a polarizing filter. However, filters are ineffective for metallic surfaces. To eliminate reflections on these surfaces, first block or extinguish any direct sources of light hitting the metal surface. Then, create a tent over the subject with a white sheet. Shine your light source through the tent onto the subject and meter off a gray card next to the subject.

## **Fluorescent Lighting**

Different types of light sources have different color balances. Daylight, for instance, has a color balance of about 5,000° Kelvin (K), a flash about 6,000° K, and a tungsten floodlamp about 3,200° K. Fluorescent light, however, does not have a continuous spectrum of color as do other sources of light. Fluorescent bulbs emit large amounts green light, moderate amounts of blue, but very little red. No color film can compensate for this discontinuous spectrum, but some techniques and accessories can mitigate the greenish cast of fluorescent light on a color negative or slide.

If the scene of the photograph is small enough to be illuminated by flashes, then you can turn off the fluorescent lights and use flash light only. However, flashes do not have enough power to cover large scenes, such as full laboratories or large offices. A magenta filter (designated FL-D for daylight film and FL-B for tungsten film) partially blocks the strong greens and moderate blues from the light spectrum, but the red portion of the spectrum will still be small in comparison. Print film is slightly less sensitive to the unbalanced light than slide film, so use it whenever the main light source is fluorescent. If you have a scene lit by fluorescent light and your foreground subject is close to the camera, you can mitigate the green cast in the scene and eliminate it from the subject by using a magenta filter on the lens (CC30M) and a light green filter on the flash (CC30G). However, one drawback of using a magenta filter is that it significantly reduces the total amount of light that reaches the film, by as much as 2.5 stops.

And finally, the color balance of the image can be adjusted with image processing software, such as Adobe Photoshop. To adjust the color balance of a subject exposed in fluorescent light, increase the amount of red and blue and decrease green until the image looks balanced, such as when flesh tones look realistic.

## **Conclusion**

For an investment of less than \$4,000, a small publication department can set up a photography and partial pre-press service that can save a company thousands of dollars per year. With a little initiative, in a few months you can learn enough to master the equipment you purchase. Developing photographic skills also increases your marketability as a technical communicator. Moreover, demonstrating a willingness to adopt and innovate money-saving measures will increase your value to your employer. An additional reward of learning photography is that taking good pictures can be fun and exciting, especially once you have mastered the basics.

## **Case Study**

In early 1995, the company I work for told me to produce a four-color brochure with many photographs for one of our research projects. After I got estimates from the photographer and pre-press vendor we had been using, I decided that I could save a lot of money if I learned how to use a camera, photography accessories, and a slide scanner. At that time, I had never held an SLR camera in my hands, had no knowledge of photographic principles, and had never used a slide scanner. Starting from scratch, as perhaps you will, here is what I did to successfully equip my company with the right stuff and me with the right skills.

First, I enrolled in a basic photography course that required three hours per week of my time. The company paid for tuition and books, but I attended classes on my own time. I convinced my company to purchase a suite of basic photography equipment, after having poured through dozens of photography magazines and picked the brains of dozens of vendors. Within three months, we had purchased enough equipment to do all of the photographic tasks and most of the pre-press tasks needed for our four-color brochure. As shown in Table 1, the total cost was about \$3,900.

Table 1. List of Equipment for a Photography and Pre-Press

| <i>Make and Model</i>  | <i>Description</i>                  | <i>Cost</i> |
|------------------------|-------------------------------------|-------------|
| Tiffen 52mm FL-Day     | Magenta Filter                      | \$20        |
| Tiffen 52mm UV         | UV Filter                           | \$13        |
| Tiffen 52mm UV         | UV Filter                           | \$13        |
| N/A                    | 20-inch Cable Release               | \$18        |
| Tiffen 58mm UV         | UV Filter                           | \$16        |
| Bogen 3221             | Tripod                              | \$130       |
| Bogen 3025             | Tripod Head                         | \$20        |
| Nikon 6006 Kit         | SLR Camera with 35–80mm Lens        | \$539       |
| Sigma 24mm 2.8         | 24mm Macro Lens                     | \$65        |
| Sunpak 433D            | Automatic Flash                     | \$65        |
| Lowe Pro Orion AW      | Fanny-pack Camera Bag with Backpack | \$76        |
| Raynox 35mm Micro E    | Close-up Lens Adapters              | \$138       |
| Nikon SC 17            | Off-camera Flash Cord               | \$50        |
| Wein WP-HS             | Flash Slave                         | \$36        |
| Polaroid SprintScan 35 | 35mm Slide/Negative Scanner         | \$1,810     |
| Adobe Photoshop 3.0.4  | Image Processing Software           | \$570       |
| N/A                    | Photography Course                  | \$240       |
| N/A                    | Reference Book                      | \$50        |

Total Investment in Equipment: \$3,869

As shown in Table 2, each photography shoot cost a minimum of \$140 for one roll of film if the job was contracted, as opposed to only \$8 if the shoot was done in-house. My labor canceled out because I spent as much time monitoring and directing a contract photographer as I spent doing the job myself, which is why labor is listed as \$0. The cost to scan a 35mm negative was about \$30 to yield a three-by-five-inch image. During 1995, I conducted 22 photography shoots and used in publications 30 of the four dozen or so negatives I scanned in. Therefore, my employer saved about \$2,900 in photography work (22 Shoots x \$132 = \$2,904) and \$780 in pre-press work (30 Photos x \$26 = \$780). Total savings in photography and pre-press services in 1995 was about \$3,700, almost enough to pay for the equipment purchased at the beginning of the year. And that doesn't include the money we saved by doing in-house portraits of our staff and dozens of photographs for presentations.

Table 2. Cost Comparison Between Contract and In-House Photographic and Pre-Press Services

|                | Photographic Costs per Shoot |            |      |             | Scanning Cost per Photo |
|----------------|------------------------------|------------|------|-------------|-------------------------|
|                | Labor                        | Processing | Film | Total Photo |                         |
| Contract       | \$120                        | \$20       | \$0  | \$140       | \$30                    |
| In-House       | \$0                          | \$3        | \$5  | \$8         | \$4                     |
| Savings: \$132 |                              |            |      |             | \$26                    |

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