Intro to Digital Photography: White Balance Notes

*** Slide 3 Review

Light: the medium through which we capture images. Without light there would be no photography.

Light is defined several ways, such as the quality of light or the intensity of light.

The best time to take flattering natural light portraits outdoors is during the Golden Hour, when the sunlight has a nice golden color to it that is very flattering for portraits. The golden hour happens twice a day, roughly a half hour before and after sunrise and sunset. Depending upon time of year and weather conditions this time can be varied somewhat. Typically here in the southwest, the golden hour is usually an hour after sunrise and an hour before sunset. In the summer you can extend this time before sunrise / after sunset upwards of 15 minutes.

Recall that all light falling on a subject is incidence light, and we see a subject because of its reflectance. Cameras are reflectance light meters, they measure the light being reflected off a subject. Hand held light meters can be used either as an incidence meter, measuring the light directly to calculate the exposure, or as a reflectance meter.

*** Slide 4 Light has color, and color has a temperature. This color temperature is measured in degrees Kelvin. The hotter the color is in Kelvins, the more blue it appears. Colors such as the reds, yellow, and oranges which we associate with warmth, actually have low Kelvin temperatures. Colors such as blues, violets, purples and whites which we associate with cool or cold, actually have high Kelvin temperatures.

The cones in the human eye have the best frequency response to green colors, most likely this is an evolutionary adaptation, along with the ability of pattern recognition. Helped our ancestors see the tiger hiding in the tall grass.

*** Slide 5 The exposure triangle of aperture, ISO, and shutter speed. These three elements are what make up exposure. If you vary aperture or shutter speed, then it will have an affect on its counterpart, but varying aperture and/or shutter speed has no effect on ISO. If you vary ISO then it has an effect on aperture and/or shutter speed.

*** Slide 6 Aperture is the diameter of the opening of the diaphragm of the lens in f/stops. An f/stop is a dimensionless number based upon the focal length of the lens divided by the diameter of the aperture. Except for macro photography, f8 on a 50mm, 100mm, or 400mm lens will deliver the same amount of light onto the sensor. A full f/stop is a ratio of light where you are either halving or doubling the amount of light.
*** Slide 7 ISO is the sensitivity of the sensor to light, and it is programmable so you can change it on the fly as needed. ISO is based off old film standard of the sensitivity of film to light. The higher the ISO number the more sensitive it is to light, and therefore the less light you need to take a photograph. Most cameras have a native ISO setting, usually an ISO setting of either 100 or 200. The higher the ISO setting the more likely you are to get digital noise, random colored pixels on your image.

Shutter speed is how fast the shutter opens and closes, exposing the sensor to light. Times can vary on most commercial digital cameras from between bulb (the shutter stays open as long as it is pressed) to 1/8000th of a second.

*** Slide 8 Depth of field is a definition of how much of an image is in focus. For those of you with point and shoot cameras, you can not do depth of field simply because of the size of the sensor and the optics of the lens: a point and shoot is designed to be sharp across all of its limited aperture range.

On digital (and film) SLRs, however, varying the aperture of the lens varies how wide on an area of focus you have. A lens that is wide open—the aperture all the way open—has a very shallow depth of field with the background being blurred out. Shallow depth of fields are typically used in portrait photography. As the aperture becomes smaller, the depth of field—those things that are in focus—increases. An aperture that is closed down, or very small, has a very large depth of field. Large depth of field is usually used for landscape photography when you want everything to be sharp from near ground to far away.

If you use automatic exposure bracketing, you want to make sure to vary your shutter speed and not aperture; if you vary your aperture you will get variable depth of fields.

*** Slide 9 While we see the world in color, for the camera the world is only one color: 18% grey

*** Slide 10 Neutral grey, that grey that sits between absolute black and white, reflects 18% of the light that is hitting it. For those of you who have done web design or used Photoshop, neutral grey is 50% grey, hexadecimal 808080, or RGB 128 128 128. Cameras see the world in this neutral grey, and cameras want to make everything into this neutral grey; this is because the world exists in the realm of mid-tones, there is almost nothing natural in the world that is pure black or pure white. And remember, human vision, while responding to the greens the best, also respond to these mid-tone colors.

*** Slide 11 Problem exposures happen when the subject is primarily white or black. The camera will see this extreme exposure and want to drive it to 18% grey. The end result is that if the subject is primarily black then the camera will overexpose the image to drive the black to 18% grey. If the
subject is primarily white then the camera will underexpose to get the white down to 18% grey. Zebras are a perfect exposure, being 50% white and 50% black.

*** Slide 12 This 18% grey is linked with what is known as white balance. White balance should be more accurately called color balance, for that is what is happening, you are telling the camera what the color temperature of the light is, or you can have the camera do that for you.

The color is balanced on a camera to remove any potential color casts in the images, those that are too blue (visually cool / Kelvin hot) or too yellow (visually warm / Kelvin cool). On some cameras you have the ability to go into the menu system and adjust your color balance along the blue-yellow axis (not all cameras have this capacity).

*** Slide 13 The color temperature of the ambient / incidence light does have an affect on perception of color. Most homes have an ambient color temperature of around 3200 Kelvin due to incandescent lighting, though with the adoption of CFLs and LEDs the color temperature will be higher. Outside at noon on a clear, sunny day the ambient color temperature is 5500 Kelvin; places like Home Depot and Lowes sell CFLs that are "daylight" in that they are color balanced to produce light that is at ~5500 Kelvin. For example, a match flame that is yellow under household light when taken outside will look red. This is how if your color balance is off on your camera you can get a color cast on your image.

*** Slide 14 This is a good example of the color cast that lights throw out. The 60 W Incandescent light bulb puts out a color temperature that is around 2700 Kelvin, very orange. A 13 W compact fluorescent light bulb has a color temperature of around 3500 Kelvin, a greenish tinge. The daylight balanced 13 W CFL puts out light that is similar to the color temperature of the noonday sun & sky light.

*** Slide 15 Most digital cameras have the ability to set the white balance based upon lighting conditions. This is done usually through the menu on the camera or on a button on the camera that reads "WB" for white balance. These default settings for the different lighting conditions have a preset white balance Kelvin temperature.

*** Slide 16 There are several ways to get a good color balance for the current lighting conditions by setting the white balance. As indicated before, you can do so through the menu or the buttons on the camera and set to a specific lighting condition or use AWB (Auto White Balance). You can buy a grey card. This is a card that is neutral gray and reflects exactly 18% of the light hitting it. You put the card next to your subject and then photograph it under the exact same lighting conditions as you're going to use. Then when you go to process your images you use this grey card as a known calibration reference.

You can also use an Expodisc by holding it over the lens and
pointing at the subject you take a photo. This photo is a neutral grey image based upon the incoming light reflected off the subject, and can be used as a calibration reference.

Note that if you are outside using just sunlight that the lighting conditions can change, sometimes rapidly. If you use a grey card or an Expodisc outside, then whenever the light changes you need to shoot another calibration image. If you are shooting in the studio, you typically only have to take one photo for a calibration image until you change the lighting setup.

*** Slides 19 & 20 Depending upon the camera you have the ability of using an image as your white balance preset. You take a photo of a grey card or through the Expodisc and then you tell your camera to use this as the white balance source for the next set of images. This remains valid until the light changes. Again, you probably don't want to do this outside where light can be very variable.

*** Slide 21 Here is an example of what happens when white balance goes bad. The image on the left is exposed and the white balance is correct. There was only one type of light source that the camera interpreted correctly. On the right image a second light source of a different color temperature was introduced—it was from the same direction at the same intensity, but a different color temperature. The automatic white balance on the camera guessed, and guessed incorrectly, giving the image an overall yellow-green hue. This image had to be taken into Photoshop and corrected by adding blue to counter the yellow-green.

*** Slide 22 If you have the option, and if the photo you are taking is critical, once-in-a-lifetime image, shoot in RAW. The RAW format does not encode the white balance into the image, so you have the ability to change it later. For example, if you have your white balance set to tungsten and then go outside to shoot, all your images will be blue (tungsten has a cool Kelvin value, so you add blue which has a high Kelvin value to balance it out). If you shot in JPEG you can fix things, but it take more effort than if you shot in RAW. In RAW it is just a matter of moving a slider to get rid of almost all color cast.

Your exposure modes determines which format the camera will record and which color space will be used by default. For the Auto / Program exposure modes, the format defaults to JPG with the sRGB (8-bit) color space. In A / Av (Aperture priority), S / Tv (Shutter priority), and M (Manual) you can set the camera up to shoot in RAW format with AdobeRGB color space. The RAW format for most cameras are 12-14 bit color space, which fits within the AdobeRGB color space which is 16 bit.