Tips on Using Digital Cameras for Manuscript Photography Using Existing Light

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The Hill Museum & Manuscript Library (HMML) uses digital single-lens-reflex (dSLR) cameras to photograph the pages of manuscripts. In most cases, this activity takes place at permanent or semi-permanent studio installations where the lighting is carefully controlled to produce consistent results. In some circumstances, a permanent studio setup is not possible, and the photographer must find ways to deal with the existing lighting conditions without the use of controlled, studio-type lighting. This document offers some tips on dealing with these lighting conditions.

General Camera Settings

-HMML tends to try to use the lowest ISO "speed" rating for the camera that is practical. For studio locations, this means ISO 100. This can be done in a studio setting because there is more than enough light provided by the flash units generally employed. In the field, it may be necessary to increase the ISO setting to allow images to be made with an optimum F-stop setting (described next) and a shutter speed that is not overly slow. The sSLRs currently used by HMML can be used at ISO 400-640 before noise starts to become overly visible in the images.

-Manuscript rarely lie perfectly flat for photography, and HMML does not use glass to flatten pages (as was done in the microfilm era). Because of this, there is some variation in distance to the camera lens across a given page or two-page spread. To create sharp images, HMML recommends using an aperture (F-Stop) setting of F8 or smaller (F11, F16, F22, etc.) when photographing manuscripts. This aperture setting will ensure enough depth of field to get all the page elements in proper focus.

-In order to obtain proper exposures at F8 or smaller, it is often the case that the shutter speed will end up having to be longer than what would generally allow for holding the camera by hand. A camera copy stand or tripod will usually be needed to hold the camera steady enough for photography at these slow shutter speeds. For location work, a tripod with a sidearm attachment is often the only practical solution. The Italian company *Manfrotto* makes excellent tripods, and a number of them have the ability to use sidearms:

> Manfrotto MT190XPRO4 Aluminum Tripod
> Manfrotto MT055XPRO3 Aluminum Tripod
> Manfrotto MT190XPRO3 Aluminum Tripod
> Manfrotto MT055CXPRO3 Carbon Fiber Tripod
> Manfrotto MT055CXPRO4 Carbon Fiber Tripod
> Manfrotto 190XPROB

In setting up a tripod with a sidearm, you may find that the weight of the camera and lens tends to make the rig unsteady—it wants to fall over in the direction of the camera. To counter this, a simple counterweight made from a mesh bag (the sort of bag that fruit often comes in) and a couple of bottles of water can be tied to the other end of the arm to stabilize the setup.

Improvised Manuscript Photography Setup. Tripod with sidearm allows camera to get a "straight-down" view of the subject matter. Suitcase serves as temporary table. Mesh fruit bag with a couple of water bottles inside provides counterbalance for the camera's weight.

General Guidelines for Setting Up In an Available-Light Situation

For maximum success in photographing manuscripts under available light, set up the equipment in an area that receives even, steady light. A north-facing window works well—such light will be fairly consistent throughout long periods if weather conditions are steady. If one has to work under existing artificial light, position the tripod and camera so that the subject matter receives lighting that is as even as possible. Watch out for shadows cast on the subject matter from such things as tripod legs. In some lighting situations, desk lamps or other light sources can be positioned to provide even illumination of the subject matter. One thing that HMML strives to achieve is good illumination into the central "gutter" between pages of books photographed as two-page spreads. If this area is rendered too dark, any marginalia that may be there will be difficult to read.

Achieving Proper Exposure and Color Balance

Compared to working in a controlled studio setting, photographing on location with available light requires being able to successfully cope with less-than-ideal lighting situations. The photographer must achieve two things for successful imaging: proper exposure and proper color balance.

Proper exposure basically means that the camera settings are optimized to allow the greatest dynamic range in the subject matter to be successfully recorded in the digital image. In technical terms, proper exposure occurs when the image is exposed to provide the maximum brightness in the darkest areas of the image *without allowing* the brightest areas to exceed the dynamic range of the sensor and brightness encoding scheme. What this means is that we want to set our exposure to produce a brightness *just below* the point where the brightest things in the picture are "blown out" to pure white, losing all detail. Setting the exposure as such gives us the most detail in the darkest areas that we can safely achieve. Achieving this means that the photographer is getting as much visual detail as possible in the resulting digital image.

Proper color balance, often referred to as *white balance,* is the process by which the camera's settings are properly matched to the spectral balance of the light illuminating the subject matter, resulting in accurate color in the final image. In practical terms, it means that the resulting images appear to be neutral in terms of color cast and that gray objects display as gray, without any color shift. Modern digital cameras have a number of settings that can be used to control this.

Without some sort of standard tonality to judge color balance from, it's hard to determine the proper color balance of, say, a parchment manuscript that's essentially light brown in color. To aid the photographer, HMML supplies special grayscale/metric scales that are included in the page images created.

Grayscale/Metricscale Positioned Next to Manuscript Being Photographed. This custom-made accessory from HMML provides a quick reference as to the size of the manuscript along with providing color-control patches that can be used to produce images with the correct color balance.

The HMML grayscale/metric scale is a custom-made accessory supplied to its digital preservation partners. It is made by printing out a PDF image of a metric scale, taking care to make sure that the resulting printout is accurately-sized. This PDF printout is pasted to a backing of acid-free matte board.

Along with the metric scale, three color-control patches are also pasted to the narrow board. These small square patches are cut from commercially-available *QP Cards*, which are photographically neutral cards containing white, gray, and black patches. QP Cards are used extensively for digital photography and scanning as a reference for color neutral tones.

The white patch of the scale is used to determine proper exposure. In manuscript photography, it is often the case that this white patch is the *brightest object* in the photograph. If the user sets the exposure for this patch to be *bright but not blown out*, it can be assumed that nothing else in the picture will be blown out as well.

The gray patch of the scale is used to produce a proper color balance for the image. It is a mid-level neutral gray and as such should not have any particular color cast in the image. Digital cameras produce images in the RED GREEN BLUE (RGB) colorspace, so if the digital intensity numbers for red, green and blue on this gray patch are closely matched, a good gray balance is achieved. By extension, if the neutral gray is correctly-rendered, it is assumed that the other colors will "fall into place" correctly.

Rather than repeat what is in other technical documents, it would be a good idea to read the studio manual for the Canon 6D dSLR, which is used in many of HMML's projects. The document can be downloaded at:

http://www.vhmml.us/Resource/Downloads/2016%20Canon%206D%20manual.pdf

In particular, the sections on using the grayscale/metricscale for determining proper exposure and white balance are useful, and apply to available-light photography as well. In practice the available-light photographer will likely have somewhat different settings for shutter speed and ISO due to the fact she will usually be facing a situation with less light than a studio technician would have at their disposal.

It's much easier to get perfect exposure and color balance if the user elects to use Canon's remote capture software to control the camera and collect the images (detailed in the document linked above). For example, there is no ability for the camera to show the user the RGB values on specific areas of the digital image within the camera itself—one has to use Digital Photo Professional and EOS Utility to be able to work to such fine tolerances. With lightweight laptop computers, working with the camera in "tethered" mode is fairly easy these days.

How to Achieve Proper Color Balance With Available Light

So, assuming that an available-light photographer is set up with remote capture software and a manuscript ready to be photographed, what is the best way to achieve proper color balance? Actually there are a number of ways. Digital cameras generally have a number of pre-set white balance settings that can be chosen by the user, and it's often possible that a number of them could work.

Most users of digital cameras have their cameras set on "Auto While Balance" (AWB), a general setting that analyzes each shot and produces an average balance based on the subject matter imaged. While handy for casual photography, this setting is not the best for controlled manuscript photography.

This is because the color balance will change for each shot taken—the system adjusts for each shot, and if a page is photographed that contains colored illuminations, for example, the camera will readjust because of this.

It would be better to try the other, fixed white balance settings offered by the camera. There are generally settings for:

-Daylight, for outdoor sunlit conditions
-Shade, for outdoor conditions in the shade (shaded areas have a more blueish light)
-Cloudy, for outdoor conditions where the sun is behind clouds
-Tungsten, for lights using incandescent bulbs or halogen lamps
-White Fluorescent, for interior lighting using typical fluorescent tubes
-Flash, for either on-camera flash or studio flash lighting units
-Color Temperature, which allow precise selection of a "color temperature," usually in degrees Kelvin. This is most useful in controlled studio situations, but can also be used with ambient light if the user is willing to try many settings until proper balance is achieved.

The trial-and-error adjustment of white balance using the last setting mentioned (Color Temperature, often listed as "K") is described in detail in the 6D camera manual linked above. Essentially, the user tries different color temperature number settings to find the one that causes the red, green and blue numeric values for the gray patch on the metric scale to be close enough to each other to be considered within tolerance (we strive for 6 units).

For final perfecting of the white balance, the 6D manual details how the "WB Shift" control can be used after reaching an acceptable balance with the "K" setting to very precisely tune the color balance. This tool can be used with any of the other preset white balance settings to fine-tune the balance. For example, if one were photographing a manuscript by the light of north-facing window, it might be best to set the WB to "Shade" and then use the WB Shift panel to fine-tune the balance from there. The same process might work when photographing under fluorescent lights (using the WB setting for that), or incandescent lights (using the "tungsten" setting, which often is shown as a lightbulb icon).
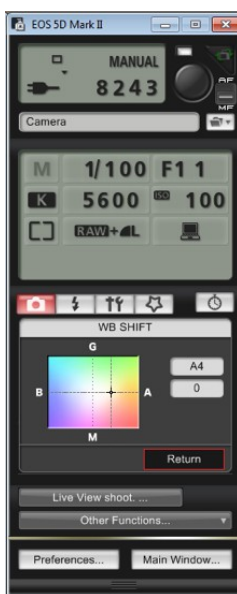
WB Shift Panel in EOS Capture Utility. This control panel gives the user the ability to precisely adjust the color balance. By default, the color indicator is in the center of the rectangular color matrix. Clicking in other parts of

this matrix shifts the color balance; the user can nudge the color balance in whatever direction is desired to achieve perfect balance. In this example, a shot that was a bit blue is being corrected by shifting the balance away from blue (B) and towards amber (A).

Custom White Balance

There is one more white balance setting that can be extremely handy in dealing with light sources that cannot be identified or that cannot be successfully handled with any of the other white balance settings. This is the "Custom White Balance," where the user photographs a white object and sets the camera to create a custom white balance based on it.

It would be wise to consult the Canon user manual to verify the methodology (I don't know if the method is consistent across all camera models), but in general it goes like this:

> -Have a data card in the camera that is empty.
> -Procure a sheet of white paper or some other white object that has no color cast.
> -Set the camera to auto white balance (AWB).
> -Set the exposure mode to Program mode (P). The camera will set its own exposure.
> -Frame the white paper so it fills the frame..
> -Turn off autofocus, as the camera won't be able to focus on a blank sheet of paper.
> -Shoot one picture of the piece of paper. Verify that it fills the frame.
> -Using the camera menu system, go to "custom white balance."
> -The camera's display will show you the pic you just shot of the white paper. Press "Set."
> -A message will appear asking if you want to use this image for the balance. Select "OK."
> -A message will then appear saying you should set the WB to "custom." press "OK."
> -With the menu, go to "White Balance," and choose "Custom."

With this method, accurate color balance can be achieved even in difficult mixed-light situations. It is, however, somewhat complex and needs to be done with the camera controls, not the remote capture software. After setting the camera, the user should then rig up with the remote capture software and take a test shot with the metric/grayscale and verify that the custom white balance worked properly. As with the other WB settings, the WB Shift control can be used to fine-tune the balance.