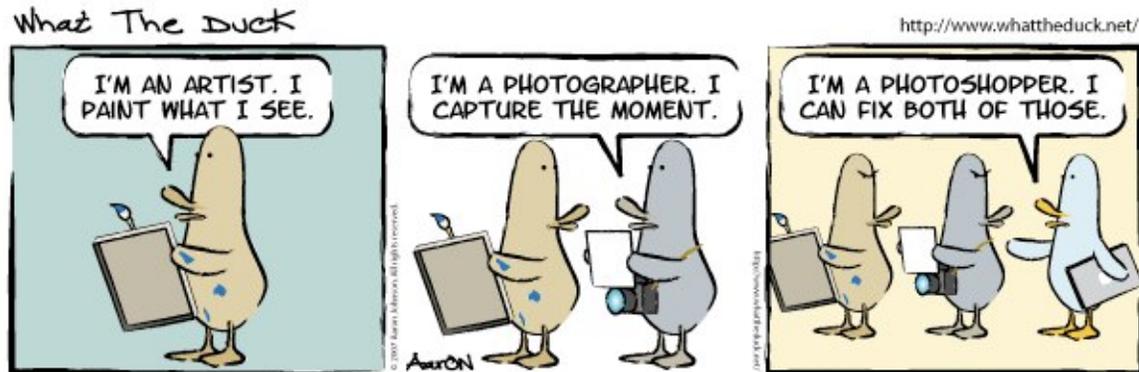


# Raw Material

Assignment #4. Due 7:35PM on Monday, April 27, 2009.



**Directions:** Type your answers for any questions requiring text responses in a word processor and save them in a file named "**answers**". We will accept Word Documents (**answers.doc**, **answers.docx**), PDF documents (**answers.pdf**), or plaintext files (**answers.txt**, **answers.rtf**). You will find submission instructions on the course website at least one week prior to this assignment's due date at the following location:

<http://cse7.org/submit>

## Part I. Pick Your Brain! (40 points)

1. (2 points) What are two advantages of JPEG over RAW?
2. (2 points) Which color space should you use for general use?
3. (2 points) Why is white balance measured in degrees Kelvin?
4. (2 points) List two reasons why batteries in digital SLRs tend to last longer than those in compact digital cameras.
5. (2 points) Why is calibrating your monitor important?
6. (3 points) What is a tone curve and why is it necessary?
7. (3 points) Many digital cameras are advertised as having a crop factor. What does this mean? What are some of its advantages and disadvantages?
8. (3 points) Assume you have two sources of light: incandescent light at an approximate color temperature of 3000 K, and the sun with an approximate color temperature of 6000 K. Which source produces warmer tones? If you take two properly-exposed photographs of a white sheet of paper, one

photo in each scene, with your camera set at a white balance of 4500 K, in which photo would the paper appear warmer?

9. (3 points) Photons hit a photodiode in the sensor which causes an increase in voltage. The job of an analog-to-digital converter is to sample this data and convert it to a digital value. What are the differences between 8-bit, 10-bit, 12-bit, and 14-bit ADCs? More specifically, how do the number of ADC bits impact the dynamic range and tonal range of an image? Be sure to reference sensor linearity.
10. (3 points) It is commonly said that compact digital cameras have a larger depth of field than digital SLRs. Explain why this is inaccurate.
11. (3 points) What is the main cause of purple fringing in compact digital cameras? Digital SLRs?
12. (4 points) Explain in a few sentences the major theoretical advantages and disadvantages of Foveon X3 sensors versus sensors that use Bayer filters or other color filter arrays. Your response should include all of the major functions of a sensor: resolution, noise, and light gathering performance. You may use a diagram, but it can only act as a complement to your explanation and not as a replacement for one.
13. (4 points) What is dynamic range? Define it technically (with an equation) and in layman's terms. Be sure to mention how dynamic range is impacted by pixel size, ISO, and quality of the sensor's electronics.
14. (4 points) A CCD or CMOS sensor that uses a color filter array (*e.g.*, a Bayer filter) will typically have the following layers: photodiode, low pass filter, color filter array, microlens, and electronic/sensor well. What does each layer do and how does each positively or negatively impact image quality?

## Part II. Cooking from Raw Material (35 points)

Many past assignments have required submissions that were “shining examples of your ever-increasing skills” with “perfect exposure” and “interesting compositions.” Though this assignment is no different—is it really a surprise?—you are allowed one major advantage: RAW file processing.

It should be clear by now that digital photographs taken in the RAW file format allow flexibility and power over many aspects of the image. Exposure, white balance, contrast enhancement, saturation, highlights, shadows, color spaces, and many other features are all under your control with minimal impact on image quality. By the due date, you will submit **7** images that meet the following requirements:

- Submit two photographs to which you had to correct exposure problems. Specifically, one photograph should have a scene that was **slightly underexposed** and the other photograph should have a scene that was **slightly overexposed**. Process the RAW files to correct the exposure and ensure that there are no details lost in shadow or highlight regions. By how many stops did you have to correct the exposure for each? Point out some details that were previously lost in the shadows region. Name the correct underexposure shot "**underexposed.jpg**" and corrected overexposure shot "**overexposed.jpg**".
- Submit one photograph in which the camera, using its automatic white balance setting, had chosen an **inappropriate white balance** for the image. Process the RAW file and adjust the white balance to be correct for the scene. What was the white balance before and after correction? How did you determine the correct white balance? Name this image "**whitebalance.jpg**".

- Submit one photograph in which an **individual color channel was clipped** even though the overall exposure was correct. Correct the clipping in some manner so that lost details are reclaimed while maintaining the proper overall exposure. How did you correct the clipping? Which details were reclaimed? Name this image "**clipped.jpg**".
- Submit **two** photographs in which you perform **masking techniques** to achieve some effect while retaining proper exposure and no clipped highlights. You might selectively desaturate portions of an image to bring focus to an object, selectively change color, exposure, or any other obvious modification. At least one-quarter of each image must be modified in this way, and each image must use masking achieve different effects. What modifications did you perform and why did you choose them? Name these photos "**masking1.jpg**" and "**masking2.jpg**".
- For the grand finale, submit one photograph in which you perform **two or more** of the above techniques and any other modification(s) you choose. For this image, you may be creative with color, over- or under-exposure, artifacts, etc., so long as you acknowledge and justify your modifications. In other words, this is your chance to break the stringent technical rules we have placed thus far in the course for the sake of creativity! Name this photo "**finale.jpg**".

All seven photographs submitted for this assignment must meet the following requirements:

- All must be **unique**. No two can have the same subject. You may submit two photographs from the same location, but the images must be different enough to be considered unique.
- For each of the images, submit **both the original RAW file and the processed JPEG file**. You may use any software you wish to process the RAW file, but the JPEG must not have been created by the camera. The RAW file should demonstrate the "problem" that the JPEG "fixes". In other words, the JPEG should be a pristine image that resolves technical issues found in the RAW file that, had you not processed the image, would have been present in a camera-generated JPEG.
- **At least 4** of the images must be original and taken for the purposes of this assignment. **At most 3** of the images may be RAW images that you had taken for past assignments but did not submit for some reason. These images should be distinct from images you have previously submitted.
- Only use one of the **Non-"Easy" Exposure Modes**. To be clear, this means you can use **Manual (M)** mode, **Aperture Priority (Av)** or **Shutter Priority (Tv)**. Do not use Program mode, any of the scene modes, or any other shooting/auto-exposure mode. If your camera does not have M, Av, or Tv modes, you will need to borrow one of the course's from Church Street lab.

### Part III. Get Published! (15 points)

You have probably noticed that there are numerous themes associated with the E-7 website. Go to the website and click on the image at the top of the page a couple of times:

<http://cse7.org>

There are currently eight themes and you have most likely seen them all. It's time for an update! In this assignment, you will submit a new theme for all to see.

A theme on the E-7 website is made up of the following pieces:

- One image 898 pixels wide by 250 pixels high.

- A 4-color scheme based off of the major colors in the image.
- Some metadata including an image title, description, and author.

A theme must include all of these things to be included on the website.

You will want it to be your best submission to date since it will be a published image. Everyone will see it! The image that you submit for this assignment must meet these requirements:

- The image must be **898 pixels wide by 250 pixels high**. You may shrink and crop the image to fit within the constraint, but you may not disproportionately stretch the image nor resize the image greater than 100% its original size. Put another way, you can resize the image to be smaller but you shouldn't scale it larger than the original. Additionally, the only action you take to change the aspect ratio should be a crop; the aspect ratio should not change when you resize the image.
- The file must be in **JPEG** format. You may, and should, take the photo in RAW format, but you must process it as a JPEG before submission.
- The file must be named "**username.jpg**", where username is your e7 Forum username.
- You should process and submit your JPEG file in the **sRGB or sRGB IEC61966-2.1 color space**. Since most browsers will ignore the embedded color profile anyway, you may choose to remove it but be sure to process it in one of these two color spaces to ensure proper color reproduction. Remember, additionally, that most monitors are set to a gamma value of 2.2. Adjust your gamma to this value, even if it is just temporary, before processing to ensure the image's contrast will appear as expected.
- The submission should be an **original photo** taken by you for the purposes of this assignment.
- Only use one of the **Non-"Easy" Exposure Modes**. To be clear, this means you can use **Manual (M)** mode, **Aperture Priority (Av)** or **Shutter Priority (Tv)**. Do not use Program mode, any of the scene modes, or any other shooting/auto-exposure mode. If your camera does not have M, Av, or Tv modes, you will need to borrow one of the course's from Church Street lab.
- You may optionally place your name unobtrusively on the image itself.
- The only modifications you may make to your image are: processing the RAW file, shrinking the size while maintaining the aspect ratio, crop, application of the proper color space, and placement of your name on the image. Major modifications with Photoshop (or similar) or composite images are not permitted. The idea is that you showcase your skills with a camera, not with Photoshop!

Once you've selected and processed your image, you should choose a color scheme. The color scheme must meet these requirements:

- The four colors for this the theme must be submitted in hexadecimal notation. You can pick any valid hexadecimal value; it does not have to be "web safe". Take a look at the following reference if you are not familiar with hexadecimal:

[http://www.w3schools.com/Html/html\\_colors.asp](http://www.w3schools.com/Html/html_colors.asp)

- The four colors should be submitted in the following format ("RRGGBB" is a placeholder and should be replaced by your hexadecimal color):

```
page: RRGGBB  
content: RRGGBB  
highlight: RRGGBB  
text: RRGGBB
```

- The "page" color is the background color of the page. The "content" is the background color of the main content of the page. The "highlight" is the color of the border surrounding the image and content and is the color of all links on the page. The "text" is the main content text color.
- The colors should be based on the colors represented in your image. All text and links must be legible in your color scheme. The text color should be different enough from the highlight color so that links are easily discernible from text.
- You may find the following online tools useful in the creation of your color scheme:

```
http://whatsitscolor.com  
http://www.colr.org  
http://www.colorschemer.com/online.html
```

- You may use the following tool to test how your color scheme looks on cse7.org:

```
http://cse7.org/colortest
```

Finally, send some information about your theme. This information will be accessible via the website, so write it as though it were for a public audience.

- Send the data in the following format:

```
title:  
description:  
author:
```

- "title" should be the title you'd like to give the photo or theme.
- "description" should be a description of the photo, no longer than one paragraph. Its content is up to you, but the description is required. You might list where the photo was taken, any interesting facts about the photo or the contents of the photo, the exposure values, or any additional relevant information about the photo.
- "author" is how you would like your name to appear with the theme.

#### **Part IV. Everyone's a critic. (10 points)**

Taking many photos is certainly a requirement to honing photographic skill. However, taking many photos and not getting feedback on them can be just as limiting as not taking photographs at all.

While you are working on Part II and Part III you may find that you are having difficulty with some particular image. Perhaps you are having trouble finding the ideal composition or lighting for a photograph and would like feedback on it. This is where the forum comes in.

Post one of your images onto the course forum in the "Raw Material" board in its own separate thread. If you are having a specific problem with it feel free to pose a direct question regarding the image. Other students and staff will reply to the image and offer suggestions on how, in their opinion, your photo could be refined. After a few suggestions, attempt to retake the photo taking into account one or more of the proposed recommendations. The goal is for you to receive constructive critiques regarding your photograph and modify your image slightly based on an independent reviewer. Part of the inspiration is that you begin to "see" your images from another point of view.

To be clear, these are the requirements:

- **Post no more than one** of your work-in-progress images from Part II or Part III onto the course forum in the "**Raw Material**" board in its own, separate thread.
- After receiving some suggestions or opinions on your photograph, **retake the image** with one or all of the recommendations in mind.
- Submit both your **original version and the final version** of your image with the rest of this assignment. The final version must be one of the required photographs for Part II, or the banner image for Part III. The original version does not count as one of the required images for Part II or Part III and should be named "**part4.jpg**".
- You may post the final version of your image in the thread you started, but you may make no additional changes to the photo if you receive additional comments.
- Along with your text answers **include a link to your thread** in the forum and a **brief explanation of which suggestion(s) you used** when creating the final version of your photograph. You may post this same information in your thread as well so that others can see what information was most beneficial, but it is the text included with your answers that will be graded.
- So that everyone receives feedback, please offer constructive feedback and realistic suggestions on at least **2 separate** work-in-progress photographs posted by other students in the "Raw Material" board in the forum.