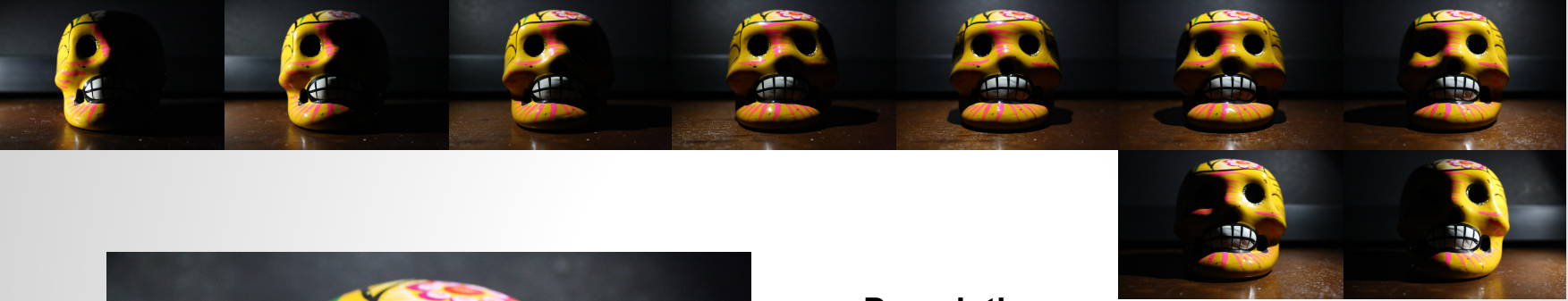


# **Computational Photography**

## **Assignment #2: Epsilon Photography**

Ryan Patrick Miller  
Spring 2018

# Epsilon Project Overview



Final Artifact

## Description:

...

**NOTE: I HAD TO RESIZE ALL MY RAW IMAGES DOWN TO 1920x1200 DUE TO FILE UPLOAD LIMITS. THIS DELETED THE DETAILS CAPTURED INFO. I'VE ADDED A SCREEN CAP OF MY CAPTURE DETAILS INTO THE PDF**

*These photos for this assignment represent the passing of light and the joint illumination light can provide. I was inspired by a recent trip to mexico where I purchased a reflective dio des los muertos skull and wanted to play around with light and darkenss.*

# Camera Settings

**NOTE: I HAD TO RESIZE ALL MY RAW IMAGES DOWN TO 1920x1200 DUE TO FILE UPLOAD LIMITS. THIS DELETED THE DETAILS CAPTURED INFO. I'VE ADDED A SCREEN CAP OF MY CAPTURE DETAILS INTO THE PDF**

Property	Value
Width	3888 pixels
Height	2592 pixels
Horizontal resolution	72 dpi
Vertical resolution	72 dpi
Bit depth	24
Compression	
Resolution unit	2
Color representation	sRGB
Compressed bits/pixel	
Camera	
Camera maker	Canon
Camera model	Canon EOS DIGITAL REB...
F-stop	f/5.6
Exposure time	1/50 sec.
ISO speed	ISO-1600
Exposure bias	0 step
Focal length	32 mm
Max aperture	

# Project Discussion

- What is your epsilon parameter? *My parameter was the position of the light source*
- Location of pictures? *Inside a dark room setup on my work desk with a black box*
- Date and time? *January 21, 2018 from 11:30 pm to 1:00 am*
- How did you control the settings, the environment, and the camera to meet your epsilon requirement?

*I mounted my DSLR onto a tripod to maintain its exact position along the front edge of my set making sure it didn't move. I waited until the middle of the night and closed all of the blinds in my apartment to shut out all light in the room. I then created a dark box using a poster board roof and four black walls within which i set the ceramic skull in the center and taped it to the desk to maintain it's position. I went to these measures to ensure the only light source in the photo would be controlled by rotating position without any interference from other sources. I then set a flashlight tied to a few stings at the top of the box to allow it to swing on a pendulum. Finally I set my DSLR to burst 10 photos with a constant delay of a few seconds between timed with the light movement to ensure it would grab a shot at varying positions from left to right at a constant interval.*

## IMG\_0779



This is the first shot in the sequence with my controlled light parameter on the left side of the skull

Camera settings:

Exposure: 1/50 sec.

Aperture: f/5.6

ISO: ISO-1600

Focal Length: 32 mm

Bit Depth: 24

Dimensions: 3888x2592



## IMG\_780



This is the second photo in the sequence, the light is changing positions at this point around the skull.

Camera settings:

Exposure: 1/50 sec.

Aperture: f/5.6

ISO: ISO-1600

Focal Length: 32 mm

Bit Depth: 24

Dimensions: 3888x2592

## IMG\_781



This is the third photo in the sequence, the light is changing positions at this point around the skull and is now shifting across the top of the skull

Camera settings:

Exposure: 1/50 sec.

Aperture: f/5.6

ISO: ISO-1600

Focal Length: 32 mm

Bit Depth: 24

Dimensions: 3888x2592

## IMG\_782



This is the fourth photo in the sequence, the light is changing positions at this point around the skull, it's approaching the mid way point.

Camera settings:

Exposure: 1/50 sec.

Aperture: f/5.6

ISO: ISO-1600

Focal Length: 32 mm

Bit Depth: 24

Dimensions: 3888x2592



## IMG\_783



This is the fifth photo in the sequence, the light is changing positions at this point around the skull, at this point the light is essentially vertically above the skull.

Camera settings:

Exposure: 1/50 sec.

Aperture: f/5.6

ISO: ISO-1600

Focal Length: 32 mm

Bit Depth: 24

Dimensions: 3888x2592

## IMG\_784



This is the sixth photo in the sequence, the light is changing positions at this point around the skull, at this point it's shifting down the other side. I really enjoyed how the shadow shift took effect here.

Camera settings:

Exposure: 1/50 sec.

Aperture: f/5.6

ISO: ISO-1600

Focal Length: 32 mm

Bit Depth: 24

Dimensions: 3888x2592

## IMG\_785



This is the seventh photo in the sequence, the light is changing positions at this point around the skull, it's now on it's way the final resting spot, generating light on the opposing side of the skull

Camera settings:

Exposure: 1/50 sec.

Aperture: f/5.6

ISO: ISO-1600

Focal Length: 32 mm

## IMG\_786



This is the eighth photo in the sequence, the light is changing positions at this point around the skull, the second the last position, the exposure setting really details the adjustment of light and dark in the facial features.

Camera settings:

Exposure: 1/50 sec.

Aperture: f/5.6

ISO: ISO-1600

Focal Length: 32 mm



## IMG\_787



This is the ninth photo in the sequence, the light is changing positions at this point around the skull, it is the final frame where the light as landed at a resting spot 180 degrees around the skull

Camera settings:

Exposure: 1/50 sec.

Aperture: f/5.6

ISO: ISO-1600

Focal Length: 32 mm



# Final Artifact



# Final Artifact Details

## **Discuss how your artifact demonstrates your epsilon.**

*My final artifact was inspired by the idea of combining the light to drown out the darkness and illuminate the skull in it's full detail. Playing with light around the original photos gave me a solid base and tying into the lectures I was interested in exploring blending that bring the lightened pixels from each photo into a final artifact that wasn't distorted. To do this I approached a few methods. First I researched a few tools that could help achieve this affect. Initially I played around with lightroom; however, I could only get HDR working and it wasn't applicable to this assignment, nor did it generate an artifact that satisfied my target idea. I moved from there onto photoshop and applied a lighten blend on the images that compared each pixels RGB values from each photo. If the pixels intensities were lighter it would set them at the lighter value and discard the darker. Doing this for all of the images generated an artifact that captured the shared illumination of the moving light without losing detail. Overall I was extremely happy with the final output and it achieved close to my overall vision. Photoshop was the perfect tool for this, while I saw some future use cases for lightroom that I'd like to explore. I did actually explore a few other artifacts that I've included in the Above and Beyond section and in the resource file as I tested. They include: OpenCV/Python alpha blend, Photoshop GIF. Of all the options I explored photoshops blending features yielded the best final artifact for my intended vision.*

# Project Retrospective

- In what ways was your project successful?
  - My project was completely controlled with only one parameter changing. My “makeshift” set and waiting until night allowed me to completely control the light in the image. This allowed me to demonstrated the controlled additive behavior of epsilon photography by blending the lightened sections to generate a new image the retains the detail of each sampled photo.
- If you were to repeat the project, is there anything you do differently knowing what you do now?
  - *I would spend more time on the set with better materials. The background box blackness is the rear of a picture frame and the desk surface is brown. I would've preferred for these to be black. I also purchased the tripod late in the week, and if I had more time, I'd love to experiment with some outdoor night shots allowing the movement of the earth as my changing paramter with a long exposure shot towards the stars.*

# Above & Beyond

- See the 90% rule on Piazza.

*I created two other final artifacts, both are included in my submission, as I was playing around with this assignment to grasp some of the behaviors around how blending works and to interpret light in different ways. The first was generating a .gif artifact that highlights the motion of light around the skull. I created this in photoshop and set the interval for each image as 0.1 second. This created an interesting behavior that mimics the sun's tracking through the sky. Overall I enjoyed interpreting the different output from the same input files, but was happier with the Photoshop blend I selected. My second extra artifact was created as I wanted to learn how to interpolate the images pixel intensity myself, rather than just using photoshop's built in blending functionality. For this I installed OpenCV and Anaconda on my machine and wrote a very simple alpha blend script that loads in the 9 images I took into a python list. From there I applied a 20% alpha multiplier to each image's pixel intensity and then added them together. I took the resultant image and wrote it to an output file. This yielded an interesting result that was close to the image photoshop generated; however, since I applied a weighted add operation rather than a replacement operation that photoshop's blend did, it lost some of the reflective details of the light. Instead giving a more "matte" finish to the picture that I wasn't as happy with. I included my script and the output file in my submission.*



# Resources

*Record your sources here. We accept all reasonable formats that would allow us to verify your sources. Our class lectures do not have to be referenced.*

- <https://opencv.org/>
- [https://docs.opencv.org/2.4/doc/tutorials/introduction/load\\_save\\_image/load\\_save\\_image.html](https://docs.opencv.org/2.4/doc/tutorials/introduction/load_save_image/load_save_image.html)
- <https://helpx.adobe.com/lightroom/user-guide.html>
- <http://www.learnopencv.com/install-opencv3-on-windows/>
- <https://github.com/opencv/opencv>
- <https://www.anaconda.com/>
- <https://helpx.adobe.com/photoshop/user-guide.html>
- <https://www.learnopencv.com/filling-holes-in-an-image-using-opencv-python-c/>
- <https://photoshoptrainingchannel.com/blending-modes-explained/#lighten>
- <https://www.barbato.us/2010/12/01/blimageblending-emulating-photoshops-blending-modes-opencv/#>
- <https://helpx.adobe.com/photoshop/using/blending-modes.html>