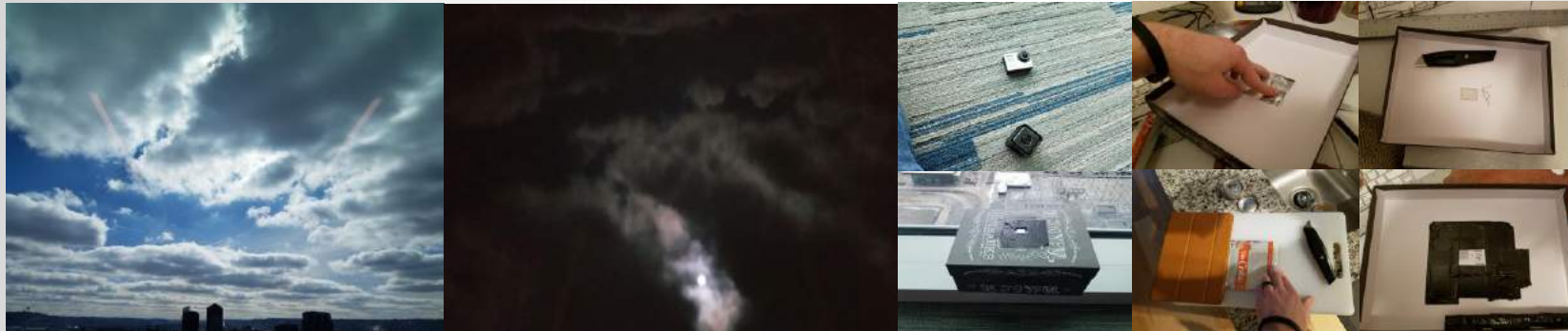


Computational Photography

Assignment #3: Camera Obscura

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Camera Obscura Project Overview



The Scene

The Image

The Set-up

Other images

- I attempted to capture the downtown view of the sky our office building has on the river. The scene is of the sun piercing through the clouds from a high rise. The image itself was about waiting for the right amount of sunlight to be captured into my obscura. For setup I built out a box as the building itself has far too much light, and I had no ability to control it. Combined with travel for work and cloudy snow filled days I needed the flexibility of the box to complete the assignment. I've included multiple shots of the construction materials in this, as well as the equipment I used inside of the box to capture the image.

The Scene - Details



- What was the **scene** of your camera obscura experiment? The scene was a view of the sky from the 12th floor of a highrise downtown over the river in Cincinnati.
- What was the **site** of your camera obscura experiment? In other words, where were you standing when you captured this scene? (i.e. living room) I built and obscura box (as the building I'm in is entirely open office, and I setup my box angled against the southside river facing glass on the 12th floor.
- Why was this **site** appropriate for you camera obscura experiment? We've had a lot of snow and cloudy days this time of year. This site allows for a high view angle and the

The Setup - Images



Line black box interior
with white cardstock paper



Cut apart 2in by 2in square
For aperture from coke can



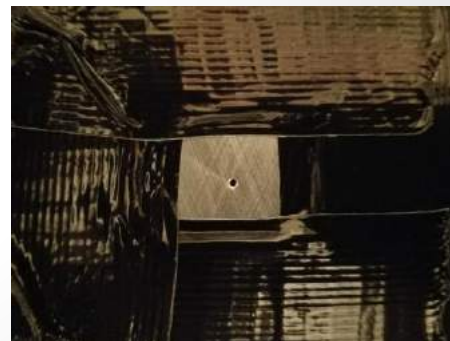
Cut 1in by 1in square hole
In lid of the box



Place the metal cutout in
Place over the hole in the lid



Use Black duct tape to hold
In place and prevent light from
Entering, puncture with thumbtack
For 1.5mm size hole



Cover top as well to prevent
Light from escaping into box

The Setup - Images



Add mount for camera at bottom
Of lid to center align the lens



Completed box external shot
From the origin of the image.



Camera and mount used inside
box to capture the image from
within

The Setup - Details

- Describe & explain the construction of your camera in detail
 - I first put a list of materials together. I then went out and purchased a thick stock black cardboard decoration box. I wanted something with black on the outside to block out light from penetrating through the exterior. I also was looking for a box similar to a shoe-box, where the top encapsulated over the bottom. This would prevent light from escaping out of the corners. I then cut apart a diet coke can into a 2inch by 2inch block with a box cutter and also cut a 1inch by 1inch hole in the lid of the box. I then punctured the can square with a thumb tack to generate a small aperture for light to enter, and I then aligned the aluminum square inside the box and taped it in place with black duct tape on the inside. I also taped black duct tape around the outside framing as well to prevent light from entering anywhere other than the aperture. Finally, I constructed a holding place for a GoPro camera to sit inside the box, and I controlled the camera with my phone app from the outside to capture the image with the GoPro inside of the box. This allowed for the interior experience of the camera in the obscura. I used rubber bands outside of the box to secure the lid tightly and I waited for the least cloudy day (this one took a while), as it's been gray skies for the last few weeks.
- Discuss what you used to capture your image on (screen material) I purchased white card stock for screen material from a local arts and supplies store and lined the inside of the box with the stock to capture the image. This allowed for an appropriate screen rather than the dark interior the box originally had.

The Setup - Failures?

- Did you have any initial setups that failed?
 - I originally thought I could use my phone camera inside of the box. This was a complete fail as I couldn't get the timing of capture correct, and the phone I was using lacked the appropriate shutter speed and iso values to capture the image projected through the aperture. I also originally attempted to use a room itself at my apartment; however, the weather was not appropriate to generate enough light, and it didn't help that my building faces north to south as the sun never had direct contact with my windows. Also, better weather would've been a godsend. I tried to get a shot of the river outside, but didn't have a clear day to capture it. I did attempt experimenting with a high powered light on a painting, but barely got a semblance of an image. I would've loved to play around with film stock on this assignment to combat the lighting issues.

The Image(s)



Aperture: f/1.7

Shutter Speed: 1/60

ISO: 800

The Image(s) - Details

- Compare your final image with the projection inside the camera obscura viewed with a naked eye. How did your camera settings impact your results? (Be sure to discuss what apps or methods you used to control your camera settings.)
 - I didn't edit the output image at all but did extract it in photoshop for observation. The output was like an inverse of the image as seen through the window, essentially upside down but much darker. Mostly due to the lack of light and limitations of the camera inside the box due to the small box size. Overall I had to play around raising the iso and lowering shutter speed to get an image that was bright enough to be visible. My initial attempts were almost pure black as a result of the lack of light.
- Discuss image enhancement and/or cropping, if used.
 - I didn't enhance the image in any way. I did play around with it in photoshop, but ultimately used the original.

The Image(s) - Field of View

- What is the camera obscura field of view (FOV) that you observed? Show your work/method. (FOV is measured in **degrees**, see appendix in instructions for details)

My FOV was roughly 115 degrees inside of the box. To measure this I printed out a protractor and extended the lines from the camera lens to the box edges with a pencil along the protractor and mapped that to the distant from the pinhole as well as it was slightly off-center.

- How does it compare to the FOV for your lens-based digital camera at the settings used for your final image(s)?
 - The full field of view of the camera I used is 122.6 degrees My measurement was slightly lower as the distance to my image was fairly close, and I was angled at the image slightly off center, lowering the overall field of view.

Pinhole Dimensions

In addition to the pinhole dimension you used to capture your final image(s) (on template slide 8), experiment with at least 2 additional pinhole dimensions. Record the and include the Image taken using each pinhole

Pinhole A dimension: 1.5 mm diameter

Pinhole B dimension: 2 mm diameter

Pinhole C dimension: 2.5 mm diameter

- **Discuss the effect of pinhole dimension on each Image, in detail.**

The pinhole captured the amount of light allowed into the image. I only slightly increased it, with increased the overall amount of light. Entering the box, and the field of view the light would traverse over.

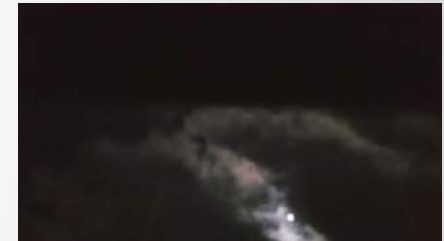
- **What did you learn from this pinhole experiment?**

Two interesting things, first time isn't static, the position of the clouds and the sun in them slightly shifted, also the position of the camera was hard to maintain, hence the shifted darkness of the image. Also, the image was slightly more distorted and blurry and lighter as the hole was larger. Indicated that a finer aperture leads to a sharper image.

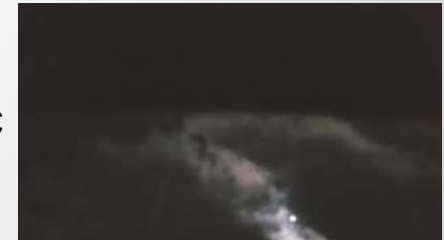
A



B



C



Project Retrospective

- What were you happy with about your project? Discuss.
 - Overall I was happy with the opportunity to learn how the internals of a camera behave at a basic level. It was interesting to understand the effect of light shifting through a small spot and exploding out the other side while maintaining it's orientation. This had me making connections to the internals of my DSLR and how it functions to generate an image. I also thought it was amazing how much light was needed to generate a solid image inside the box. I plan on playing around with this concept with film stock to see how clear of an image I can produce.
- If you were to repeat the project, is there anything you would do differently knowing what you know now? Discuss.
 - I would live in an area with more sunlight so I can attempt the full room. On a more serious note, I would definitely explore with multiple scenes and see how light effects them inside the box. I'd also love to attempt an internal scene generating my own light, to see the amount needed to produce a meaningful image. Finally, I'd love to build out a full camera with film stock, and also explore different stocks to see how they react differently to the same amount of exposure to light.

Resources

I referenced the videos in the github repo around building a box pinhole camera.

Field of view reading:

<https://www.edmundoptics.com/resources/application-notes/imaging/understanding-focal-length-and-field-of-view/>

Image of a protractor:

https://www.google.com/imgres?imgurl=https://www.mathsisfun.com/geometry/images/protractor.svg&imgrefurl=https://www.mathsisfun.com/definitions/protractor.html&h=264&w=456&tbnid=1wT6lyS3u_izaM:&tbnh=116&tbnw=199&usg=__FdFz9QRT9IKjW1dTmd3EmcCFs8g%3D&vet=10ahUKEwips9aJ24_ZAhVPjlkKHT_xDmMQ_B0leDAK..i&docid=3O5EAffblshM_M&itg=1&sa=X&ved=0ahUKEwips9aJ24_ZAhVPjlkKHT_xDmMQ_B0leDAK