Computational Photography

Assignment #4: Camera Obscura

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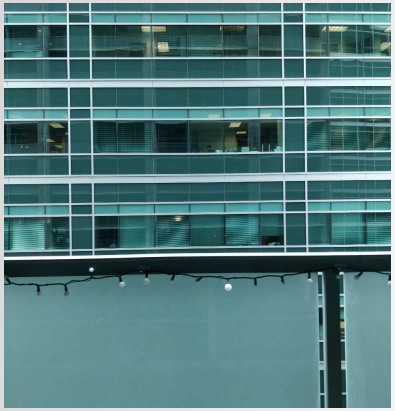
Spring 2019

Camera Obscura Project Overview



The Scene

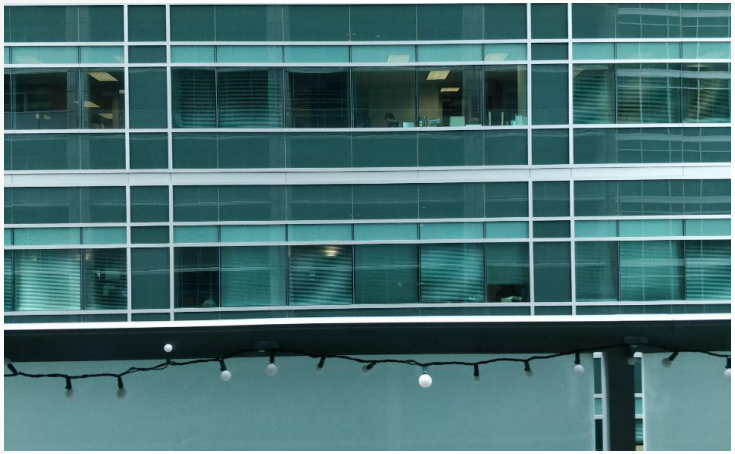
The Image

The Set-up

Other images

- My apartment has full-wall windows, and I didn't have the necessary materials to completely cover any one of those walls. That said, I drew and stapled my curtains together around a piece of cardboard with a hole punched in it, and attempted to project light from that pinhole onto a sheet of printer paper. Due to substantial light leakage caused by the entire wall being a window that I wasn't able to fully cover, the image did not turn out as one would expect one from a camera obscura to. That said, the image is very blue due to light bouncing from the scene.

The Scene - Details

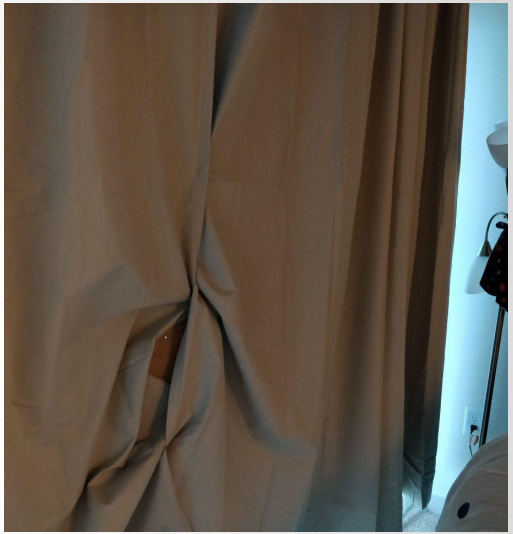


- The **scene** of my camera obscura experiment is one of my balcony and viewing the office building across from me.
- The **site** of my experiment was from my bedroom.
- This **site** was appropriate as my bedroom holds the smallest window in my apartment.

The Setup - Images

Curtains stapled together around a piece of cardboard with a pinhole, a tripod, and a piece of paper to project the image onto.

My apartment from the outside, depicting one of my roommates' used cardboard with a pinhole punched through it to act as the optics in my camera obscura.



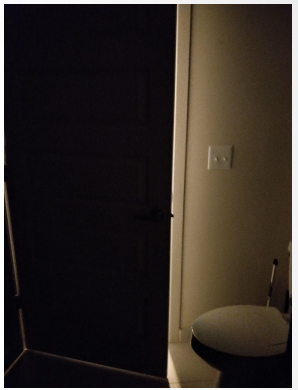
Ample light leakage due to my not having means on-hand to prevent light from entering the room by the window wall.

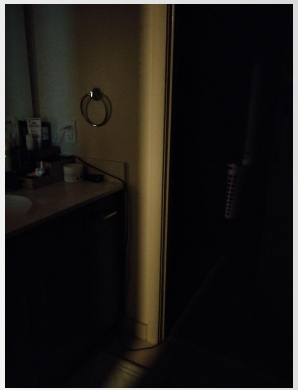
The Setup - Details

- Describe & explain the construction of your camera **in detail**
  - I first found a large piece of cardboard in my recycling bin from my roommates, and decided to punch a paperclip-sized hole in that to use as the camera's optics. I then stapled that to my blackout curtains to filter out most light from the scene. I set my tripod roughly 5 feet away from the scene, and attempted to project an image through the pinhole and onto a sheet of printer paper. I then aimed to capture an image projected onto that paper using my Sony a7ii camera.
- Discuss what you used to capture your image on (screen material)
  - The screen in my image was a white sheet of printer paper stapled to my curtains.

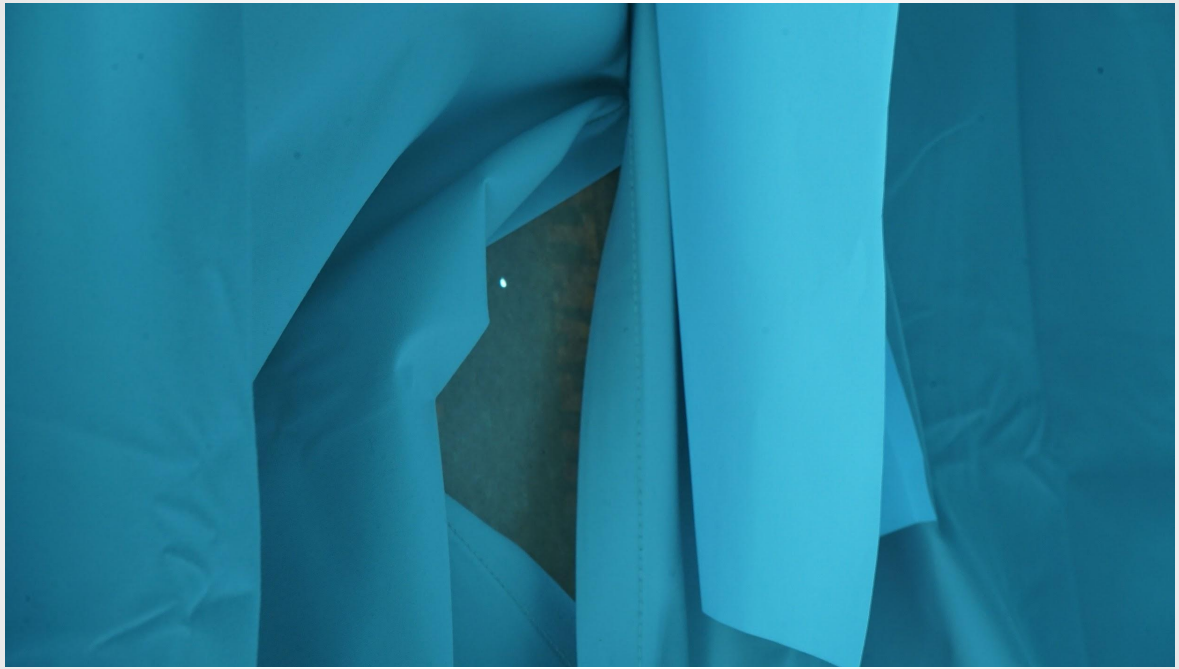
The Setup - Failures?

- Did you have any initial setups that failed?
  - Yes. I attempted to project a scene into my bathroom, as it has no windows and one door, and a door was easier to block light out of, but there was not enough light entering the scene for me to operate.





The Image(s)



Aperture: f/14 Shutter Speed :8 sec. ISO: 640

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.
  - Due to the amount of light leakage within the scene, an image was only visible on the screen when the pinhole was under an inch away. Unfortunately, there was no way for me to get my camera to focus closes enough to see the image, and my phone camera would not have been stable enough to take a proper long exposure image. That said, I used my mirrorless camera's manual mode and a zoom lens to capture an image from a tripod.
- Discuss image enhancement and/or cropping, if used.
  - I used photoshop only to downsize my images to be smaller than 2 MB

The Image(s) - Field of View

*FOV is measured in **degrees** - See appendix in instructions for details*

- What is the camera obscura field of view (FOV) that you observed? Show your work/method.
  - Roughly 11.421 degrees.
  - 11.421 degrees = 2*arctan(2mm/2(10mm))
  - Using the formula angle= 2(arctan(dimension/2focalLength))
  - This is only valid for when the screen is 1cm from the pinhole, which roughly created the best viewing for my camera obscura.

- What is the FOV for your lens-based digital camera that you used? Show your work/method or say where you got the FOV from.
  - 30.5 degrees Horizontal, 20.6 degrees vertical.
  - Franke, V.J. Depth of Field (DoF), Angle of View, and Equivalent Lens Calculator. 25 September 2010. https://www.pointsinfocus.com/tools/depth-of-field-and-equivalent-lens-calculator. Accessed 5 February 2019

- How does your camera obscura's FOV compare to the FOV for your lens-based digital camera at the settings used to capture your final image(s)?
  - The camera has a vastly larger FoV, likely due to its more robust optics and ability to collect light from a larger area than a pinhole and a sheet of paper one centimeter away.

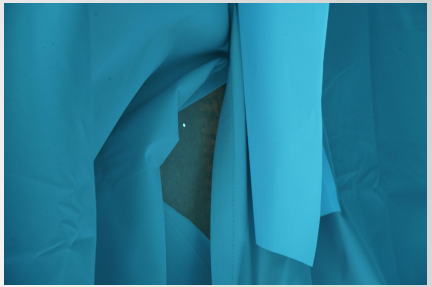
Pinhole Dimensions

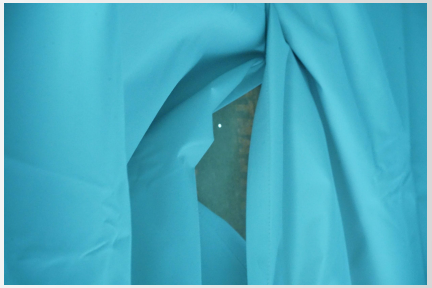
In addition to the pinhole dimension you used to capture your final image(s) (on template slide 8), experiment with **at least** 2 additional pinhole dimensions. Record the measurements and include the final image of your scene taken using each pinhole (replace the blank placeholders)

Pinhole A dimension: 2mm
Pinhole B dimension: 3mm
Pinhole C dimension: 4mm

- **Discuss the effect of pinhole dimension on each final image and compare -** The 3 images are the different pinhole dimensions, 2mm, 3mm, and 4mm, respectively. I attempted different means of projecting the image onto a screen in moving the screen, allowing more light in, and changing the exposure settings of the camera, but none of the above made the image more visible.

- **What did you learn from this pinhole experiment?** - It is critical to minimize light leakage in a camera obscura. A screen might need to be incredibly close to the pinhole to reveal a clear image, or any image at all. Movement in the screen, pinhole, or camera can vastly decrease the quality of a camera obscura image. The focal length of a lens camera used to capture a camera obscura image can make a big difference, as I was not able to get my own camera close enough to the screen to capture a clear image. I also learned that the time of day at which a camera obscura is functioning has a large impact on the image, as the angle of light shining onto the screen will affect the brightness of the image.





Project Retrospective

- What were you happy with about your project? Discuss.
  - I am glad that I was able to set up a camera obscura, as I'd never done so before, and this was a good opportunity.
  - I was glad that the project was an opportunity to work with my hands in a computing context.

- If you were to repeat the project, is there anything you would do differently knowing what you know now? Discuss.
  - I would have scheduled a full day on a weekend to do this project, but I was unable to due to work.
  - I would have given myself more time to fill out this report, and I would have captured more images while experimenting with pinhole size.

Resources *(Optional)*

- Franke, V.J. Depth of Field (DoF), Angle of View, and Equivalent Lens Calculator. 25 September 2010. https://www.pointsinfocus.com/tools/depth-of-field-and-equivalent-lens-calculator. Accessed 5 February 2019