

Camera Evolution

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Abstract

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My thesis draws a comparison between humans invention of photography and natures invention of the eyeball. I explore photography as a natural result of natural selection by building cameras through my own artistic process of evolution.

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INTRODUCTION

As a photographer I have always been interested in the camera as a medium. Building cameras has been as much a part of my practice as making images. While in graduate school I began to study how cameras came about and the many forms they have taken throughout history. This led me to ask the question when was the first camera invented? I came across Darwin's writings on the evolution of the eye in his "On the Origin of Species" and was struck (as many have been) by its remarkable similarity to the development of photography. Nature did not create the eye fully formed—Darwin demonstrated how this occurred over countless generations in a slow methodical process. It started with a flat disk of light sensitive cells that could detect the presence of light but nothing more. This disk began to dimple which grew deeper to form a cup. As the cup closed over the opening formed an aperture which had enough power to resolve a dim fuzzy image onto the back of the proto eye (still used today by the Nautist). This cup filled with mucus and an encapsulated lens formed over the opening. We now had the compound eye, a very sharp and bright camera for seeing the world.

The analogy to human made cameras is not perfect. We did not progress slowly by dimpling light sensitive paper until it eventually became a Nikon. But cameras have evolved on their own trajectory. Humans were playing with pinhole camera obscuras as written about in ancient Chinese and Greek text, and we had simple lens camera lucida's by the in the early renaissance. So what was the first human made camera? What was equivalent to the flat disk of light sensitive cells? Many theorists have written about the analogy of Plato's cave in which people trace the shadows cast on the back wall of a cave. The first human made proto cameras could have been present with the first proto humans who watched their shadows dance across the cave walls cast from their fire pits.

To put this into practice I chose to make my camera building process evolutionary—drawing from the idea of natural selection. I would build iterations of cameras and look for the random mutations that occurred. Those mutations I liked I would keep, those I didn't would die out. Unlike nature's natural selection the process would not be decided by who could out compete for food and procreation, but by those which I decided worked best. I would not have a goal in mind, but I would see where the process led to on its own.

The materials I chose were those I often used for camera building—cardboard, thin plywood for laser cutting, and 3dprinted plastic. Materials that allowed me to create shapes quickly and with as much freedom as possible. I also find them esthetically pleasing. I would also use electronic circuits, LED lights, and a large variety of lenses and pinholes.

I would try to keep and organize the failures as a record of the projects history. Just as nature shows us its history through its fossil, this project would have its own of fossil record.

THE CAMERAS

The Box Camera

For my first camera I decided to start with a simple box camera. In the passed I had built this camera by placing a light bulb in a box and placing a pinhole in the side which would project an image of the light bulb onto the wall. I built the box quickly out of cardboard and I created a simple landscape on the 3d printer. It was a field of tightly packed cones. Cones seemed like an appropriate shape as it is the shape light makes when it diffracts while passing through an aperture.

With this box I began to perform experiments changing the light source, the pinhole sizes, and the shape of the 3d printed cone landscape. The images of the cone landscape were beautiful—I projected them onto tracing paper—but it was to dark to see well. I thought the box was to big—and the light source to small.

The Cone Bulb

For my second camera I used a super bright LED bulb and printed a cone landscape that fit right on top of the bulb. I then printed a black top to fit over the bulb and cones and sealed the whole objected into a cardboard base with a switch to turn the light on. I then drilled holes in the outer black covering to provide apertures that would project the cones onto tracing paper.

This worked much better. Having the brighter bulb combined with the closer holes made a much brighter image and the cones appeared ghostly and mysterious. Unfortunately they soon began to melt with the heat of the bulb. The bulb was to hot and the pinholes were brighter but still to dim, I would have to use lenses. I would return to the box.

Box Camera with lenses

I returned to the box camera placing mounts for lenses on all sides. I tried different types of lenses in different focal lengths eventually finding the sweet spot where I could get a projection that was bright enough to see but not to small. I had a camera that worked.

I then began to try different subjects inside the camera. I printed a number of cone landscapes, along with busts of my friends head. While placing these in the camera I discovered that the movement of my hands showed in the projections creating an uncanny and unexpected effect. A mutation that I liked—I now needed a way to make the cones move inside the camera.

The Cone Creature

For an earlier project I had created a simple cardboard breathing machine. It was driven by a small servo motor and would push up and down a kind of cardboard pagoda. I tried placing this in the Box Camera. It worked but it was much to large

and the cardboard was too dull to project well. Next I created a version of the pagoda on the 3d printer out of a bright white filament. The pagoda shapes failed but a simplified version using stacked cones worked. I placed the mechanized version of this in the Box Camera and the cones came to life on the projection screen. The Cone Creature was a success but the box was entirely too big, and the projection screens were too far away as the image was still too dim to work outside of my very dark studio. I decided to shrink the box so that it just fit over the Cone Creature.

The Cone Cameras

Now I had a small box that fit just over the cones making a very bright small projection. It was while moving these Cone Cameras around that I realized I could place an uncovered cone on the opposite side of the projection screen. The real cone would appear next to the projected one causing a confusing sensation as your brain attempted to determine which was which.

The Final Cone Cameras

I could now begin to refine the shapes, I created better fitting box tops, better mounts for the cones, and changed the placement of the projection screens. I built four pairs of Cone Cameras. Each pair was made of a projecting cone and a cone with a screen. These were then wired up and programmed.

CONCLUSION

What struck me most about this process was how much my decisions were being controlled by the natural properties of light. My shapes could take on any form I wished but light followed very specific rules—and these dictated and directed what would work. Yet it felt strangely collaborative. As if the light was working with me to help me make this camera.

EPILOG

Natural selection has a flip side. The same random mutations that move a species forward are the same mutations that, if slightly different, cause cells to become cancerous. I worked for 8 years as a night shift nurse on a pediatric cancer ward. I worked closely with families dealing with the trauma of a child's diagnosis. Unlike adult cancers the random mutations that cause a pediatric cancer do not come from anything. There is no environmental factor like smoking or diet, and there is no genetic link. As far as we can know right now these cancers are caused by the purely random mutations that occur throughout a population. A diagnosis of leukemia or osteosarcoma is typically (aside from a few rare clusters) an entirely random event. It can be a difficult idea for a patient or family to process. We want to have something to blame, we want to have a cause that we can attach to our anger and frustration.

I have had to come to terms with this idea myself. I would often find myself contemplating these questions while working late at night in the darkened rooms of sleeping cancer patients standing silently next to a whirring glowing IV pump. It was only after I had the Cone Cameras working in my studio that I saw how much they resembled the look and feeling of these late night hospital rooms.