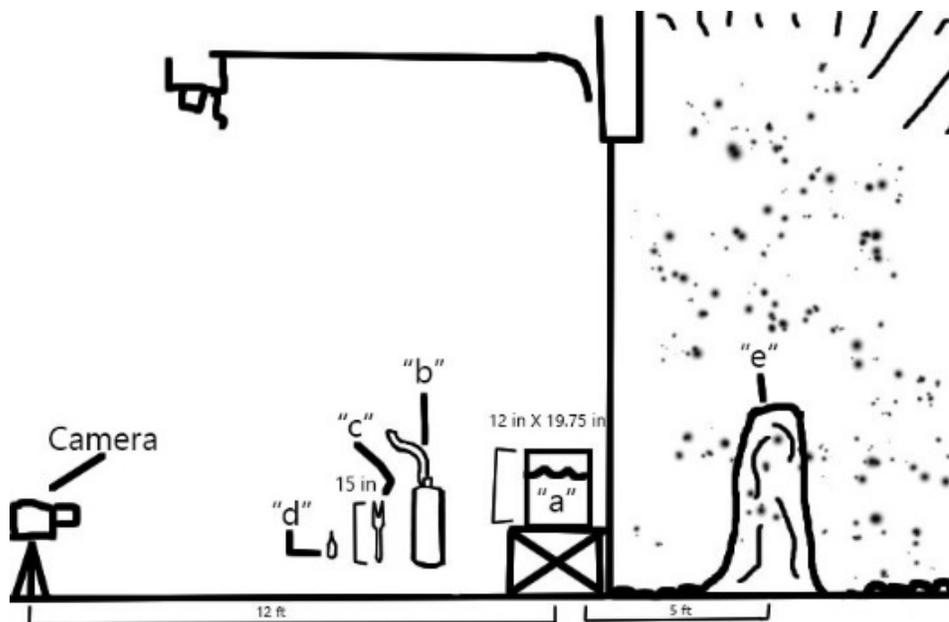




For my very first assignment in my college course studying flow visualization, a study on the capturing of scientific phenomenon on photograph or film, I got the idea to capture what I only really knew in laymen's terms as, "the bubbles and steam that are created when you stick a red hot metal prong into a pool of water." This experiment in photography and science satisfied my curiosity on the subject at hand and fulfilled the curriculum for the project. The idea came from an old job I used to have tuning skis where I would get a metal scraper red hot and use it to melt epoxy to repair chewed up ski bases. The metal scraper would get so hot that it would start glowing in a pretty orange/red tone. I thought that it would make a really interesting photograph to get something metal that hot again, stick it in water and then take a picture. The amateur scientist in me knew something interesting could be captured. As it turns out the effect I was searching to photograph is called "film boiling" and describes the effect of how the energy from the heated metal is transferred to the water upon contact. I thought that if I got a telephoto lens and a nice enough camera I could create an interesting, flattened image with the phenomenon of film boiling as a subject.

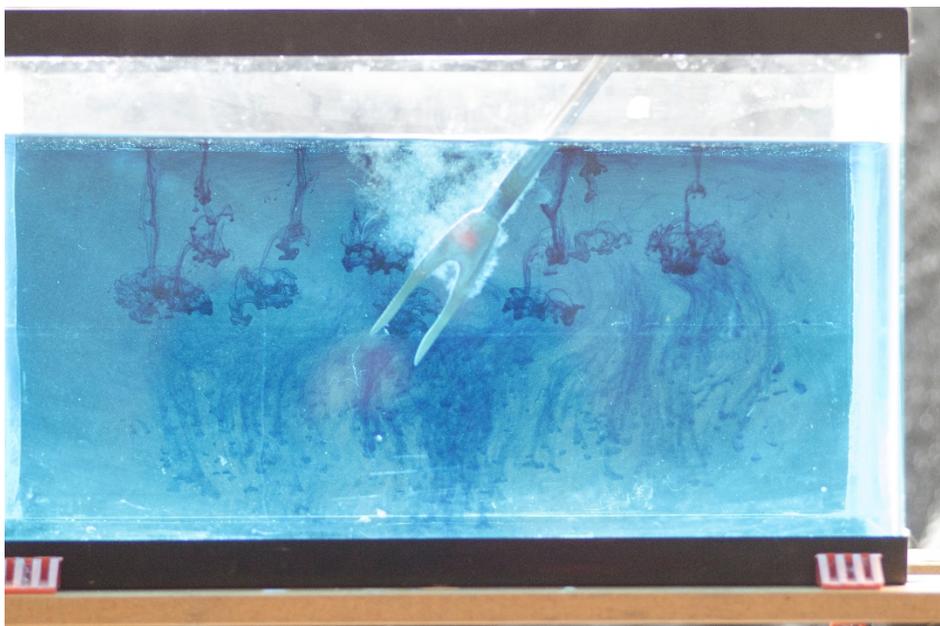
The first thing I needed to do to capture the photograph I wanted was to acquire a few things that I had visualized would work for the project. Luckily my girlfriend and her family had all of the supplies I needed to start setting up. I needed a fish tank (which can be seen in the accompanying sketch below and is labeled as "a"), a blow torch ("b"), a metal prod ("c"), blue food coloring ("d") and a black sheet ("e") to start. I set up the fish tank in my parent's garage

and used my father's standing vice grip to hold it. We set the fish tank at the edge of the garage door with the door open for I knew that natural lighting would suffice to capture the image I wanted. First, I filled the fish tank with water and then placed some blue food coloring in it once it was filled so it had time to diffuse into the water. I then set up the black sheet I obtained about 5 feet away from the fish tank (fully outside of the garage door to catch all the sun), laying it over a couple of step ladders. I then set up the camera (a Nikon D7000 with a Nikon 80-200mm ED telephoto lens attached to the front) on a tripod about 12 feet away from the fish tank inside of the garage (mostly to protect the camera from the snow falling outside). The idea was to frame the fish tank so that the telephoto lens would flatten out the image and cause the black sheet in the background to flatten up against the objects in the foreground, creating nice backdrop and hiding my neighbor's house. I set the telephoto lens at 116mm focusing it to about the middle of the tank to the background. I set the aperture to $f/3.2$ and the ISO to 800 to let in the proper light and compensate for the snowy weather outside. After I was done with the framing/focusing and setting the aperture I was ready to begin the experiment. I began by heating up the metal prod with the blow torch, focusing it on the fattest part of the prod. When the prod was as red/orange as I could make it I had my girlfriend put a few more drops of food coloring in the tank and stuck the prod into the water, not wasting anytime between taking it off the flame and its submergence. As soon as I stuck the prod into the water I had my neighbor (who owned the Nikon and was very helpful in instructing me on how to use its features) push the button and help me capture the image. I should actually say images for (thanks to my neighbor's advice) I decided to set the camera to an interval setting where it takes multiple pictures consecutively depending on your shutter speed, (I had mine set to $1/100^{\text{th}}$ of a second). With this setting I would be sure to capture the precise moment the prod plunged into the water and would be able to pick from multiple pictures to eventually crop/Photoshop.



Upon asking my teacher Prof. Jean Hertzberg about what I had actually managed to capture, she told me the flow process is called film boiling. The film boiling effect achieved with this experiment took me a bit by surprise. I did not expect so much bubbling and steam to come off of the prod when I put it into the water. After taking my teacher's advice I looked up film boiling online and found a post on PhysLink.com by someone asking: "What is film boiling?" The question was answered by David Latchman, B.Sc. Physics, University of the West Indies. What he said (and how it applies to my experiment) is that the heat transferred from the metal prod to the water through a process of radiation (Latchman). This in turn caused the water to vaporize upon contact which made the bubbles in the photograph (Latchman).

The bubbles are perhaps the one thing in the photograph that as a photographer I could have done better. I'm not quite sure why I was not able to get the bubbles completely in focus (if it was the motion of the prod or if the focus was just a hair off I don't know). Next time I will try to take more photographs and document a bit closer what I'm doing and what camera settings I'm using. I don't quite regret the bubbles being out of focus though, I just feel I could have done better as a photographer. If it weren't for Adobe Photoshop and Lightroom I feel the photograph would have probably been not half as interesting (as you can see in the final image above compared to the original image below before it was cropped and altered using the Adobe software). The original image was framed to encompass the entire fish tank so I would be able to choose and crop the photo appropriately. Once I realized that the bubbles in the photograph were out of focus I will admit that it kind of bummed me out. However, after playing with the sharpness and the focus in Lightroom I was able to get this effect out of the image where it started to look somewhat like a painting. The fact that I used the telephoto lens to flatten out the image went really well with the concept of a painting and since the project was for an art/science class I felt I really made something that had an interesting aesthetic and also displays a natural phenomenon of fluid flow mechanics. As is evident by looking at the



unedited photograph, I also used Lightroom to turn down the exposure as well and also used Photoshop to mess with the colors a bit a turn up the blues and the purples to get a more saturated a rich effect. Overall Photoshop and Lightroom really helped me achieve an image I am still proud to look at. In the future I will be more critical and a bit more of a perfectionist for I feel that I further understand the workings of digital cameras and post production software. I'm looking forward to one day owning my own DSLR camera and exploring the world through its lens and furthering myself in the world of digital photography and flow visualization.

Bibliography

Latchman, David. "Answer: What is film boiling?" *PhysLink.com*. Ask The Experts. Web. 10 Feb. 2014.