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Team First

October 2019

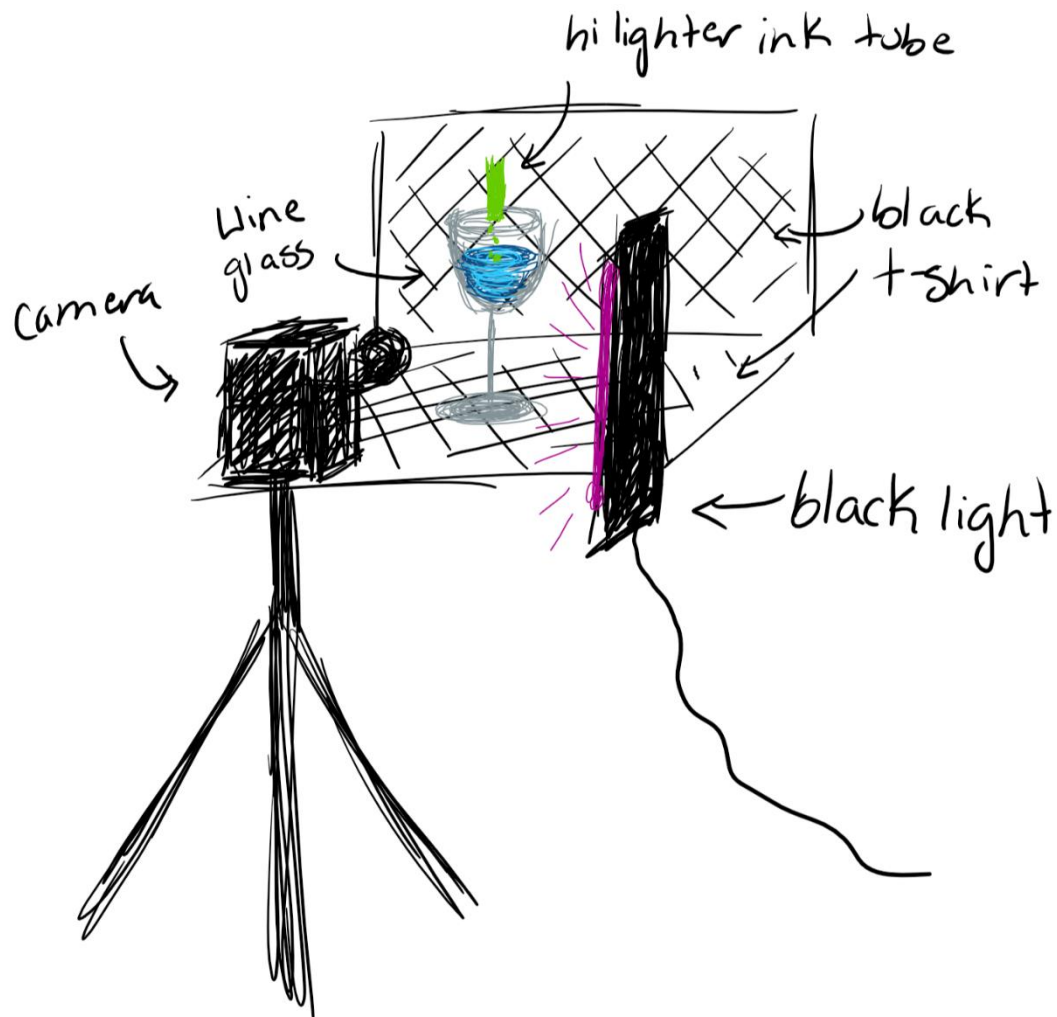
ATLS 4151-001

Spin

For the Team First project, I decided to experiment with bubbles and create a colorful macro photo focused on their variable surface tension. I decided to visualize bubbles by mixing the bubble liquid with highlighter fluid and shining a black light on the scene to make the light source be the bubbles themselves, as highlighter fluid glows in black light. I set out to do this by filling my bathtub with water, highlighter ink, laundry detergent (which also glows under blacklight) and body soap. Lighting the scene up with a black light, I fluffed the water with a knife to create bubbles. I tried capturing these bubbles, but the images weren't coming out as I envisioned. I started focusing on taking pictures of the highlighter fluid as I was squeezing it into the tub water, as this looked cooler than the bubbles themselves. I then got the idea to just capture this instead of the bubbles in a controlled setting. I went and filled a glass with tap water. I set my tripod and mounted camera up and placed the glass on a black t-shirt. I zoomed in as far as I could and tried to focus the camera where I thought the highlighter fluid would fall. I set up the blacklight as my only light source and started to shoot. Shooting proved to be extremely difficult with my kit lens: a 18.0-140.0mm with f/3.5. Things weren't correctly in focus and I couldn't get the placing of the blacklight quite right. As I was struggling with the scene, I realized the phenomenon I was unintentionally capturing was vortex rings. Vortex rings are created when a region of liquid or gas spins around an imaginary axis of a closed loop. These rings happen extremely commonly in the physical world but are only visualized through certain mediums such as smoke rings, mushroom clouds or, in my discovery, highlighter fluid being dropped into a glass of water lit up by a black light. I gave up on shooting for the night, walking away with nothing usable, but excited with my new discovery and project direction. I completed my final shoot the next week with the help of my teammate Kensue Kiatoukaysy, who managed the highlighter flow.

I came back to shoot the experiment the second time, prepared with what not to do and a new vision of what I wanted to capture. First difference, I decided to use a macro lens to capture

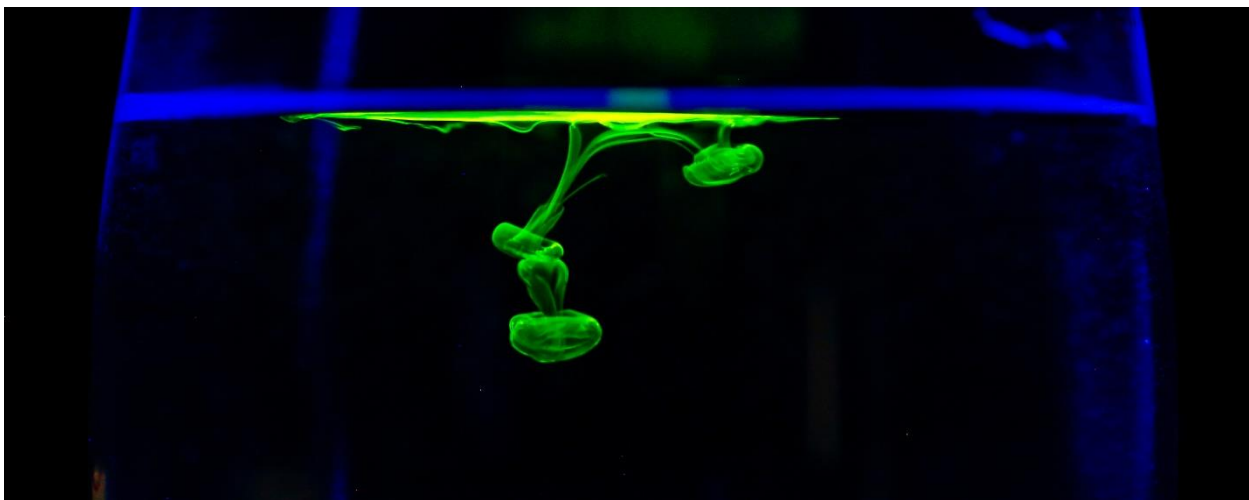
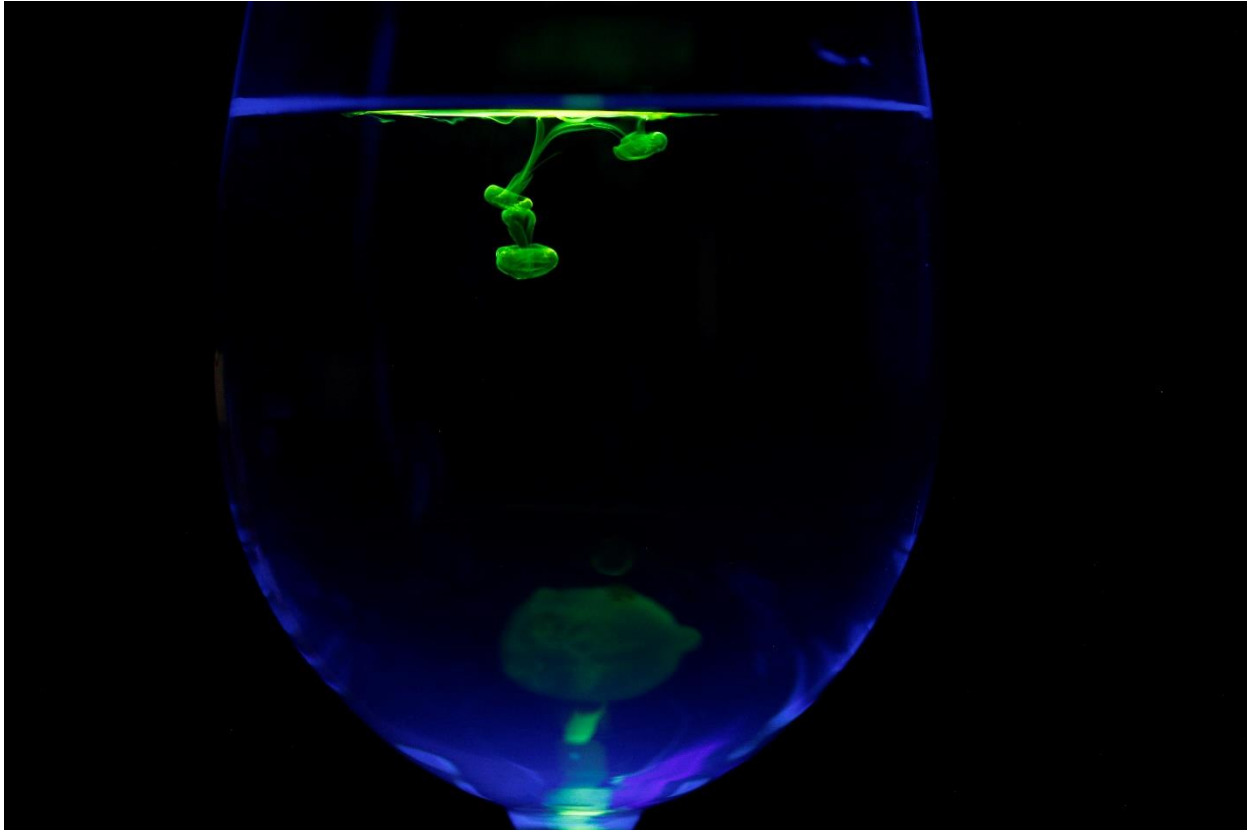
the flow as close and clearly as possible. I borrowed my boss's macro lens and camera body for this second shoot. My background consisted of a black t-shirt laid out under and behind my scene. I used a wine glass and filled it with warm tap water. I wiped the inside and outsides of the glass with a paper towel before and after adding water to make sure there were no distracting dust particles or bubbles between my camera and the flow. I placed the wine glass in the center of my t-shirt scene. I removed the inside tube of a highlighter from the pen casing by prying out the bottom of the casing with pliers and using tweezers to pry out the ink casing from inside. I then had Kensue hold this ink tube above the water. I set up my camera mounted on my tripod about 3 inches from the edge of the wine glass. I had Kensue stick the tip of the ink tube into the water so I could correctly place the camera where it would focus on the ink displacement, rather than the ink tube outside of the water. After placing the camera correctly, I made sure all the blinds in my house were shut and no other light was entering the room. I held the blacklight in my right hand as close to the wine glass as I could without it getting in the frame. This created a blue glow on the wine glass, which wasn't intentional, but I really liked so I decided to make sure it was in all of my pictures. I did a few test shots to get the ISO, shutter speed, focus and placing of the black light right (I couldn't adjust the f-stop as I used a fixed f-stop macro lens) and then we were good to go. I had Kensue squeeze the ink into the glass as I held the black light with one hand and shot with the other. Each time the ink reached the bottom of the glass, I washed the glass out and re-filled it with water to ensure fresh water for each ink drop so there was no distracting highlighter fluid already lighting up the water. I wanted the flow to have a stark glow to it and really stand out against its surrounding watery environment. We did this at least 7-10 times before I got enough shots that I felt satisfied captured the vortex rings the way I envisioned.



My visualization technique was based on have my vortex rings glow themselves, lit up by only one external light: a black light, which was what caused the fluid to glow. The focusing of the ink was the hardest and most important part for me to make sure was correct. Since I used a fixed macro lens, I had to physically move the camera to focus the correct spot. It was also difficult to know exactly where to focus because since the macro lens's f-stop was fixed at $f/2.8$, my focal depth was so small and once the ink hit the water, it dispersed quickly out of my focused range, making some parts out of focus. This I could deal with, as long as the most interesting part of the ink flow was actually in focus. We had to do so many iterations of this experiment solely because the ink didn't happen to fall in exactly the right spot. Aside from focusing, I had to adjust the camera's settings to work around the small f-stop. I pushed the ISO up as high as I could. I put the black light as close to the glass as possible to help aid the camera in capturing the photo and give me the ability to raise the shutter speed as high as I could get it with the scene still able to show

up in the picture. Luckily the ink wasn't moving too fast through the water, so the shutter speed of 1/320 worked just fine.

The size of the field of view was just as wide as my wine glass. I lined up the camera's frame to be exactly this width to create a pleasing aesthetic with the glowing blue wine glass's edges framing the scene. I used a Canon ESO 6D with a f/2.8 macro lens to take these pictures. The final image had an exposure of 1/3200, f/2.8, a focal length of 100 mm and a ISO of 4000. The original image's width and height was: 5472 x 3648 px. The cropped image ended up being 3707 x 1469 px. Since the ink droplets I captured were so small compared to the wine glass, I cropped the image to focus the viewers' attention on the small mushroom cloud like vortex rings. I didn't have to do much post processing on this image as the vortex rings luckily were extremely in focus (directly in my focal field), and the black light made the ink glow clearly with a decent amount of contrast and clarity. I did some minimal editing like increasing the contrast, heightening and lowering the shadows/highlights, enhancing the colors through saturation and vibrance and running some denoising through the picture to help correct the image from its ISO 4000 noise.



I was happily surprised with the new direction of my project and loved the phenomenon I was able to capture. I also loved the blue highlighting of the glass which adds a nice color contrast and interesting aspect to the photography aesthetically. It was hard for me to choose one final image; I had six other images I was attached to at the end of the shoot. I decided on the image above as my main image because I felt it visualized the vortex rings the clearest out of any of the

other images. However, I was still attached to the other images even after submitting the one above, so I sent them to Professor Hertzberg and she recommend I include them all on flowvis.org for archival. I was happy I was able to do so as I feel all the images bring something different to the table and together, they tell a story that isn't complete when you look at each individual piece. I included my other final six images on the page below.

