Team First Report

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I. Purpose

This is our second experimental project of the semester and the first that we were permitted to work in our assigned teams. The guidelines were the same as our previous assignment; we were to experiment with and explore any type of fluid flow of our choice, either in or outside of our teams, with a goal of capturing the artistic nature and science behind the flow using different mediums of photography and documenting our results and process as well as explaining the science behind the flow.

For my project this time around, I chose to replicate a popular magician's trick, *smoke from the fingertips*. In this report, I will be explaining my process for performing this experiment as well as the science behind how the flow works and my photographic workflow.

II. Flow Apparatus/Visualization Technique

The procedure for this experiment was quite simple and easy to replicate. This made it easy for me to repeat the process with different apparatus, camera settings, and light sources. I set up a black backdrop set in the background of the frame in order to clearly mark a boundary for the lightly colored smoke. I used a black rope to do this at first, but after playing with different lighting positions, I found that my black sketchbook cover worked just fine. The light was positioned directly above where I had my fingers, pointing down and into my camera lens. I would use my left hand to perform the experiment, and operate the camera with my left. Below shows a rough 3D model configuration of my setup:

Now onto the science behind what is creating the smoke in the first place. The process begins by placing a ceramic (any kind will do, I used a mug) into the freezer and wait about 15 minutes for it to get nice and cold. I then cut off the striking surface of a matchbox. This red strip contains a chemical element known

as *red phosphorus*. By peeling away the strip of paper attached to the back of this cut, I isolate just the red phosphorus and fold it in on itself with the red phosphorus facing down (hotdog style). I then retrieved my cold ceramic from the freezer and placed the folded red phosphorus strip on top. Next I light the strip on fire. When red phosphorus burns, one of the products is *white phosphorus, one* of two *allotropes* (each of two or more different physical forms in which an element can exist) of phosphorus. The white phosphorus condenses onto the cold ceramic leaving behind a gooey substance under where the tent was burned. When I was ready with my setup, and once the goop had cooled down, I wiped the waxy substance onto my fingers. By rubbing my fingers together the friction created just enough thermal energy for the white phosphorus to react with oxygen in the air to form particles of phosphorus oxides that drift off my fingers as smoke. Keep in mind that white phosphorus is an extremely dangerous chemical and while this experiment uses only a small amount, one must still use extreme caution around this chemical.

III. Photographic Technique

The camera I used is my grandfather's old Nikon model COOLPIX P900. At first I tried using the manual settings, but found later that shutter speed priority worked best for capturing the smoke. The best settings (and the settings used on my final result) were as follows:

- F-stop - f/3.5
- Exposure - 1/125 sec.
- ISO speed - 800
- Focal length - 11 mm
- Max aperture - 2.9

Once I had a few pictures that captured both my fingers and smoke elegantly in focus that I was happy with (this took a while, definitely 300+ photos), I exported them into Lightroom Classic and edited them. I mostly did some light cropping, highlights/shadows, whites/blacks, some tint adjustments, and bumped up the clarity and toned down the texture. This is what I ended with:

Edited:

Unedited:

IV. Image Revelations / Self Assessment

At first I wasn't able to capture the smoke coming from my fingertips as clearly as opposed to the later instances I performed the experiment. I knew that since this was such an easy thing to replicate, I had to do it again until I had a result I was happy with. Somehow, I only got these last pictures when I was on my last strip of matchbox, so I am very happy to have pushed myself to repeat this process so many times, because it was worth it, I am very pleased with the result. It took changing the camera settings multiple times over multiple instances of performing the experiment to achieve clear results that really depicted the flow as it looked and as I wanted it to look. I'm really glad that I didn't give up, and constantly kept changing my apparatus and little configurations here and there. It would have been a miracle were I to have gotten the perfect shot on the first attempt.