Owen Brown

2018 Fall Get Wet

10/01/2018

The purpose of this first assignment is to capture an observable fluid phenomenon. This image demonstrates how there is more than meets the eye in even the most ordinary of interactions. A rainy day in the heart of downtown Cleveland left scatter of raindrops perched on the window of the airplane, held upright by the intermolecular forces, creating the phenomenon of surface tension.

Three different materials, air, water, and the window pane are simultaneously interacting internally and with one another, to keep the fluid stationary. The fluid is internally going through a series of intermolecular bonds held together the polarity of the molecules, reducing the net force between neighboring molecules. The air to water interaction results in a pressure jump across fluids, putting pressure on the surface of the water molecules causing a sphere to form, in the overserved case only semi-sphere's form because of the wall interacting. The size of the droplets in the two-radial direction is inversely proportional to the pressure in the form,

$$\Delta p = \gamma \left(\frac{1}{R_x} + \frac{1}{R_y} \right)$$

where γ is the surface tension coefficient, in units of $\frac{N}{m}$. Water has a γ of 0.073 [1]. The Δp is the pressure drop across the surface interaction.

Taken with an iPhone 7 from approximately 7 inches from the window, with the camera's focal length set to 4 mm. Full dimensions of the images can be found in figure 1, below. The depth of the image is a result of an angle of the camera pointing towards what would be the top of the window. The F-stop on the image is f/1.8 with an exposure time of 1/2037 sec. No flash was needed to capture the images as the diffused natural light from the sky acted a backlit source. The ISO speed was ISO-20. The pixel dimensions were 4032 x 3024.

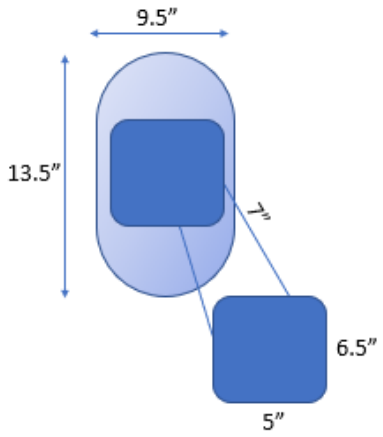

Figure 1: Schematic of image with capturing dimensions

Post-processing of the image consisted of adding contrast with the a built in iPhone editing toolkit. This creates darker, more intense, rings to identify how the bubbles are shaped. The additional contrast also adds a small amount of variation in the background, which gives nice texture to the otherwise simple background. The progression from original to final can be seen in figure 2 below.

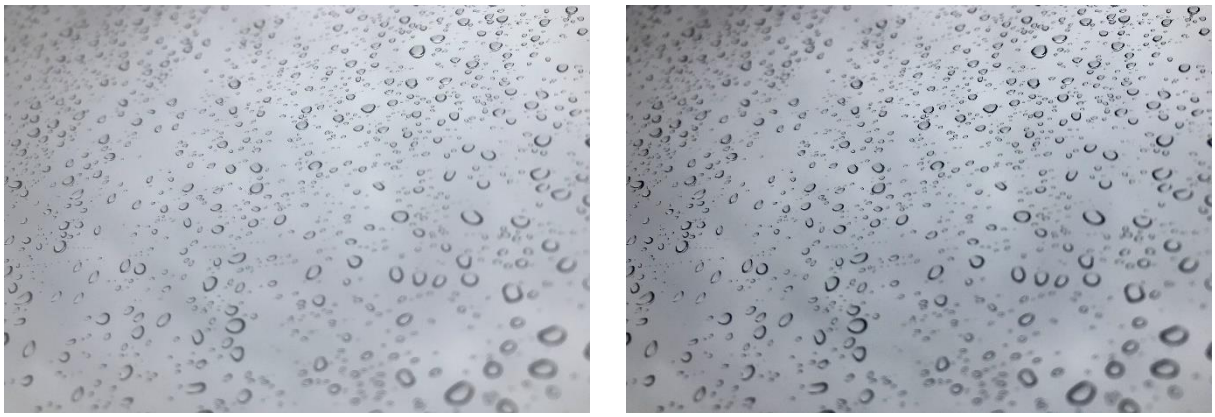

Figure 2: (a) Original image (b) Post-processed

This image has the ability to confuse the viewer preconceived idea of. The closer the viewer looks, the more backwards the image becomes. When I originally took the picture, I had not given any thought to this outcome, it was only till group discussion that I realized how much that actually added to the image. As I continue to work in flow visualization I become more drawn to these abstract viewpoints that make even simple images complex in thought.

[1] Pierre-Gilles de Gennes; Françoise Brochard-Wyart; David Quéré (2002). *Capillarity and Wetting Phenomena—Drops, Bubbles, Pearls, Waves*. Alex Reisinger. Springer. ISBN 0-387-00592-7.