Matt Feddersen
MCEN4151
Professor Hertzberg

Get Wet Report

Surface tension inspired my photo. Initially I wanted to create the feeling that the water was traveling down the cord. I wanted to show the water falling from above and "catching" the cord, then flowing down the cord. After playing around with my set up for a little bit, I determined that an image like that would be very difficult, if not impossible. I therefore decided to settle on an image of multiple droplets resting statically on a cord.

In the image, a cable travels from the top right to the bottom left with three water droplets hanging from the cable in the middle of the image. The droplets appear to be in a spherical shape due to surface tension effects. Surface tension can be defined as an increased attraction of molecules on the surface of a liquid as a result of attraction forces on fewer sides.[1] The surface tension is created by cohesive forces between the molecules of the liquid.[2] Surface tension can be described as having a "film" over the top of the fluid. The Reynolds and Grashof numbers will carry minimal importance for explaining my image since my image is fluid at rest. The convective forces in the water droplets are very small because the water droplets themselves are so small. The two forces that control the shape of the droplets are gravity and surface tension. Gravity is causing the droplets to elongate towards the bottom of the image because gravity is trying to pull the droplet back to earth. Surface tension is holding all the water together and to the cord, thus preventing the droplet from falling. The surface tension on the underside of the droplet is strong enough to hold up the mass of the water droplet. While the droplets are not huge, they are probably about 3mm diameter, which is a fair bit of water considering it is supported only by itself. The force due to surface tension is strong enough to overcome the force of gravity, thus the droplets cling to the cord instead of fall to the ground.

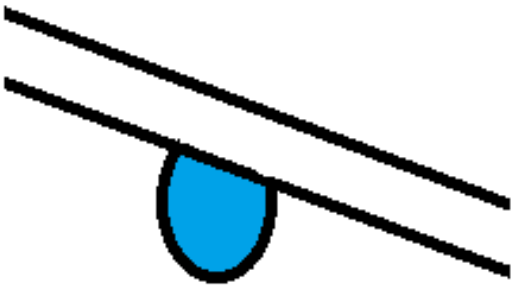

Figure 1- A droplet on a cord drawn on the computer.

In order to create the droplets on the cord, water was gently poured onto the cord. This just took trial and error to get it to work. After a few tries and some playing around with it, I got a group of three drops that was perfect for the image I wanted. The shape of the drops was nearly spherical, but gravity pulled down on the droplet to distort it and make it look a bit like the one in figure 1.

The picture was taken with a black card stock back drop. The backdrop is really good because it is black, but it still has some texture so it isn't completely sterile. The cord and drops were illuminated from the right. Lighting from the side made it so the back drop was lighter on one side of the image, and really helped to accent the foreground of the image. Lighting was done by two "warm" CFL light bulbs fairly close in proximity on the same side of the set up. The water used was around eight degrees Celsius; surface tension is stronger in cold water,[2] so I wanted to use really cold water to get nice big droplets.

When taking the picture, I just used the "macro" mode on the camera. In addition, I used a tripod and the timer setting on the camera when actually taking the photos. This allowed the camera to be perfectly still when the image was takes, no movement from pressing the button down. I used a Coolpix S9, which is just a simple point and shoot camera. Both the original and final images are 2816x2112 pixels. When I took the image, I was able to frame it exactly how I wanted the final image to look, so I didn't need to crop it at all. The field of view was approximately a foot and a half. The distance from the camera to the cord was a foot, with a focal length of 15mm. The exposure time was a quarter second, the ISO was set at 159, and the max aperture was 3.6. Once the image was imported into Photoshop, all I did was play with the colors using curves and then use the auto sharpen feature.

The image does a good job revealing the beauty and strength of surface tension. I am very pleased with the final image that I have. I do wish that the image was a bit sharper; however, given more time and a better camera I could definitely get a sharper image. The image does still show the physics quite well. The drops are clear, and their shape can be easily observed. I would like to experiment with different diameter cords. Also it would be interesting to have a lot of droplets on the underside of a sheet of glass. In order to show the "film" created by surface tension, a needle could be used to show the surface bending in when a needle is pressed gently to the surface.

Sources

[1] Lefers, Mark. "Surface Tension Definition." *Surface Tension*. Web. 11 Feb. 2011. <http://groups.molbiosci.northwestern.edu/holmgren/Glossary/Definitions/Def-S/surface_tension.html>.

[2] R. Nave. "Surface Tension." *Test Page for Apache Installation*. Web. 11 Feb. 2011. <http://hyperphysics.phy-astr.gsu.edu/hbase/surten.html>.