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2/15/18

Flow Visualization

Get Wet Report

For my get wet image, I did a lot of research on different kinds of fluid flow. I came to the realization that creating a water vortex would result in an interesting dynamic of fluid flow and in turn, a really cool image. After looking into different ways of creating a water vortex, I decided to buy a 2-liter bottle and drill a quarter inch hole into the cap. Then, I poured water into the bottle and experimented with varying amounts of water. I started with filling the bottle full of water and swirling the bottle as I poured the water out. I quickly realized that completely filling the bottle was too much water for a vortex to form. My next iteration of the experiment was filling the bottle halfway and trying another time. Again, this was too much water to form a vortex. After varying the amount of water between half way full and a quarter of the way full, I came to the conclusion that using enough water to fill about a third of the bottle resulted in a really nicely formed water vortex. Next, I got out my Nikon D90 DSLR camera to try and capture the perfect photo of the water vortex. I explored different angles to take the picture from and varying lighting techniques to get an attractive photo. First, I used the light in the room as the lighting and recognized that it created a lot of glare reflecting off of the plastic 2-liter bottle. I moved the bottle around the room and changed the angle at which I was taking the picture, but to no avail because the glare was still affecting the quality of the image. I then decided to turn off all the lights in the room and use the built in flash on my camera as the lighting. This technique resulted in a lot less glare and a high quality image. After I found out how to get a good picture, I asked one of my roommates to fill a third of the bottle with water and swirl it to create the water vortex while I took about thirty pictures of the phenomenon until the bottle was completely empty. After looking through all of the photographs on my computer, I chose the best one that displayed good fluid flow of the water vortex, did not have

very much glare, and had the best focus. Then, I uploaded the picture into Photoshop and did some editing. I cropped the image to make the water vortex in the bottle the main focus of the image and edited the contrast and brightness to make the image more aesthetically appealing. I also realized that the background of the picture was pretty distracting so I decided to use the selection tool in Photoshop to only select the 2-liter bottle. I copied this selection and pasted it on top of a dark background. I ended up using a dark blue background because the green bottle and the dark blue color had a good color contrast. Lastly, I reshaped the image into a square so that it would look nice when I uploaded it to flowvis.org. The original image I took and the final edited image can be seen in Figures 1 and 2, respectively.



Figure 1: *Original Image*



Figure 2: *Final Edited Image*

To explain the physics of what is going on, when the water starts swirling in a circle motion, it presses up against the outside of the bottle as consequence of Newton's first law of motion, which states that the water will move in a straight line unless acted upon by some force. In this case, the forces acting on the bottle are the centripetal force from swirling the bottle and the sides of the bottle keeping the water confined to a certain space. More of the water weight is pressed to the sides of the bottle with less weight in the center of the bottle. This imbalance of water weight makes the water drain out through the sides of the hole cutout in the 2-liter

bottle cap, that allows water to enter the bottle through the center of the hole, which creates the water vortex and a much smoother flow of water out of the bottle.

Realizing that this image is not perfect, I recognize some improvements that could've been made from comments that were made on the flowvis.org website. For example, it can be seen in Figure 2 that the bottle is not perfectly vertical and there are some reflections on the bottle from the surrounding environment. To get rid of the reflections, I could have used black or white paper to cover the surrounding backdrop so nothing would reflect on the bottle. Also, I could have used some sort of food coloring to make the water a different color to make the water in the image pop. Thinking back, it would have been cool to use a colored liquid with a lower density than water to outline the vortex that can be seen in Figure 3.

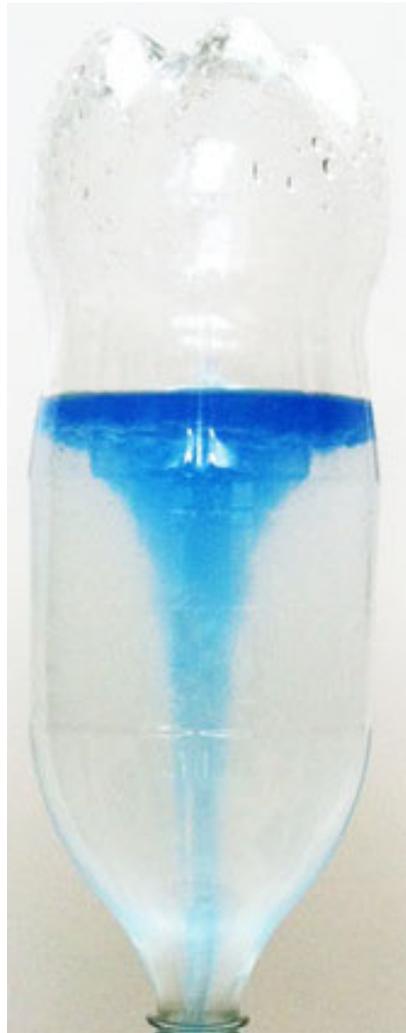


Figure 3: *Water vortex in clear bottle with a little bit of blue lamp oil*

References:

<http://sciphile.org/lessons/vortex-bottle>