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Flow Visualization

9/14/04

Get Wet Report

Introduction

The purpose of the Get Wet assignment is to get a start in developing images of fluid flows. The main objective will be to set up a simple apparatus that will create a visually stimulating fluid flow. The conditions and specifications of the apparatus are documented in order to allow others to easily produce an image that is similar to the final image given in the Appendix. After the apparatus is set up, multiple pictures are taken at different camera settings to obtain the best image possible.

Image Purpose

The purpose of the desired image is to watch the flow of blue food coloring as it is dropped into a small puddle of water that is sitting on a smooth, flat surface. The intent of the image is to display the dispersion and dilution of the food coloring into the water puddle after they make contact. This phenomenon should produce an image that is not only visually stimulating but indicative of the type of non-linear flow involved with dispersing one liquid into another.

Flow Apparatus

First, a small, nonsymmetrical puddle of water is formed that is about two inches in diameter. The surface that the puddle is sitting on should be white in order to better contrast between the background and the food coloring in the foreground. Next, a fluorescent light source (i.e. a kitchen light) is powered on roughly ten feet above the

puddle of water. Finally, two drops of food coloring are quickly released from a .25 fluid ounce vial about two inches above the surface of the water puddle. Immediately after the drops are released, a digital picture is taken from above using the flash for increased visibility of the flow (See Figure 1). The initial flow speed of the food coloring is approximately .001 m/s.

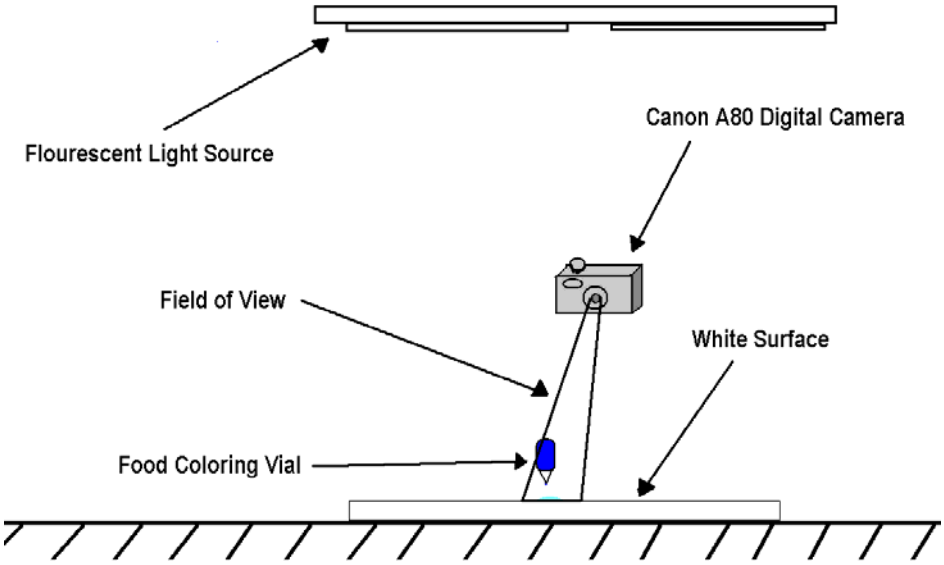


Figure 1

Visualization Technique

The visualization technique for this setup is a fluid dyeing technique. The flow of the initially undiluted food coloring is easily seen as it contrasts with the solid white surface on which it flows above. As mentioned before, the lighting used for this setup includes a fluorescent light shining above and the flash of a Canon A80 digital camera.

Photographic Technique

The field of view shown in the final image (See Appendix) is a twenty cubic inch rectangle. The distance from the puddle to the lens of the camera is approximately two feet. Again, the camera used is a four mega pixel Canon PowerShot A80 digital camera.

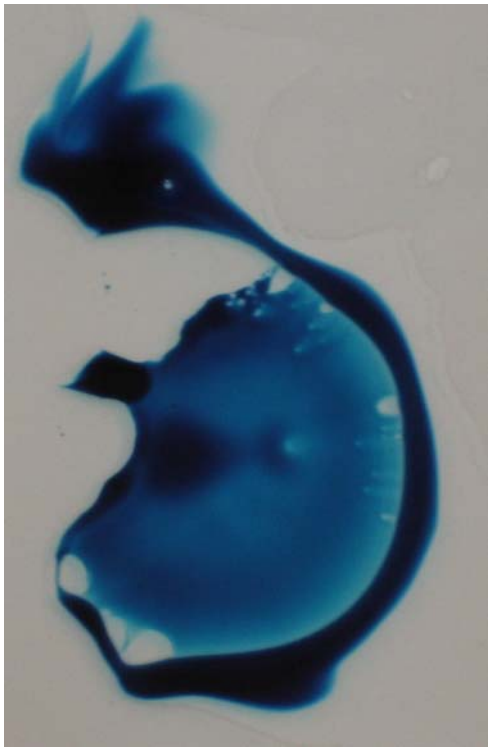
The auto setting was used because it seemed to consistently produce higher quality images. Therefore the aperture and shutter speed correspond to the automatic setting. The shutter speed it set at 1/2000 s and the aperture is set between 4.5 and 8. The original picture taken was improved by adding contrast in addition to making slight color modifications needed to improve the aesthetic quality of the image (See Appendix for both images). All changes made to the image were done using Adobe Photoshop.

Conclusions

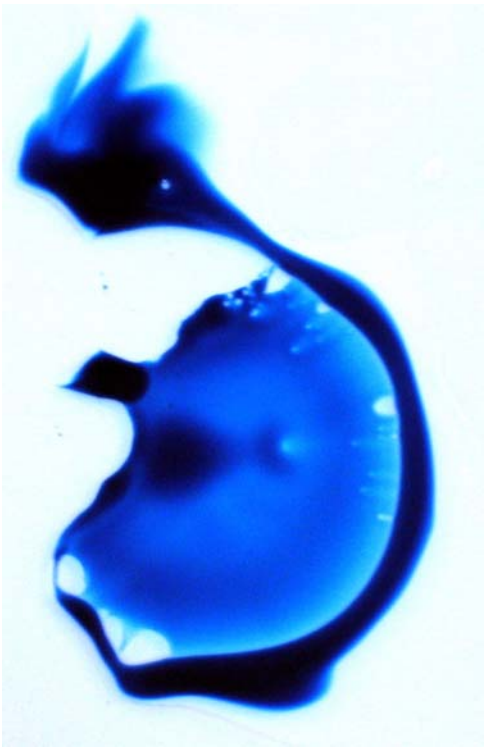
The image seems to show the food coloring dispersing radially outward from where it is dropped and then it seems to flow along different paths that are near the edge of the water puddle. I like the image because it is a good representation of dispersion and dilution of a fluid in a similar fluid. I dislike the image because it could have a sharper resolution. I feel that I have succeeded in the sense that I have captured an aesthetically pleasing image of a non-linear fluid flow. I could definitely expand on this by adding multiple puddles of water or even looking at the dispersion of fluids with different viscosities. Finally, I learned a lot about the valuable features my camera has to offer and how I can exploit them to obtain higher quality images.

Appendix

Original Image



Enhanced Image



Inverted Image