Get Wet Report

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The first photography assignment of the semester allowed the class to explore fluid dynamics in many creative ways while learning how to effectively capture the phenomena on camera. In my endeavor to snap a pleasing and interesting photograph, I made a mess of my living room while dropping, mixing, and throwing different liquids and solids together. While I had, and still have, many other more intricate situations in mind, I wanted to start basic and explore common situations for this preliminary assignment. Attempts included dropping objects such as washers, into milk and observing semi-spectacular fountains shooting up through the middle, or injecting compressed air into mixtures of colored honey, oil, and water to observe the expansion of bubbles against fluids with different polarities and viscosities. The shot that I selected for submission, however, is of blue-dyed water being poured into a shot glass of canola oil. While this may sound like an elementary effort, I noticed many phenomena in the shot and found it to have a strong, basic appeal to the eye.

Approximately a quarter ounce of water was dropped into one ounce of oil from eight inches above the surface of the oil. A diagram is included to the right (*Figure 1)*. This distance allowed the water to gain enough speed for an interesting interaction upon impact. Making the assumption that the water follows constant acceleration equation:

$$2a(x-x_0) = v^2-v_0^2$$

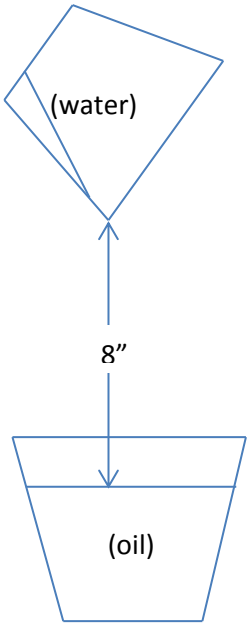

Figure 1: Diagram of apparatus

it is determined that the maximum speed of the water is 1.99 m/s when it splashes into the oil. It is extremely important to note that this is assuming no resistive forces such as air drag or surface tension to the water still in the glass so the actual velocity is definitely less. Using this velocity over the exposure time (1/100 sec), the incoming fluid moved around two centimeters. This matches the information that can be seen in the unedited, uncropped photo. The stream of water being poured appears ghostly and transparent because of the long exposure time (see “Appendix” for unedited photo). The difference in polarity causes the water and the oil to remain separate. Water molecules are attracted to one another because of van der Waals forces, that is, each molecule has a positive and a negative side that causes a net attraction. The same phenomenon is responsible for the “bubble” effect when water is placed on a penny. The shot was taken before the droplets of water at the bottom had time to coalesce into one layer. The water forms droplets when it is poured from the glass and continues to be a droplet in the oil. When momentum and density carry the water to the bottom of the glass, a thin layer of oil exist around each droplet and allows the form to be temporarily preserved until the polar force of water overcomes and creates one single layer. In the middle of the oil, a droplet of water was captured with a tail of an air bubble behind it. When the water droplet plunged through the surface of the oil it created a void right behind it. As the oil begins to collapse this void due to the force of gravity, some of the air was trapped behind the water droplet and formed into an ideal teardrop shape to minimize drag.

As mentioned above, the water was dyed blue in order to highlight the interaction between the two fluids. I preferred to use liquid dye but out of the three stores I tried a gel dye was all that I found. Although the ratio of dye to water was small, this definitely increased the viscosity of the water. In

capturing the picture, natural, artificial, and flash lighting were used. Immediately behind the shot is a white piece of paper that is approximately two feet from an open sliding glass door. Overhead light from an incandescent light bulb came from overhead, and a flash mounted to the camera helped to give definition to the contours of the fluids.

The digital Fujifilm camera had the following settings: f/4, 1/100 sec, and an ISO of 200. The focal plane was set to the middle of the glass to focus on the interactions occurring there, as well as help give the photo depth; any interactions occurring in the front or rear of the glass appear slightly blurred. Many different sorts of lighting combinations and backdrops were tried, but the diffusion of the natural light with the addition of a bright flash yielded the highest quality result. Post processing helped to further intensify the contrast, brightness, and sharpness of the image. Additionally, some imperfections and a logo on the glass were removed using the clone tool.

This image gives an insight into the fun that we all had when playing with water in elementary school. I really enjoy the visual appeal that this photo exhibits with the bright blue water bubbles and the frame of the glass around the fluid dynamics. The physics of the mixing fluids are exhibited and captured well. Looking towards the future, different perspectives of the same mixing could give more information for the mixing and repelling interactions that occur.

Appendix:

Image Assessment Form

Flow Visualization

Spring 2013

Name(s): Cameron Misegadis

Assignment: Get Wet Date: 2/13/14

Scale: +, ! = excellent √ = meets expectations; good. ~ = Ok, could be better. X = needs work. NA = not applicable

Art	Your assessment	Comments
Intent was realized	√	
Effective	√	
Impact	√	
Interesting	~	
Beautiful	√	
Dramatic	√	
Feel/texture	!	
No distracting elements	√	
Framing/cropping enhances image	!	

Flow	Your assessment	Comments
Clearly illustrates phenomena	√	
Flow is understandable	√	
Physics revealed	√	
Details visible	√	
Flow is reproducible	√	

Flow is controlled	√	
Creative flow or technique	+	
Publishable quality	+	

Photographic/video technique	Your assessment	Comments
Exposure: highlights detailed	√	
Exposure: shadows detailed	√	
Full contrast range	!	
Focus	√	
Depth of field	√	
Time resolved	+	
Spatially resolved	√	
Photoshop/ post-processing enhances intent	√	
Photoshop/ post-processing does not decrease important information	√	

Report		Your assessment	Comments
Collaborators acknowledged		NA	
Describes intent	Artistic	√	
	Scientific	√	
Describes fluid phenomena			
Estimates appropriate scales	Reynolds number etc.	√	
Calculation of time resolution etc.	How far did flow move during exposure?	√	
References:	Web level	+	
	Refereed journal level	+	
Clearly written		√	
Information is organized		√	
Good spelling and grammar		√	
Professional language (publishable)		√	
Provides information needed for reproducing flow	Fluid data, flow rates	√	
	geometry	√	
	timing	√	
Provides information needed for reproducing vis technique	Method	√	
	dilution	√	
	injection speed	√	
	settings	!	
lighting type	(strobe/tungsten, watts, number)	+	
	light position, distance	√	

Provides information for reproducing image	Camera type and model	+	
	Camera-subject distance	√	
	Field of view	√	
	Focal length	+	
	aperture	+	
	shutter speed	!	
	Frame rate, playback rate	NA	
	ISO setting	!	
	# pixels (width X ht)	+	
	Photoshop and post-processing techniques	!	
	"before" Photoshop image	√	