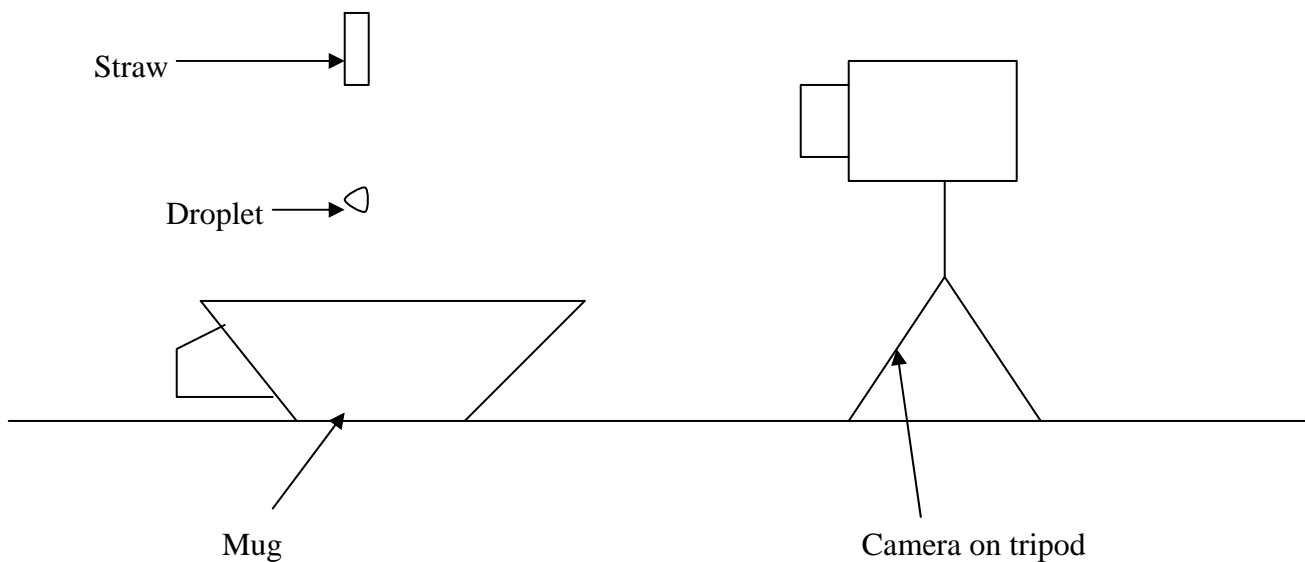


Tim Jarrell  
February 2, 2009  
Get Wet



With the first project, Get Wet, I was investigating the impact of a drop of fluid on another fluid. My intention was to have a drop of milk create the “crown of thorns” as it is called in the fluids world on top of the dark coffee in the cup. This means that the milk droplet will impact the coffee surface and due to surface tension rebound slightly and form an impact and an elongated drop right over the surface. Additionally I was hoping to have some sort of ripple affect captured as the impact was occurring. I decided on the angle from the vertical in order to get the full impact of the droplet.



*Figure 1: Apparatus Setup*

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I used a basic setup of a coffee mug and a straw to create the picture that I created. The drop fell roughly 5 inches (0.127 m) into the coffee and with an estimated mass of 0.025 g its velocity upon impact was 1.57 m/s. Using the Reynolds Number Calculator (1) I was able to calculate the Reynolds number of the droplet upon impact. Using the dimensions of  $d=0.26$  cm, velocity of 1.57 m/s, and air density and dynamic viscosity of  $3.58E-6$  lbs/in<sup>3</sup> and 3.5 lbs-slug/ft<sup>2</sup> the Reynolds number is  $2.41E-5$ . This means that the droplet was in laminar flow as is correct since the droplet was intact at impact. The mug width was 3.5 inches with a surface area of 9.62 in<sup>2</sup>. This area exhibited surface tension after the impact with the drop rebounding and a shockwave moving away from the center of the mug. This is also in affect with the drop of milk as well, without surface tension it would not have a characteristic “drop”/sphere shape that it does.

I used the simple visualization technique of contrasting fluids to make my image. I brewed a pot of coffee for the image and used 2% lowfat milk for the drop. Using my

left hand I took a drop of milk in the straw and since the setup was already ready to go, I used my right hand on the shutter and simultaneously released the drop and hit the shutter. To light the apparatus I used the available sunlight that came through my living room window early in the afternoon, and I added a spotlight about a foot and a half away from the fluid surface.

Using my Canon Rebel Ti 35mm film camera I used set my zoom to 75mm with the lens 9 inches from the surface of the coffee. With this setting the field of view was 4 inches, just barely beyond the width of the mug. I had my aperture at 5.6 which was unfortunately the lowest available and shutter speed of 750. I was using ISO 800 film to capture the still droplet upon impact. I had my film processed at Wolf Camera and the negatives were digitally scanned.

This image reveals the impact of the milk on the coffee. Unfortunately my lighting was still a little dark and I was unable to completely capture everything as clear as I would like to. The physics of the image reveal the impact and subsequent initial spreading of a portion of the milk drop in the coffee. Also the drop is rebounding and even within this short time after impact the ripples have fully progressed to the edge of the mug. If I were to do this image over I would change a few things. First, I would change my lighting, and I would try to take the picture outdoors or use a lot more indoor lighting and up my shutter to over 1000. Next, I would change the angle that I took the picture to a lower point of view in order to get more height on the milk droplet rebound. Lastly I would change my coffee to tea or some other lighter colored fluid to get more clarity. With these improvements my idea would go much further.

References:

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1. Reynolds Number Calculator

[http://www.efunda.com/formulae/fluids/calc\\_reynolds.cfm#calc](http://www.efunda.com/formulae/fluids/calc_reynolds.cfm#calc)