

Get Wet Flow Visualization



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Introduction

This project is for the “Get Wet” assignment in the Flow Visualization Class with Professor Jean Hertzberg at the University of Colorado Boulder. Amazing fluid flow phenomenon occurs around us every day; however, most go unnoticed. This experiment is focused on beverages that are served on a daily basis, they contain interesting fluid dynamics, but are only appreciated for their aesthetics. The “Alien Brain Hemorrhage” is an alcoholic drink served in many bars. It contains four different fluids that interact unexpectedly making it very unique. The drink contains a mixture of Peach Schnapps, Irish Crème Liquor, Blue Curacao and Grenadine were mixed together in that order respectively.

Experimental Setup

The experiment took place in a room with bright lighting. A fluorescent light source was positioned right above the experiment. White A4 paper was placed below the cup and behind it to create a white and bright uniform background as shown Fig.1.



Figure 1: Experimental Setup

Once the cup is positioned, a 20 ml of the cup was initially filled with Peach Schnapps, and then another 10ml was filled with Irish Crème Liquor. After the mixture has settled, 7 ml of Blue Curacao and 7 ml Grenadine were used as fillers in the end. This equates to 44 ml of total fluid in the glass cup.

Photographic Technique

The intention was to create a very bright setting that would help illustrate some of the details within the different fluids. To do so, exposure specs were manipulated. First, ISO was modified. ISO is the level of sensitivity of a camera to available light. An ISO setting of 2500 was selected, this made the camera fairly sensitive to the light sources. To not cause over exposure with the image, a fairly fast shutter speed of 1/60 seconds was used. To keep the fluid in proper focus, a large depth of field was required, similar to macro imaging. An aperture setting of 4.2

was used, this allowed for the large depth of field and that the fluid was in focus. In addition, the camera's built in flash was disabled as to avoid any unwanted reflection off of the glass cup.



Figure 2: Unedited image.

Visualization Technique

The original picture was further modified using photography processing software. The original was very bright and had some distracting features; to combat that, it was edited using Adobe Photoshop. The image was first cropped, this helped remove some of the excessive white background. A color inversion was then applied. The contrast was then raised to a level of 100. The combination of these modifications brought out more detail about the different layering that occurred and the interface between the fluids.



Figure 3: Final image.

Flow Physics

There are several phenomenon that can be observed from the final image. When the Irish Crème Liquor is inserted with the Peach Schnapps, the two fluids don't mix. They are immiscible together; therefore, they don't mix together as the surface tension is too high. The Blue Curacao and Grenadine are then inserted. Both fluids are denser than the Irish Crème, and therefore displace it and go to the bottom of the cup. However; this still does not break the surface tension between all the fluids. Interestingly the fluids do not form a stable separation, an unstable interface was formed. It can also be observed that a Rayleigh-Taylor instability is

present, this occurs when a fluid of high density is put above a fluid of lower density, causing the less dense fluid below to start moving upwards, mixing with the denser fluid above.

The image reveals a lot of interesting phenomena; however, it might be better illustrating using a video. This will better show the fluids displacing each other. From an aesthetic point of view, the picture fulfilled my intent. The post processing procedures really brought out the colors in the image and gave it a very interesting look. However, as mentioned, with the implementation of a video, better understanding of the underlying physics would be clearer.

References

Jacobsmeier, Brian. "Art and Physics Converge: Accidental Painting." Physics Central, n.d. Web.

Jacobsmeier, Brian. "Mixing Physics: Rayleigh-Taylor Instabilities." Physics Central., n.d. Web.

Nikkon. "DSLR Camera Basics." N.p., n.d. Web.

Rowse, Darren. "Introduction to Aperture - Digital Photography School." *Digital Photography School Introduction to Aperture in Digital Photography*. N.p., 23 Aug. 2006. Web.

"Understanding ISO - A Beginner's Guide." *Photography Life*. N.p., 15 Dec. 2009. Web.