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Get Wet Report

For my "Eye of the Quarter" image, I was attempting to capture the effect of magnification. The purpose was to get our feet wet with not only capturing an image of a flow phenomenon but also the editing and enhancing of the image or video using Photoshop or a similar program.

The image was created by filling a 12-ounce glass with ordinary tap water. Then droplets of household olive oil were added via a straw until a disc of oil was formed on top of the water. This separation is caused due to the two differing densities as well as the polarity of the two substances. Since oil has a lesser density it rises to the top while the water sits below the oil. Also, oil and water have very different polarities; oil is a nonpolar substance, while water is a very polar material. This difference in polarities further keeps the two from separating. Since we now have a disc of oil on top of the water, it forms a convex lens that bends the light giving it a magnification effect. The index of refraction of water is 1.33 and is 1.47 for olive oil [1]. Using Snell's law, shown below, we can investigate how the light is bent in order to cause magnification.

$$\frac{n_{oil}}{n_{water}} = \frac{\sin\theta_{water}}{\sin\theta_{oil}}$$

Since our eyes will see the effect of the water to oil refraction we understand that the quarter will appear closer to our eye then it really is. One of the big reasons the

oil and water do not mix is because water is a dipolar molecule and has strong attractions forces between molecules. Oil has non-polar molecules and has weak attraction, which creates immiscible fluids [2]. The surface tension of water is 72.8 dynes/cm [3]. This surface tension exceeds the force due to gravity on the oil and thus the oil floats on top of the water. The density of water is 1000 kg/m^3 while the density of oil is only 800 kg/m^3 [4] and thus the fluid with the least density would sit on top of the water.

Visualizing this magnification effect is a very natural phenomenon and it can be observed with the human eye. All that is needed is oil, water, and an object. A quarter was chosen in this case due to the reflectiveness of metal. Natural lighting was used to view the magnification although artificial lighting would also work. It was a very clear day with a lot of sunshine on the day I took the image. The more light you have the more opportunity you have for interesting effects in the image.

For the image I used an Olympus digital camera and took it at a distance of around 2 in from the top of the surface of the liquid. I chose that distance because it eliminated all the unnecessary objects and focused on just the glass of water. I chose a shutter speed of 1/100 sec in order to capture just the reflectiveness happening at that instant and to prevent over exposure. My aperture value was f/4.3 and my ISO was at a value of 1600. After discussion and suggestions, I have come to believe that my ISO value was set to high and produced a somewhat grainy image. The resolution of my picture was 240x240 pixels/in giving it 3648x2736 pixels total. I adjusted the curves slightly in order to cover the full range of colors in the picture. The biggest change I made was changing the image to color negative.

This caused a very cool effect by inverting the colors and changed the natural yellow color of oil and clear color of water to a more interesting color combination.

This image reveals the interesting reaction between water and oil and the effect they have on light. I was very pleased with the depiction of the magnification but was somewhat disappointed by the graininess of the image. This was my first time attempting to capture an image with a manual focus camera as well as my first introduction to Photoshop. This phenomenon could be further explored with different materials in the glass. Overall, I learned a lot about my camera as well as Photoshop and am excited to get to use it more.

1. Robin Wood http://www.robinwood.com/Catalog/Technical/Gen3DTuts/Gen3DPages/RefractionIndexList.html
2. http://www.buzzle.com/articles/why-oil-and-water-dont-mix.html
3. http://hyperphysics.phy-astr.gsu.edu/hbase/surten.html
4. http://www.engineeringtoolbox.com/liquids-densities-d_743.html