



Team Second

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ATLS 4519

Intent

Oobleck is fascinating in its characteristics. This mixture of cornstarch and water can be a mysterious fluid to play with as well as a beautiful art medium. My intent with this Team Second assignment was to represent how oobleck holds the shape of dye and the strange state it reaches that is neither liquid nor solid. Initially, I had a bowl of oobleck and put drops of food dye in it. I mixed it with a rod and the dye remained in shape without mixing completely into the mixture like it would in a fluid. I took images of this process and began mixing the concoction with my hands for 5 minutes. The image you see above is the result of continuous stirring of the mixture. It was insanely beautiful how the dye remained individual from the white oobleck with all the folding and mixing.

Flow Apparatus

The flow apparatus used was simply a bowl where the fluid would reside. The dyes that I put in the oobleck was mixed around manually initially with a rod then with my hands. The reason that the dye is still visibly its own part from the oobleck is because this is not a liquid or solid, it's a non-Newtonian fluid. The difference is that the former can be described by temperature and pressure while the latter changes viscosity depending on the forces acting on it. When I was stirring the mixture, my hand was acting as a shear stress that caused it to stiffen, or increase viscosity. When the oobleck was stiff, the dye was not able to freely move around the way it would if it were in a liquid but flowed more than if it were in a solid. Thus, the color created folding and swirling patterns.

Another aspect of this image is the flowing of the oobleck to the side of the bowl. I tilted the bowl about 60 degrees and this image was captured about two seconds after it was tilted. A liquid would've emptied from the bowl by that point, but the shear stress of the oobleck particles moving amongst themselves created another stiffening force.

Because of the properties previously stated, oobleck is characterized as a

shear-thickening fluid. Its has an apparent viscosity that can be represented by the following:

$$\eta = \frac{\tau}{\dot{\gamma}}$$

Where the viscosity is dependent on the shear stress being applied to the fluid.

Visualization Technique

The food dye and cornstarch I used were both made by Signature Kitchens from Safeway. I used room temperature tap water and the room was 70 degrees. I mixed 2 parts cornstarch with one part water (1 cup cornstarch to ½ cup water in this case) and added 2 drops of blue and 4 drops of yellow food dye after the oobleck was made. Note that a small portion of the water evaporated by the time this picture was taken, but it didn't have a great effect on the consistency. The lighting I use was the fluorescent light bar that is on my kitchen ceiling. The bowl was facing toward, but not directly into, the light.

The information on my camera and its settings can be found below:

Property	Value
Camera	
Date taken	3/14/2018 12:26 AM
Dimensions	6000 x 4000
Size	20.7 MB
Authors	
Camera maker	NIKON CORPORATION
Camera model	NIKON D5200
Camera serial number	2502750
ISO speed	ISO-126
F-stop	f/4
Exposure time	1/80 sec.
Exposure bias	+2 step
Exposure program	Manual
Metering mode	Pattern
Flash mode	No flash
Focal length	24 mm

Also, my camera was a foot away from the subject and I was holding it.

I use Adobe Photoshop for my post production. The original image had my distracting hand in it and was highly underexposed to reduce graininess and decrease motion blur. I increased the brightness and contrast of the whole picture, and then feathered a mask on the front area of the image. I brightened that mask to bring that area out more. I also blacked out the corner of the image where the background showed through. I cropped the image quite a bit as well.



Original Image



Final Image

Reflection

I really enjoy playing with oobleck and experiencing how color moves within it. It was such a beautiful thing to witness and capture on camera. With that said, Flow Visualization is about striking a balance of art and science and my image seems to have been made more for art's sake. The properties of oobleck could've been shown through more movement or if it was placed on a speaker where it would "finger" out. I would love to make a personal series of these photos that show the spectrum of artistic styles and scientific observations that can be achieved with this fluid.