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Flow Visualization Essay – Group 3 Image

This was definitely the most fun image I had the opportunity to take in this class. It was like being a kid at the museum again. This time though, I was able to look at the oobleck from the perspective of a scientist and a photographer. Non-Newtonian fluids are also very fascinating to me.

The set up of the experiment started with the following ingredients: water, cornstarch, and dye. The water and cornstarch were mixed together and green dye was added. As the cornstarch was combined more, the mixture became thicker and more difficult to stir. Once the cornstarch was completely combined we started doing experiments. Including scratching the surface of the oobleck with a fork and a sharp knife, scooping some up with a spoon that had holes in it, placing an object on top of the oobleck and allowing it to sink, and applying a quick force (such as a punch) to the surface of the oobleck.

The final experiment that was conducted was the one that was used for this image. Oobleck was again scooped up with the slotted spoon and it was allowed to drip down. As it was dripping a spatula was used to scoop more oobleck and held above the spoon. This configuration allowed the oobleck to slide through the slits in the spatula, fall (almost like a solid) into the slotted spoon, and then appear to 'melt' through the holes in the spoon. This produced an image of the oobleck dropping from the spatula into the spoon and then back into the bowl.

Two versions of the image were created. In both the image was cropped and flipped 180^{o}. In the first version, the contrast was increased and the image was left with the green slime. In the second, the colors in the image were inverted. In the second image, the white background became dark, the spoon changed to a different silver color, and the oobleck became a bright neon purple. I chose the second image because the colors looked unreal. Since the image was flipped 180^{o}, the 'strings' of oobleck that were dripping down now appeared to be reaching upwards. I like this alien image combined with the out-of-this-world purple color.

Non-Newtonian fluids are fluids that do not act like fluids. They have viscosity dependent on the shear rate. This means that when shear force is applied the liquids tend to behave more like a solid. This is exhibited by the oobleck because the more force that is applied, the more solid the substance appears. For example, if you were to punch the oobleck, it would not act like most liquids and splash all over. Instead, it would act more like a solid and resist your force. This is what makes non-Newtonian fluids interesting. Many people have filled pools with oobleck and run across them to simulate running on water. Adults and children alike have been enjoying oobleck and all its strange properties for years.

When the oobleck is allowed to rest, it will “flow” like a fluid, spreading out and filling whatever container it is put in. In this experiment the oobleck was scooped up (this involves some shear and is not easy to do) and held in a slotted spoon. After a moment, the oobleck began to fall through the holes in the spoon and ‘dripped down’. It dripped down in skinny strings for the most part. If the oobleck went off the edge of the spoon it would drip in more of a clump instead of a long string. It would slide over the edge like slime and then continue falling in its clump. It appeared as though it was going to do the same thing as the smaller strings and just drip down into the bowl, however it actually became too heavy and it appeared to rip in some areas and a chunk would fall. This ‘ripping’ is caused by the weight of the oobleck below. It creates a shear force that essentially puts the oobleck in tension and makes it rip in its weakest area. This was all fascinating while we were doing this experiment.

Other examples of non-Newtonian fluids include shampoo, toothpaste, and blood. These are lesser-known non-Newtonian fluids. They behave in a way that a normal fluid does not, yet they are not solids either.

This image was fun to both manipulate and take because oobleck is such a complicated and interesting substance. The best part of the experiment was getting to manipulate the oobleck in different ways and observing its reactions.