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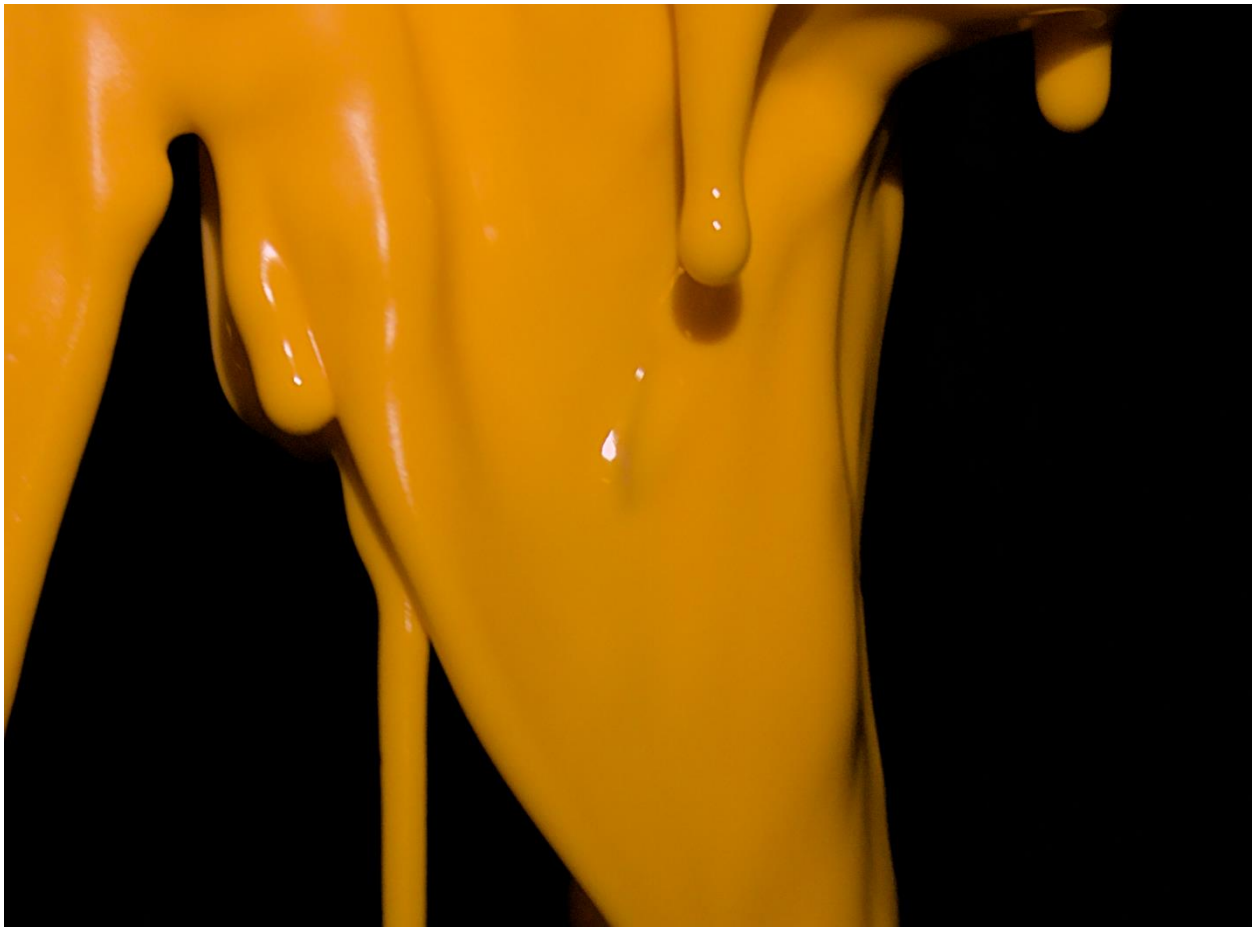
Team Second

MCEN 4151

11/10/24



1. **Introduction**

   The image above shows the flow of the non-Newtonian fluid called Oobleck. The Oobleck was mixed and then suspended over a bowl against a black background. The flow down into the bowl was then photographed. The flow created interesting patterns as the fluid dripped downwards.

2. **Set up**

   The set up for this experiment was relatively simple. Oobleck is created by mixing corn starch in water. 1 cup of Harris Teeter brand cornstarch was mixed with ½ cup of water and orange food coloring. Once the Oobleck was allowed to settle, the mixture was grabbed by hand and lifted out of the bowl. The phenomenon that was captured is what's known as shear thickening, or dilatant, where the viscosity increases when put under stress[1]. This property is what allowed the fluid to be lifted out of the bowl by hand. As the stress decreased the fluids' viscosity also decreased and thus began to behave more like a liquid again and began to drip. This phenomenon happens in Oobleck because the cornstarch particles are irregularly shaped and significantly larger than the water particles[2]. As the friction of the particles increases, the forces between the particles overcomes the liquids properties. This phenomenon is why Oobleck and other non-Newtonian fluids can defy the traditional rules of viscosity found in other liquids.

3. **Visualization Technique**

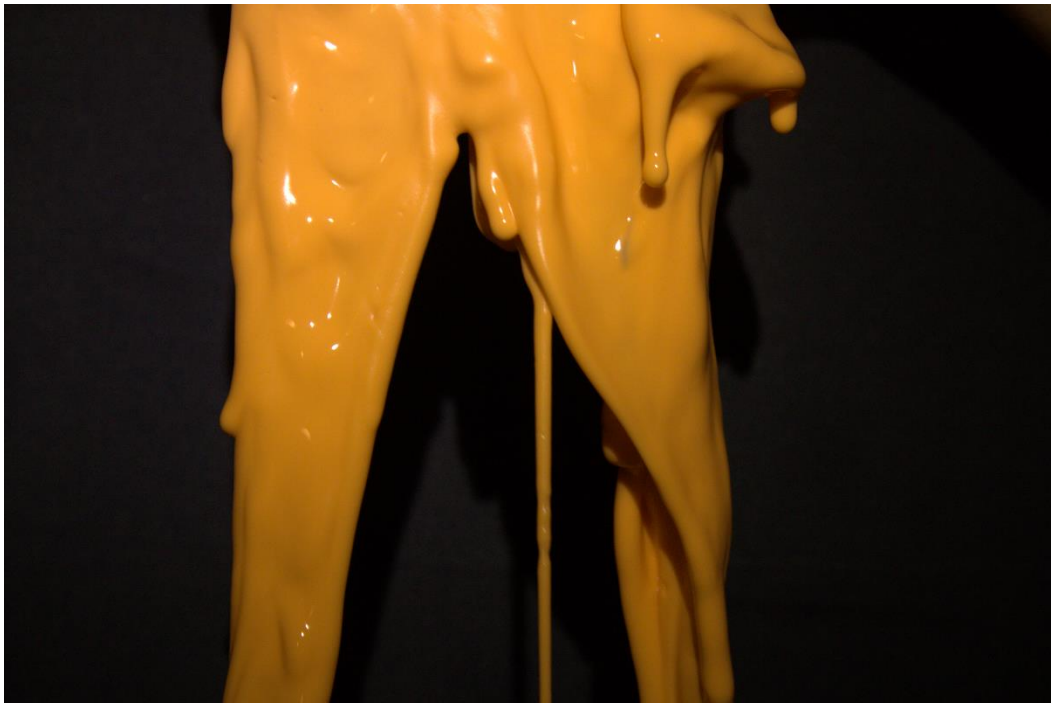
   The experiment was conducted at room temperature using Harris Teeter Corn Starch, Color Right Orange food coloring and regular tap water. The bowl was filled with 1 cup of cornstarch and ½ cup of tap water. The food coloring was dropped into the water and mixed then the orange water was mixed with the cornstarch until the final fluid was created.

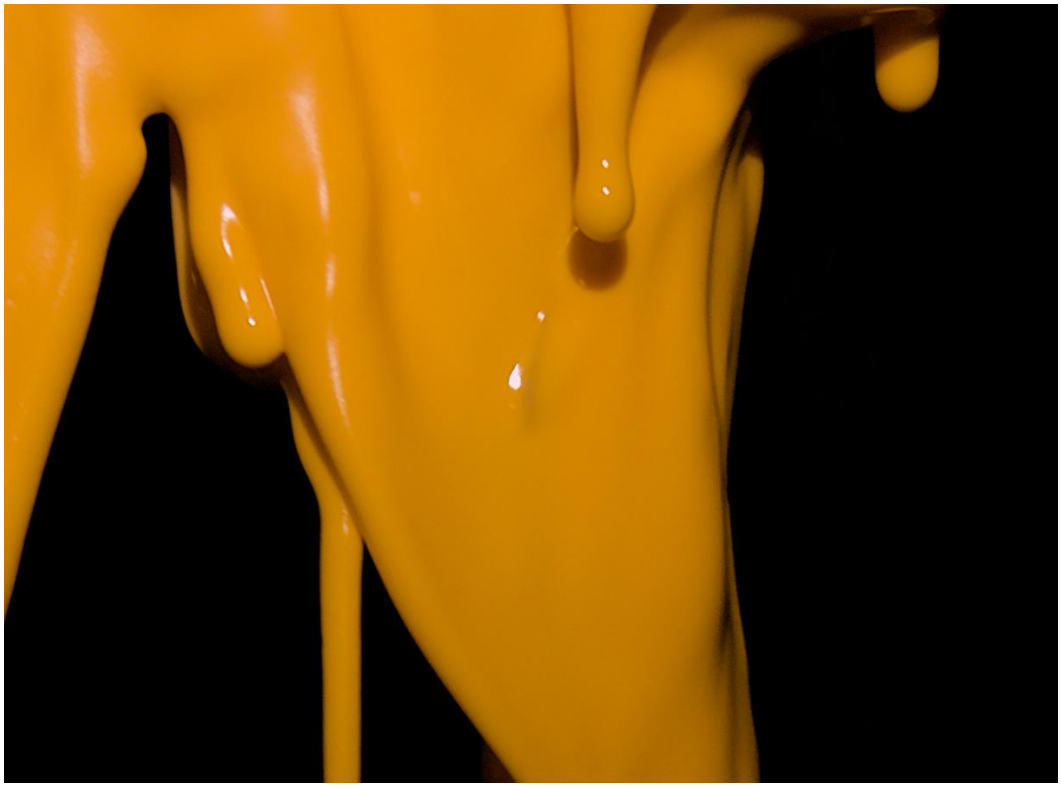
4. **Photographic Technique**

   The camera (Canon Rebel T7) was held approximately 2ft from the closest part of the flow. A Petzl headlamp was held directly above the camera to provide consistant and adequate lighting. The headlamp was an LED light emmiting 350 Lumens [2]. The field of view of the camera was approximately 12 inches. The aperture was f/8, exposure time was 1/60 sec and ISO speed was 800. The focal length was 55mm which gave the original photo dimensions of 6020x4015. The photo was edited using the program Darktable.

   To edit the image, first extra space on each side was cropped out. Then the black relative exposure was set to -2.99 EV. The global chroma was increased 24.30% and then the sharpness was adjusted. Within the sharpness category, the Radius was increased from 2.000 to 4.335, the Amount was increased from .5 to .86 and the

Threshold was decreased from .5 to 0.0 leading to the final image. The final image dimensions were 2586x1910. The original and edited images are shown below.





5. Conclusion

While very simple the experiment was an overall success. The visualization of shear-thickening was clearly demonstrated and effectively captured. To improve this experiment I would suggest studying how the fluid reacts to differet frequencies of sound, possibly observing it on a speaker. This could have also been improved through the use of high speed video. This could have more effectively shown the difference between when the fluid is under high amounts of stress vs when it has settled again.

6. References

[1] *Shear thickening*. Shear Thickening - an overview | ScienceDirect Topics. (n.d.). https://www.sciencedirect.com/topics/engineering/shear-thickening

[2] Steele-Cornell, B. (2024, January 9). *The weird science behind oobleck (water + cornstarch)*. Futurity. https://www.futurity.org/oobleck-cornstarch-1057042-2/