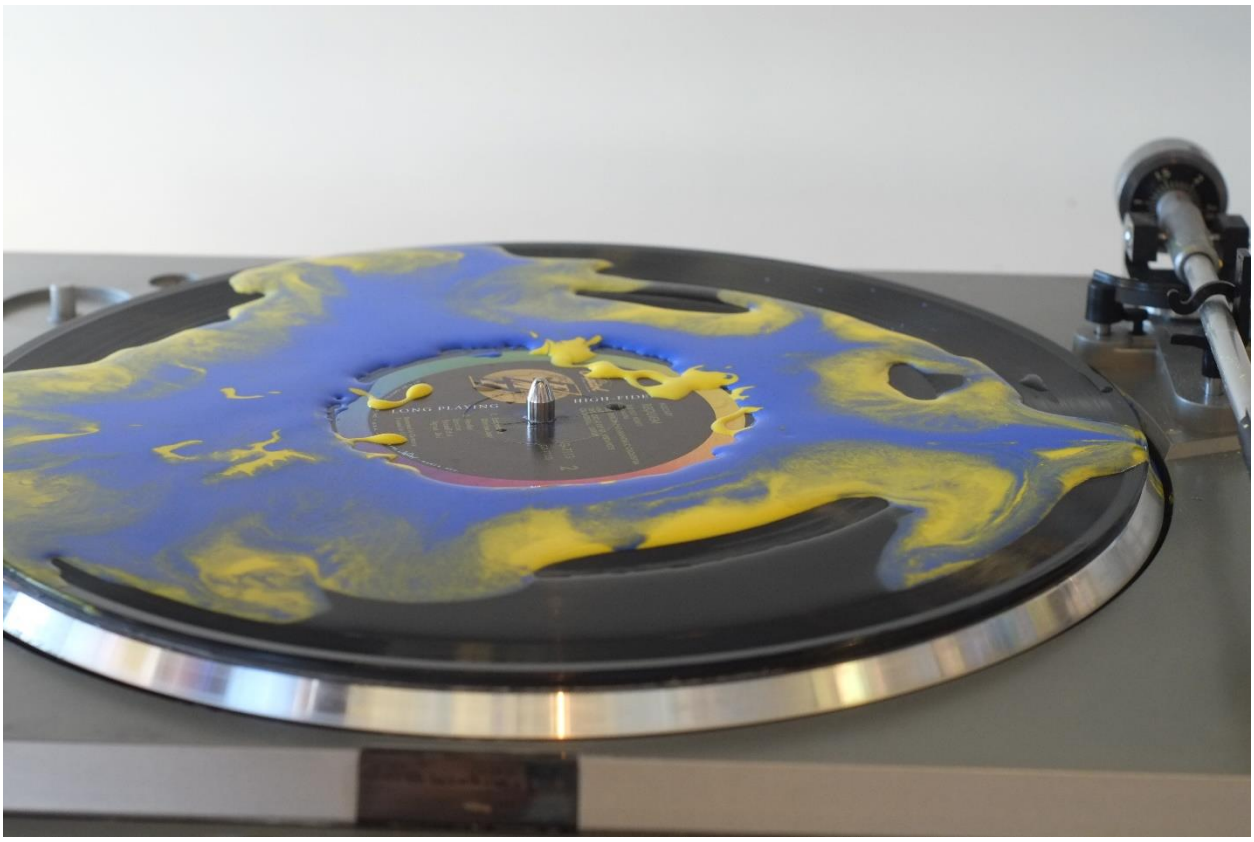

Team First Report

Brandon Toves

Flow Visualization: 4151-4200-001

Intro

The image depicted below displays yellow and blue oobleck poured and mixed after being rotated on a turntable. The purpose of the image was to reveal the different features of flow phenomenon within fluid dynamics. This report outlines the different phenomenon that may have occurred to create the observed fluid flow. Figure 1 shows the point at which the turntable was stopped, and is the final edited version that was submitted.

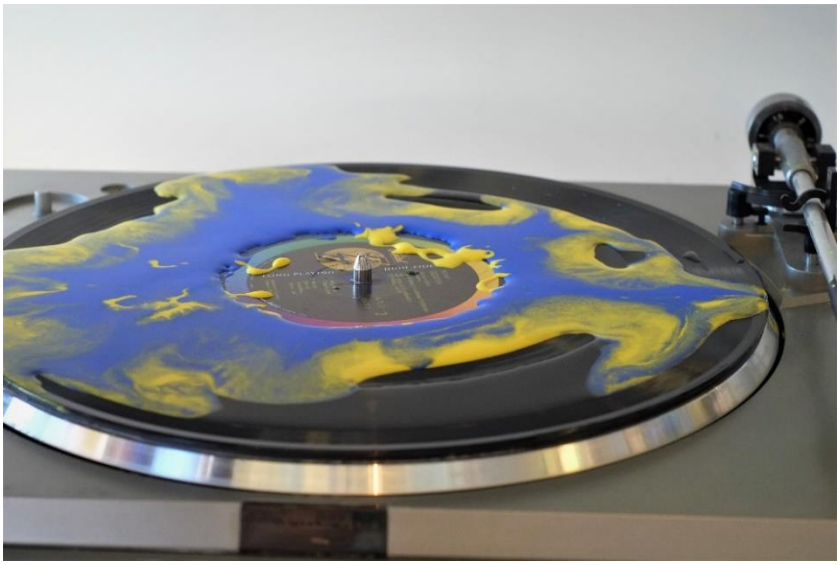

Figure 1: Trial 4 of mixing oobleck on a rotating turntable

Set Up

The materials needed were water, mixing cups, a stirrer, cornstarch, blue and yellow artist paint, a tripod, several cameras, and a turntable. The experiment occurred in the ITLL in a well-lit space on the top floor. Natural sunlight lit the room, coming from the left of the image in figure 1. A white expo board was used to provide the white background and reflect the light, creating a less distracting back drop.

Several cameras were used to record and capture the experiment as it was performed. A Nikon camera was mounted on a tripod and placed in front of the set-up, angled downward for recording. This camera had a set focal length zoom, and focus, and continuously recorded. A Canon camera was held by one person standing above the set-up, capturing downward shots of the experiment. Several Iphones captured different angles of the experiment.

Figure 2: Blue oobleck mix being poured during the last trial run

Experiment

The experiment was performed several times. Different consistencies were tested to create different oobleck density concentrations. We found that putting 4 parts water to one part cornstarch and then mixed with artist paint created the result we were aiming for. These mixtures were stirred equally to ensure that the oobleck did not solidify. The turntable had different speeds, ranging from 15 to 45 rotations per minute. We found that the mixture created the best images when rotated at the mid speed, or 30 rotations per minute. A layer of water was added, before oobleck was added, to ensure that the mixtures would maintain a viscosity that would still allow mixing to occur.

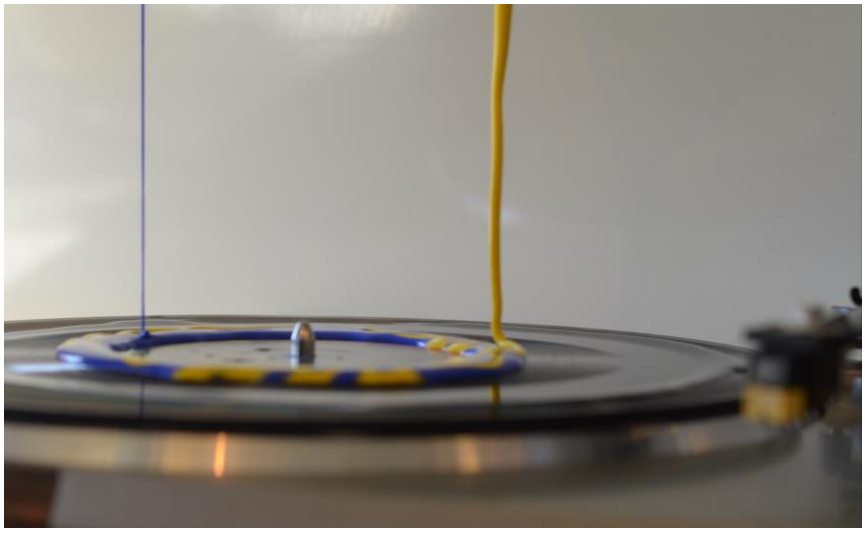

Figure 3: Steady pours of both oobleck mixtures

When all members were set up with cameras, two members both synchronized pouring in the same spot, from identical heights, attempting equal pour rates. Although each mixture had equal composition, the pour rates varied as seen above in figure 5. The mixtures were poured until the

turntable displaced the fluids to the edges. The experiment was forced to stop once the fluid reached the edges, otherwise the oobleck would seep into the edges of the turntable, destroying the equipment.

Flow

Oobleck has interesting flow characteristics. The non-Newtonian fluid solidifies as more friction occurs (i.e. stirring). This means that as the fluid is poured onto the turntable, the rotation inhibits the solidification of the mixtures. The frictional force slams particles together, and their rough surfaces prevent slipping of particles, forming long chain of the shear-thickening fluid (Collins).

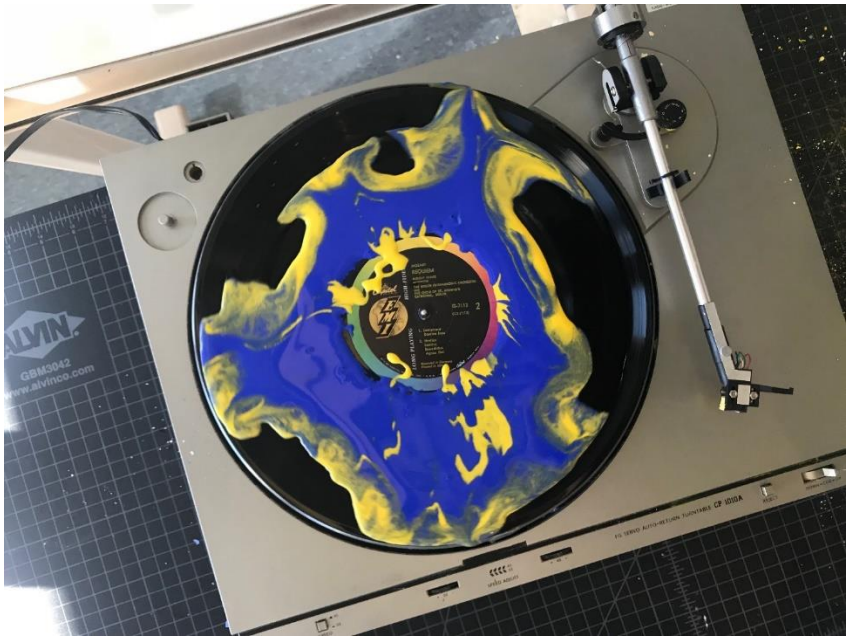

Figure 4: Overhead shot at the end of trial 4.

Post-Processing

The image I selected was captured at the end of trial 4. I believe that this showed the best representation of the fluid phenomenom we intended to capture. It was framed well, and focused in at the center, where clearly the oobleck had solidified, which still exhibiting how the fluid continued being a liquid in other regions of the record. I edited the brightness and contrast to better enhance the colors and the state of each part of the oobleck.

Conclusion

I learned a lot from the experiment about the characteristics of oobleck and how this additional frictional force causes the shear-thickening fluid to solidify. The team contributed immensely in framing the image and in setting up / cleaning up the experiment with each trial. Collectively, I believe the images we captured really represent the effort put in the project, as well as the flow phenomenon we wanted to create.

Sources:

Collins, Nathan. “Friction Makes Cornstarch and Water into Bizarre "Oobleck".” Scientific American, 1 Feb. 2014, www.scientificamerican.com/article/friction-makes-cornstarch-and-water-into-bizarre-oobleck/.