

Report #2 – Team First Assignment Fall 2018

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MCEN 4151-001: Flow Visualization

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ABSTRACT

The Team First assignment provided an opportunity for students to meet and work with their newly formed teams in MCEN 4151-004: Flow Visualization. Team 5 set out to capture photographs of the Worthington Jet phenomena, by timely splashing water drops into a rectangular container of water. The setup to achieve the photographs in this report was made possible by the detailed instructions done by Kyle Walters and Kyle Hollis, the creators Project SplashDrop, and students of an independent study class taught by Professor Jean Hertzberg.

The phenomena studied in this report, the Worthington Jet, occurs when a water droplet hits a flat pane of liquid. Initially the droplet spreads through the surface but also retract and rebound, producing all sorts of different effects like crown splashes, deposition, or rebound.

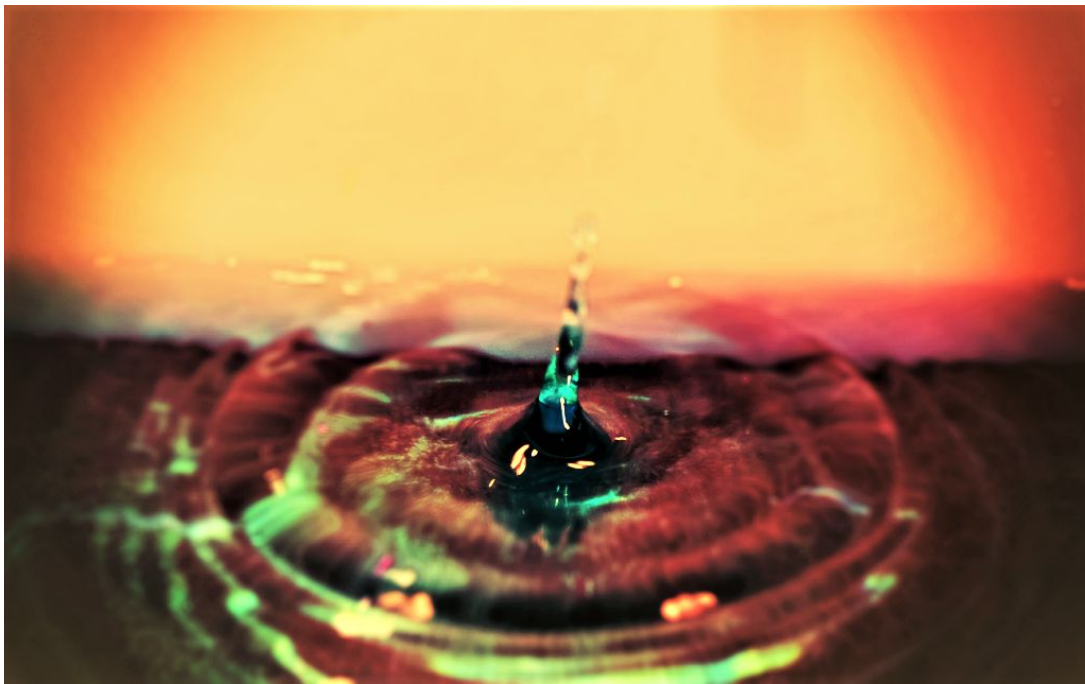


Figure 1: A drop of blue dye impacting a rectangular container of water, using the drop-collision apparatus provided by Professor Jean Hertzberg.

FLOW APPARATUS

To setup the Droplet Splash System, an instructional video was viewed by Team 5, provided in the Quick Start Guide documentation in Project SplashDrop. The materials within the guide and used to produce our image are as follows:

- Dedicated Nikon Camera and its batteries
- Two flash diffusers and their respective flash lamps
- Seven frames making up the structure
- Three valves for the liquid
- Rectangular basin to store a solid surface of water
- Cables to hook up to the project hardware box
- Tools to tighten the connections
- Several different colored backgrounds for different visual effects

The procedure to set up the system are as follows:

1. Frame 1 and 3 connected to frames 2 and 4, which are the frames with the feet.
2. Frames 5 and 6 connected in between the already assembled frame connections,
3. Frame 7 connected to the top.
4. Fill the rectangular basin with water until it is more than halfway full under the structure.
5. Place a backslash plate perpendicular to the basin
6. Flash lamps angled at 45 degrees at the corners of the rectangular basin
7. Hook up the cables to the camera and project hardware box.
8. Download the dropControllerBT app to be able to time the droplets.
9. Fill the valve with your dyed liquid and droplets can be timed for photographing.

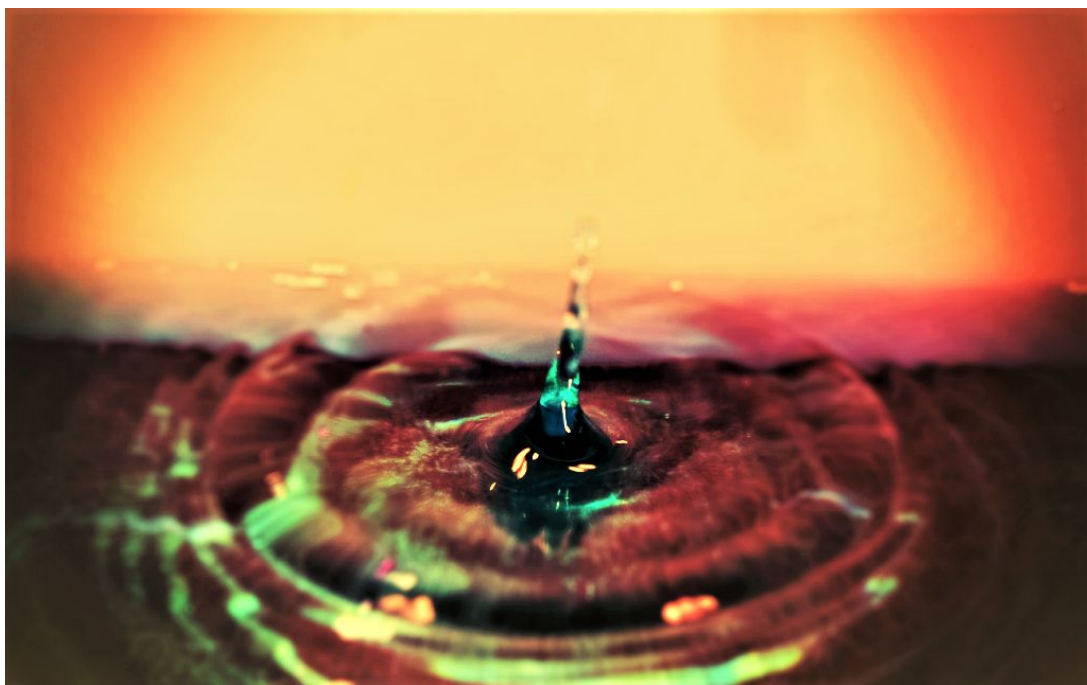
VISUALIZATION TECHNIQUE

Team 5 was unable to setup the dedicated Nikon Camera with the provided cables to the project hardware box. Therefore, a camera from team member Wenjin Li was used to capture pictures of deposition, one of the effects of the Worthington Jet phenomena. The camera used was a Sony A7 III. It was angled slightly at 15 degrees and positioned about a foot away from

the droplet. The droplet was still timed with the app and continuous snapshots were made to capture the collision with the water. The shutter speed was set to 1/160s, F5.6, and IOS1600. The unedited raw photo is provided below:



Figure 2: Comparison between unedited (above) and edited version of the photo



CONCLUSION

This image, figure 2, reveals the differences done by post processing, bringing the beauty in the Worthington Jet phenomena. Deposition is being shown here as the drop spreads across the surface and is attached throughout the whole impact without breaking, showing a very low velocity and smooth surface ripples. Post-processing was done through Gimp and further in the Photos editor on a standard HP laptop with Windows 10.