Team Second 2026

By Elijah Jones, Collaborating with Alex Knight



Introduction

For our group's team second we decided to create a water maze and then film the flow passing through it. We had seen some videos of people doing something similar and thought it would be a fun experience and produce some interesting videos. Initially the plan was for each of us to make our own maze out of acrylic cut with the laser cutter in the ITLL. However life got in the way for me and I wasn't able to design and fabricate my own in time. Alex was kind enough to let me use his maze for the project. I didn't want to just do the same thing as Alex though so I decided to film it at a higher frame rate and closer up then slow it down. This made the final product distinct in some interesting ways.

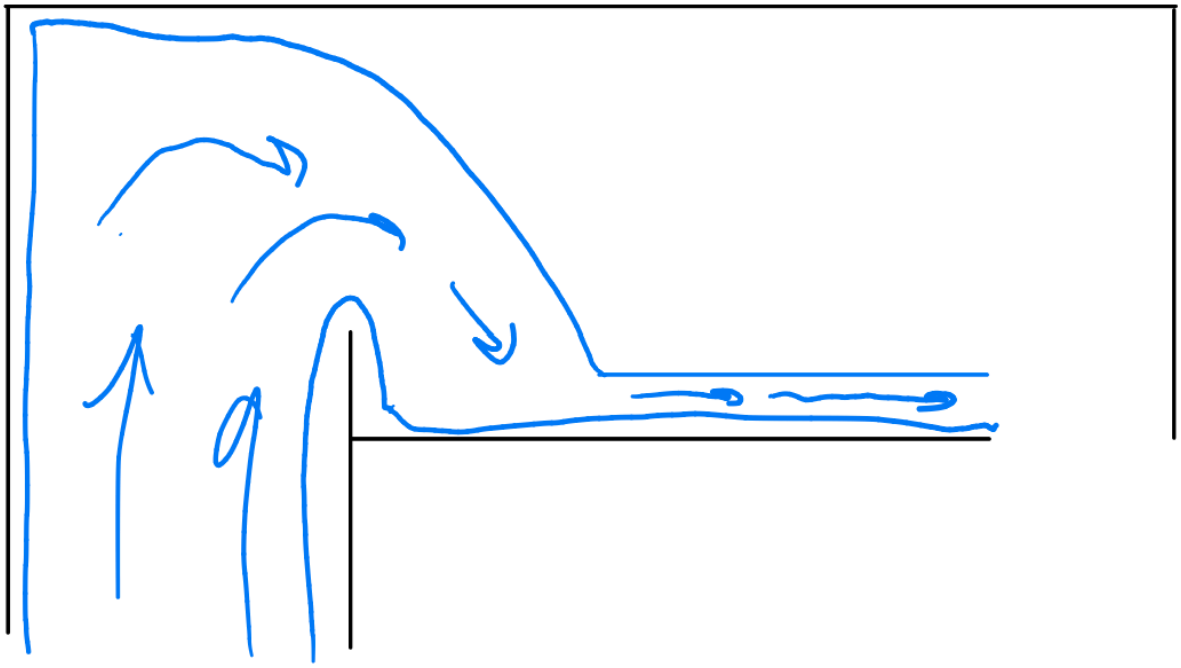
Process

I taped the maze to the wall of my apartment on top of a large black popcorn bowl. This ensured that it would stay upright during the filming process and that none of the water would spill out over the floor and make a mess. I cut a gallon bag and taped it to the inside of the top of the maze to provide a larger opening for me to pour the water into. I set up the camera on a tripod about seven feet away from the maze. This was partly because it had to be on the far end of the kitchen table but it also ensured that the camera would not get wet or damaged if something bad happened with the maze. Finally I used a large measuring cup to pour about a liter of water into the maze through the bag at the top.

The water poured straight into the first opening of the maze but quickly began to fill up the top as the flow rate through the rest of the maze was too slow to account for the amount of water being poured in through the top. This allowed us to observe the more interesting parts of the flow as it became mostly driven by the water pressure in the upper chamber. It can be seen in the flow that the speed of the flow would often cause air pockets to be preserved as the water cascaded over corners and ledges. In one area on the left hand side of the maze the water is forced up a column and almost completely jumps over the middle chamber beginning to fill the left hand chamber. There is almost a rolling wave effect as some of the water drops into the middle and some rolls over the top. As the middle fills there remains a pocket of air present under the roll that is eventually filled with water as the middle chamber fills completely. The air trapped there can be seen rotating with the flow and cascading over the edge of the left most chamber.

In addition to that in the left chamber after the middle chamber is filled the water doesn't just drop down and begin to fill it. It travels across the empty space until it hits the wall then flows down it. It's like a bridge is formed there. Perhaps that pocket of air has nowhere to go so it holds its shape. Preventing the water from entering that space. However as the water runs out the bridge loses its shape and collapses. The Left chamber is never completely filled.

Another very interesting phenomenon present is the way the water builds up in front of a small wall at the bottom of the maze then cascades over it. This is something that can be seen in rivers all the time when a rock is placed in the flow but it is neat to see side on.



This happens as the flow separates because of the wall in the way. It also became smaller and faster because of the laws of conservation and Bernoulli's equation. Where the flow ahead of the wall is 1 and the flow past the wall is 2.

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$$

Photographing and Post Processing

I chose to video the whole process rather than photograph it because I thought it would be more interesting to see. I used a Canon EOS 80D Set on a tripod about four feet off the ground and angled slightly down so that it was seeing the maze head on from seven feet away. I used a 50 mm lens with a 1.8 aperture. I used a manual focus before recording to make sure that it was focused on the maze and would produce a clear image. I shot it at 60 frames per second because that is the highest the camera can handle. In the post I cropped down the image so that it focused on the maze by itself as much as I could. I also had to cut down the length of the video to cut out the parts where I walked to the maze and back to the camera. I slowed the frame rate down by half to 30 frames per second to achieve the best slow motion I could while preserving the smoothness of the footage. Finally I color shifted the entire thing so that the background of the maze was green instead of tan. I think this helped make the flow more visible and the entire video a bit more interesting visually.

Conclusion

I very much enjoyed the process of making this piece. I wish I had had the time to make my own maze but I am very grateful to Alex for letting me use his for my video. I think if I were to do this again I would make my own and try to get hold of a high speed camera. I think it would be interesting to focus very closely on some of the specific phenomena present as the water flows through the maze. All in all though the maze did a great job of showing a variety of fluid flow situations in interesting ways. Everything from how it moves through different spaces at different speeds to how surface tension and trapped air can create some interesting flows.

Sources

Jobson, H. E., & Froehlich, D. C. (1988). Basic hydraulic principles of open-channel flow (U.S. Geological Survey Open-File Report 88-707). U.S. Geological Survey. https://doi.org/10.3133/ofr88707