

Elemental - Fireshop floodwater FX

AMIT BAADKAR, Pixar Animation Studios, USA

In Disney and Pixar's *Elemental*, I was tasked with developing and executing flood water effects for the fireshop flooding sequence. The effect starts out as water spray emitting from gaps in the door and then grows in intensity as it breaks through the doors and windows with stronger force. This starts to flood the the fireshop and puts the main character Ember, who is made of fire in great peril. The characters eventually end up trapped inside a small reading room with water spouts spraying in from debris blocking the entrance. During the initial stages , we reviewed the storyboards, concept art and the layout staging and decided to group the shots in to 3 sections. The first part involved all shots with the water spouts spraying from the doorway. We created a sequence level effects simulation for the majority of the shots in this group. When the flooding got stronger and more turbulent, we decided to make a multishot Houdini rig to tackle these group of shots. For the water spouts in the reading room, we created sequence level effects simulation similiar to the door spray water. While crafting the effect we made sure to make the flooding feel progressively more and more turbulent and dangerous during the first 2 sections. During this time, we also identified dependencies with character/set animation and other effects like floating props and destruction effects.

ACM Reference Format:

Amit Baadkar. 2024. Elemental - Fireshop floodwater FX. In *SIGGRAPH Talks*. ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/nnnnnnn.nnnnnnn>

1 DOOR WATER SPRAY



Fig. 1. Renders of door spray shots. ©Disney/Pixar

The water spray simulation was created using Houdini Flip. Particle emitters were placed around the door frame with noised layered emission velocities and deformations to create the pressurized spray dynamics of the water. We had to ensure that the water spouts dont spray on Ember and pointed the sprays outwards towards the sides of the door.

Additionally there was also the water flowing on the floor slowly making its way to the blue flame. During our intial tests the water particles would break apart into smaller shapes and slide erratically across the surface. By adding some friction to the floor collision object we were able to get the water simulation to behave more naturally. We also found that simulation got very slow and heavy as the floor water would would get further away from the door. We created a second water simulation that emitted from the floor and combined it with the main water spray simulation. We generated about 1000 frames of the water effect and populated it in all the shots as needed with the appropriate

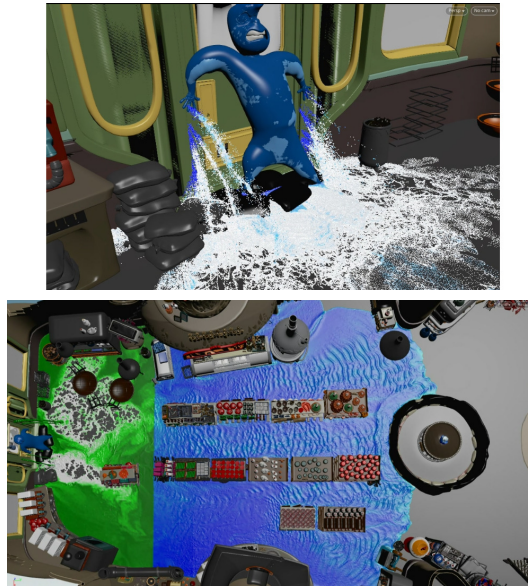


Fig. 2. Spray particles and floor water sections. ©Pixar

timing offsets. Some of the shots required animated set/character interaction and we simulated these effects with the appropriate collision objects from the shot context.

2 MAIN FIRESHOP FLOODING

During this part, the flood water gushes in vigorously from various windows and doors. For developing the look and the rig, we relied heavily on our Houdini multishot workflow. This allowed us to create shot overrides and test the rig on multiple shots without having to switch between different Houdini files. Amongst the many shot overrides for each shot, the three main properties that changed from shot to shot were the simulation bounds, water level and the sourcing of the flood water. We allowed custom spaces within the rig to manually handcraft these aspects. The flood water simulation was a layered effect and mainly consisted of 3 parts:

- Primary water: To create this element we first created a water tank with initial noised velocities to add some turbulence. Additional particle emitters were placed in doors and windows for the water entering from outside. The turbulent gushing dynamics of the water was achieved with noisy layered emission velocities and deformations in the particle emitters. For shots that needed the water level to visibly rise, we animated the ground collision upwards.
- Secondary splashes and foam : The secondary splashes and foam were created in a single simulation. We used the primary water surface and sourced from areas of high vorticity and velocity. At every timestep the particles were projected upwards to the water surface where they would be advected with velocities from the water surface. Additionally we injected repellent particles in the simulation which added velocities to the foam particles to shape them into stylized shapes. The splashes were rendered as polygons on top of the primary water surface and the foam on the surface was rendered as volumes as interior and global volume aggregates to create the white water look. We clustered these simulations to get higher detail and resolution.

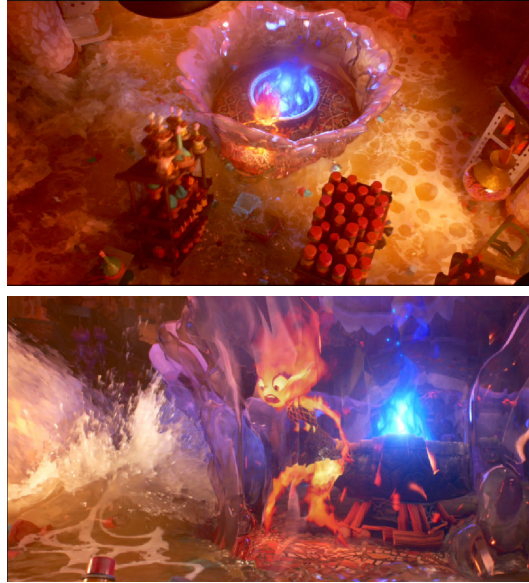


Fig. 3. Turbulent fireshop flooding. ©Disney/Pixar

- Underwater aeration : The underwater aeration was created using Houdini pyro simulation . We used the primary water simulation particles and sourced from areas of high vorticity and velocity. The velocity data from the primary simulation was used to advect the gas simulation . The aeration volumes were rendered as interior volume aggregates.

The water surface, velocity vdfs and particles were packed and published as bgeo assets for use by effects artists working on simulating floating objects and destruction effects.

3 READING ROOM WATER SPOUTS

During this part the main characters are trapped in the reading room as the water from the outside are making their way into the room from gaps in the debris blocking the room. The water spouts are similar to the door spouts and used a lot of the same techniques. The water spouts were strategically placed to make sure they don't obscure the main characters from different camera angles. We needed to reposition the spouts in some of the shots to match with Ember's hand position as she melts the debris to block the spouts.



Fig. 4. Drawovers for water spouts position and render. ©Disney/Pixar