Caustics

* Waves in water result in the refracted and reflected light bending in different angles and producing patterns on the surfaces under and near water.
* The patterns are created by regions where more light rays intersect.
* This is called caustics.
* Caustics can also occur when light passes through other materials as well such as curved glass.

How are they simulated

* Rasterization works but from one point of view (nvidia video)
* Ray tracing can be done for real-time but needs some short cuts
* Commonly an animated texture in videogames
  + Does not preserve realistic looking shadows
* Splatting (nvidia video)
* Most common: approximate intersections of rays on surface
* Vertex connection and merging (chaos blog)
  + Very slow
  + Over samples rays
  + Combines photon mapping and BDPT
* Corona (chaos blog)
  + Reverse path tracing and phton mapping
  + Cheaper than VCM

Math behind how the code simulates them

* Path/ray tracing
  + Follow rays sent out from pixels and compute pixel color based on what ray hits and reflects and refracts from
* When rays go through water, they refract at different angles (snell’s law)
  + When water surface is disturbed, more rays focus on some spots for lighter spot and some areas are not very focused darker spots

Notes:

* Code uses r, g, b to access components of vectors instead of x, y, z
* Look at environment shader for caustic info
  + Shaded color = underwater color \* computed light intensity
  + Light intensity is computed from caustic information calculated in [different file]
* Shadow mapping used for shadow computations
* Raycater is used to determine where mouse hits
* Caustic is calculated and stored as a texture
* Sides of bowl emulate reflection by using the environment as its texture.
* Fresnel equation used to shade water (and also glass)

Things I changed

-adding bowl

-use LatheGeometry to create a ‘bowl’ looking geometry

let points = [new THREE.Vector2(0,0), new THREE.Vector2(-1,-0.5),

              new THREE.Vector2(-2,3.5), new THREE.Vector2(-1.9,5),

              new THREE.Vector2(-1.5,5.5), new THREE.Vector2(-1.8,5.5),

              new THREE.Vector2(-1.8,6), new THREE.Vector2(-2,7)];

const bowlGeometry = new THREE.LatheGeometry(points);

bowlGeometry.computeVertexNormals();

bowlGeometry.scale(.25,.25,.25);

bowlGeometry.translate(0,-1,0);

bowlGeometry.rotateX(Math.PI/2)

Sources:

<https://en.wikipedia.org/wiki/Caustic_(optics)>

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nvidia building skybox from

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