ANITA BORG INSTITUTE
GRACE HOPPER CELEBRATION
OF WOMEN IN COMPUTING

2013

ANITA BORG INSTITUTE
WOMEN TRANSFORMING TECHNOLOGY

Association for Computing Machinery

#GHC13

Teapots Can Fly

3D Graphics for Web Programmers

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So…

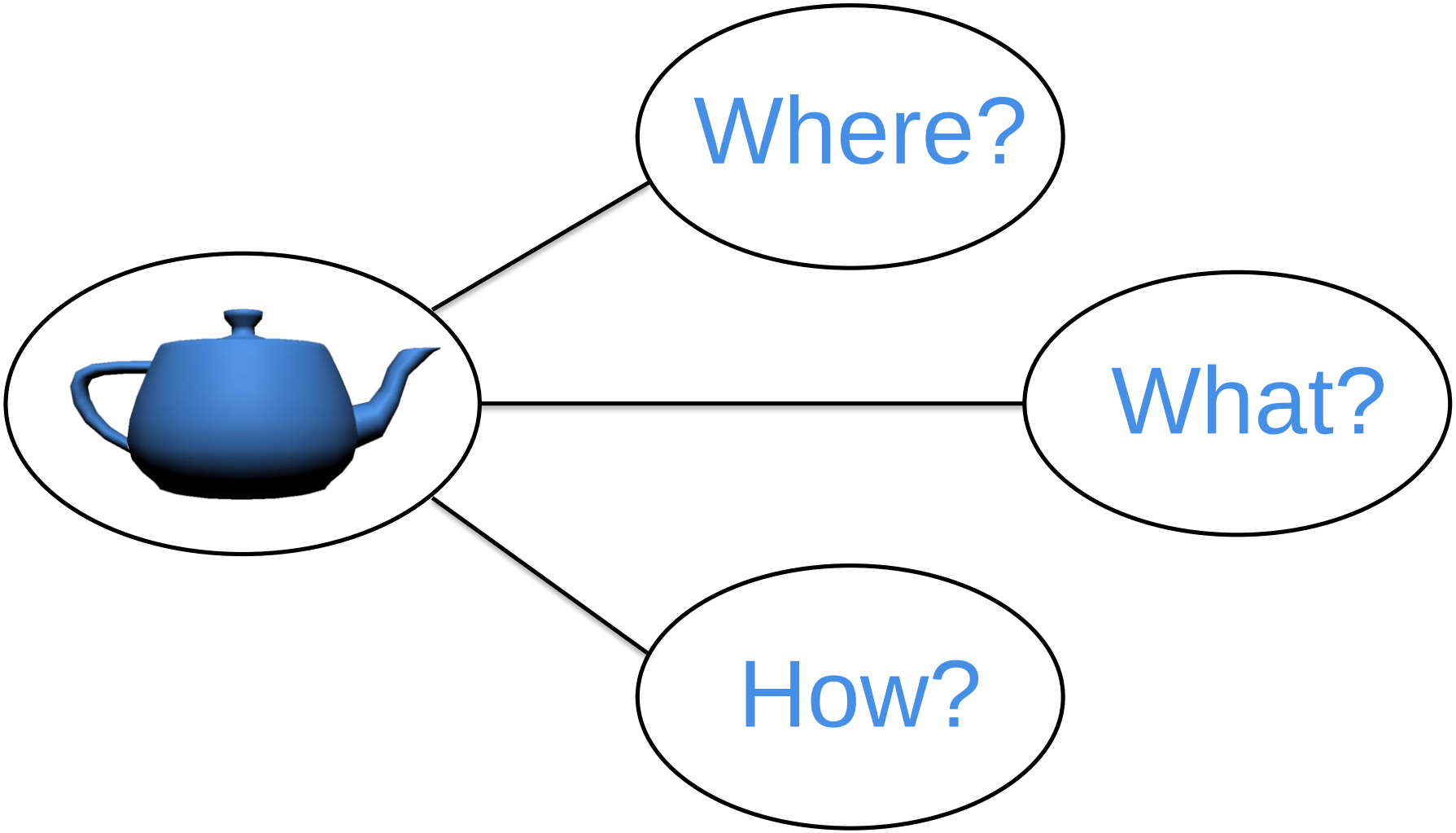
How does 3D Animation Work?

3D animation is like Claymation

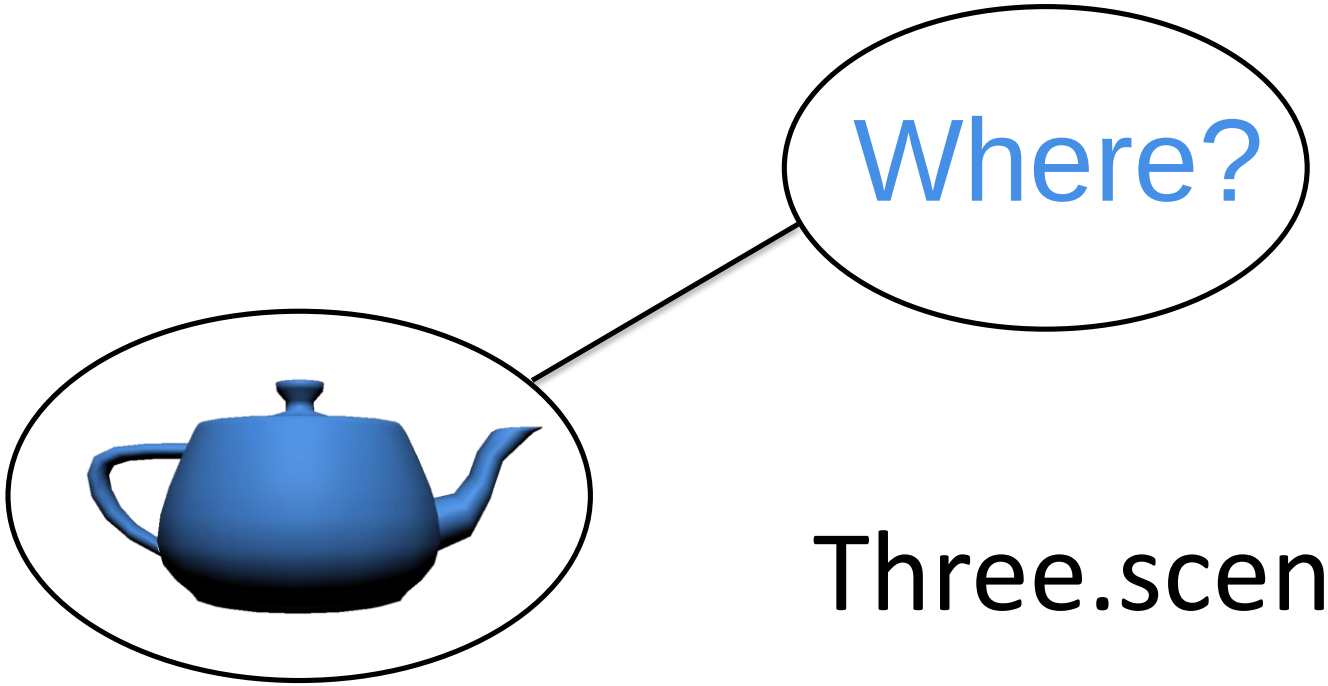
We’re building

Our own little world

Three orienting questions



Three orienting questions



Three.scene

Three.PerspectiveCamera

Three orienting questions

Three.Mesh

Three.PointLight

Three orienting questions

requestAnimationFrame()

Affine transformations: translate, rotate, scale

How?

What do we need?

- three.js
- teapot.js
- An html5 page

To get it all:

https://github.com/shegeek/teapots_can_fly

clone or download zip

The basic setup

```
<head>
    <title>Teapots can fly!<title>
    <style>canvas { width: 100%;
        Height: 100% }
    </style>
</head>
```

The basic setup

```
<body>
    <script src="three.min.js">
    </script>
    <script>
        ** Our Stuff Goes Here! **
    </script>
</body>
```

The last setup step

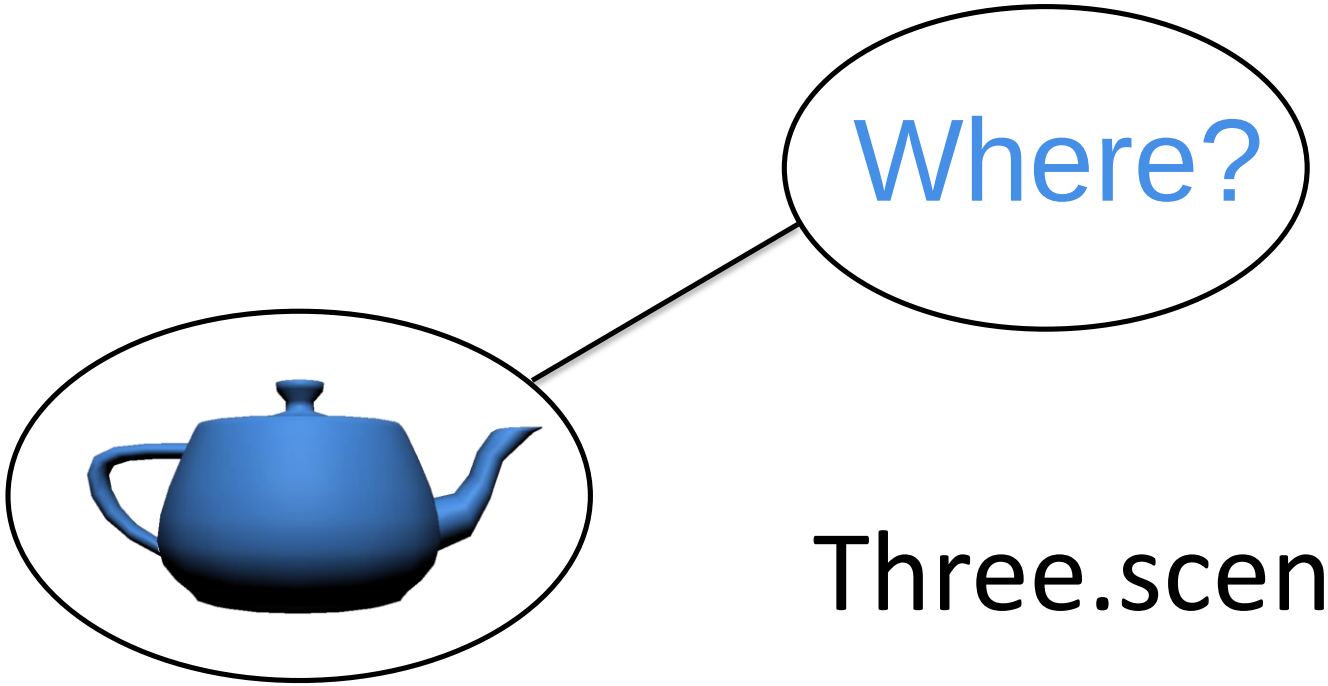
```
<script>
    var renderer = new THREE.WebGLRenderer();

    renderer.setSize(window.innerWidth,
                     window.innerHeight);

    document.body.appendChild
                     (renderer.domElement);
</script>
```

And now,
the
3D code!

Three orienting questions



Three.scene

Three.PerspectiveCamera

The diorama

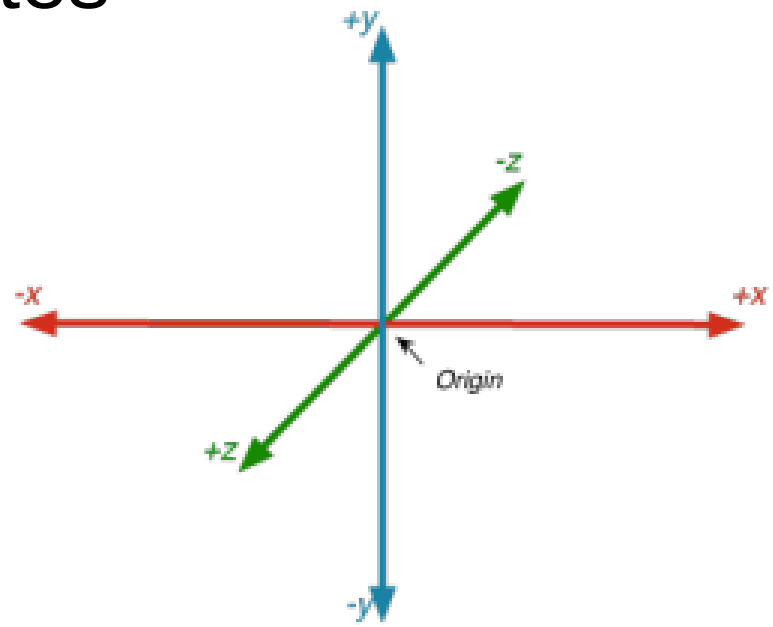
```
var scene = new THREE.Scene();
```

The Camera

```
var camera = new
THREE.PerspectiveCamera(
   35,
   window.innerWidth/window.innerHeight,
   0.1, 1000);
camera.position.z = 50;
```

The coordinate system

- Right-handed coordinates
- Positive X to the right
- Positive Z coming out of the screen



Three orienting questions

Three.Mesh

Three.PointLight

The teapot

```
var teapot;

var jsonLoader = new
    THREE.JSONLoader();

jsonLoader.load( "teapot.js", createTeapot);
```

The teapot's callback

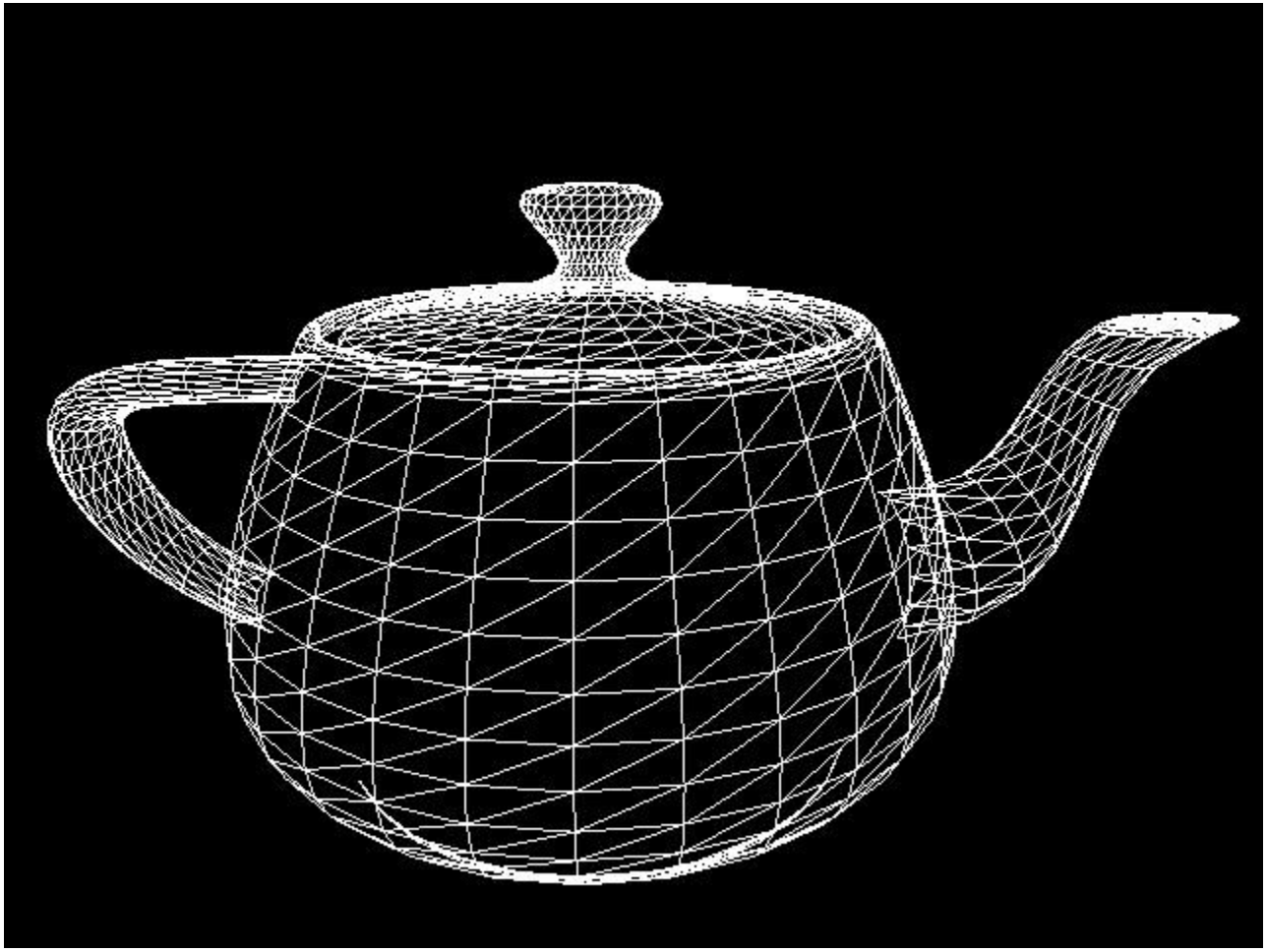
```
function createTeapot(tGeometry){
    var tMaterial = new
            THREE.MeshPhongMaterial({color: 0x00ffff});
    var tMesh = new
             THREE.Mesh(tGeometry, tMaterial);
    scene.add(tMesh);
    teapot = tMesh;
}
```

A closer look…

```
new THREE.Mesh( tGeometry, tMaterial );
```

A mesh has two parts

A geometry is like bones



A material is like skin

The teapot's callback

```
function createTeapot(tGeometry){
    var tMaterial = new
            THREE.MeshPhongMaterial({color: 0x00ffff});
    var tMesh = new
             THREE.Mesh(tGeometry, tMaterial);
    scene.add(tMesh);
    teapot = tMesh;
}
```

Let there be light!

```
var light = new THREE.PointLight(0xffffff);

light.position.set(0,150,150);

scene.add(light);
```

Three orienting questions

requestAnimationFrame()

Affine transformations:
translate, rotate, scale

How?

Making the teapot move

```
teapot.position.x += 0.1;

if (teapot.position.x > halfScreenWidth)
    teapot.position.x = -halfScreenWidth;
```

Rendering the frame

```
renderer.render(scene, camera);
```

Setting up the next frame

```
requestAnimationFrame(render);
```

The complete render loop

```
var halfScreenWidth = 80;
var render = function () {
if (teapot) {
    teapot.position.x += 0.1;
    if (teapot.position.x > halfScreenWidth)
        teapot.position.x = -halfScreenWidth;
    renderer.render(scene, camera);
    }
    requestAnimationFrame(render);
};
render();
```

…And once again, the repo:

https://github.com/shegeek/teapots_can_fly

Enjoy! Make cool stuff!

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Got Feedback?

★ Rate and Review the session using the GHC Mobile App

To download visit www.gracehopper.org

Resources and links

- three.js repo: https://github.com/mrdoob/three.js
- three.js home page: http://threejs.org/
- Stemkoski's examples: http://stemkoski.github.io/Three.js/index.html
- *WebGL Up and Running* (by Tony Parisi): http://shop.oreilly.com/product/0636920024729.do
- Learning Three.js blog: http://learningthreejs.com/

Resources and links

- three.js boilerplate builder:

  http://jeromeetienne.github.io/threejsboilerplatebuilder/

- *An Introduction to Web GL:*

  http://dev.opera.com/articles/view/an-introduction-towebgl/

- Tutorials on the LearningWebGL blog:

  http://learningwebgl.com/blog/?page_id=1217

- WebGL 1.0 spec: http://www.khronos.org/webgl/

Image credits

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  gumbyworld.com
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- Coordinate axes image courtesy of
  http://www.cocos2d-x.org/
- Teapot wireframe image courtesy of
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- Saran Wrap man image courtesy of
  funnyordie.com

Teapots Can Fly

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