Script 02

- Instantiating primitive models.
- Illumination and shadows.
- Animation.
- Perspective camera vs orthographic camera
- Window resizing

1.1 Instantiating primitive models

Open the file **threejs_ex_02_01.html**

Analyze the **init()** function:

- How many **models** are defined in the scene?

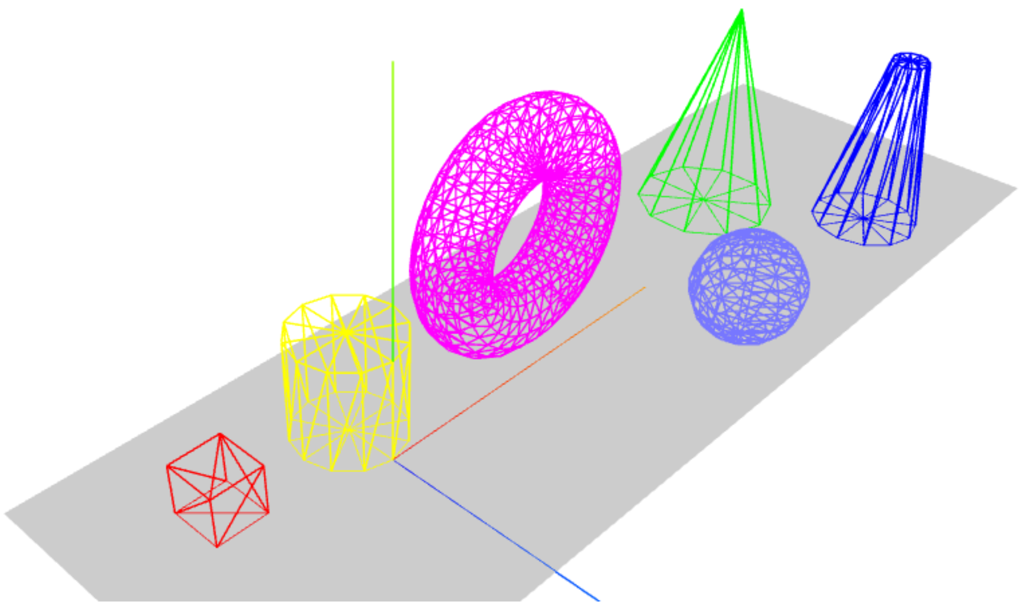
- Where are they placed? Are any **rotations** applied? Why?

- How is the **camera** looking at the scene?

Tasks:

- Check the **code comments** and carry out the **suggested tasks**.

- Add **four models** to the scene – with appropriate features – to obtain the scene displayed below.



1.2 Illumination and Shadows

Simple illumination effects are easily obtained by **adding a spotlight** to the scene, assigning proper **materials** to the models, and **enabling the rendering of shadows**.

Tasks:

- Disable the **wireframe** rendering mode. Add a **spotlight** to the scene, placed **at (-40, 60, -10)**. Do you notice any **differences**? Why?

- Change the material defining the models to **Lambert Material**, which computes shading using the Gouraud model. Which **differences** do you notice?

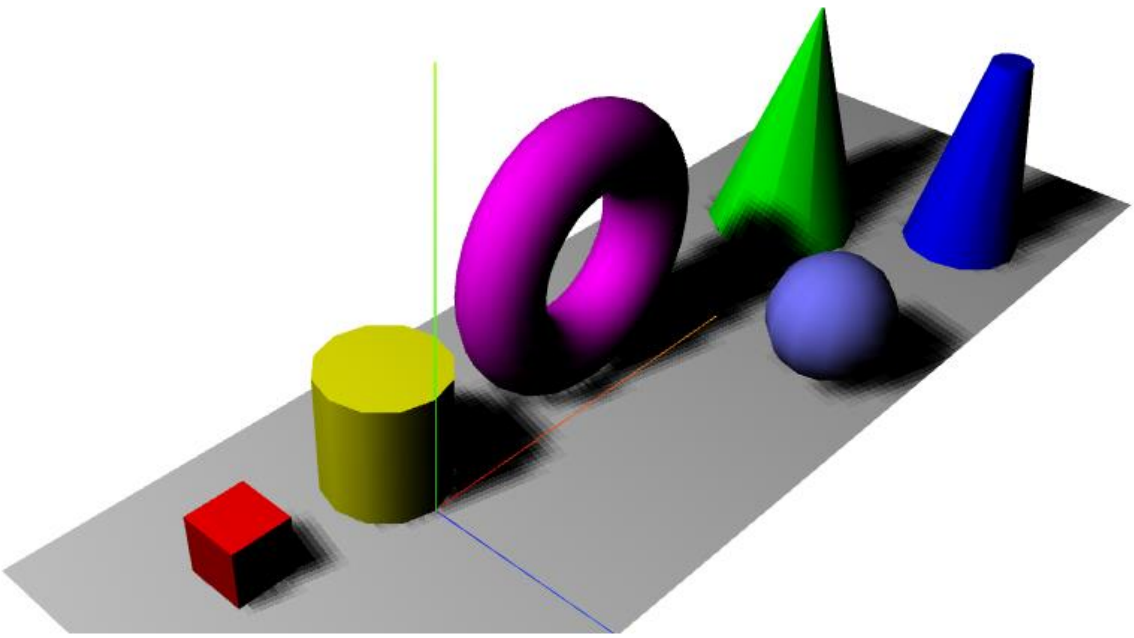
- Enable the rendering of shadows:

```
renderer.shadowMap.enabled = true;
```

- Enable the models to cast shadows on each other and to receive shadows:

```
plane.receiveShadow = true;

cone.castShadow = true;
cone.receiveShadow = true;
```



- Change the material defining the models to **Phong Material**, which computes shading using the Phong model and simulates the reflection of shiny surfaces. Associate **shinier materials** to some of the models.

- Compare side-by-side the results of the Gouraud and the Phong shading models. Do you notice **any differences**?

1.3 Animation

Simple animation effects are easily obtained by **updating model position or rotation angles** just before rendering each frame, and by rendering an appropriate number of frames per second.

Tasks:

- Add the following code at the end of the init() function:

```
var step = 0;
// Update model features and render the scene
renderScene()

function renderScene() {
	// Rotate the cube around its axes
	cube.rotation.x += 0.02;
	cube.rotation.y += 0.02;
	cube.rotation.z += 0.02;

	step += 0.04;
	// Bounce the sphere up and down
	sphere.position.x = 20 + (10 * Math.cos(step));
	sphere.position.y = 3 + (10 * Math.abs(Math.sin(step)));

	// Render using requestAnimationFrame
	requestAnimationFrame(renderScene);
	renderer.render(scene, camera);
}
```

- What happens?

- Add code to **rotate the torus** around its XX axis and to **shuffle the cylinder** back-and-forth in the ZZ direction.

- Add code to **displace the camera** back-and-forth along a given direction.

1.4 Perspective camera vs orthographic camera

There are two different camera types in Three.js: the orthographic camera (at an indefinite distance to the scene) and the perspective camera (at a finite distance to the scene), which produce different final images.

Tasks:

- Change the camera to the Orthographic Camera. Which **differences** do you notice in a **still image** and in an **animation**?

- Compare side-by-side the images produced by the two cameras. Which camera produces **more realistic** images?

1.5 Adding an event listener to handle browser window resizing

Updating the display whenever the browser window is resized can be easily done by registering the corresponding event-handling function:

```
window.addEventListener('resize', onResize, false);
```

In this onResize() function, camera aspect ratio and renderer window size are updated as follows:

```
function onResize() {
        camera.aspect = window.innerWidth / window.innerHeight;
        camera.updateProjectionMatrix();
        renderer.setSize(window.innerWidth, window.innerHeight);
}
```

Tasks:

- Add the event-handling code to your example file.

- Declare the camera and renderer variables as **global variables**.

- Resize the browser window and see what happens.

- Run the example on your **smartphone**!