Computer Graphics

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Scenegraph in Three.js

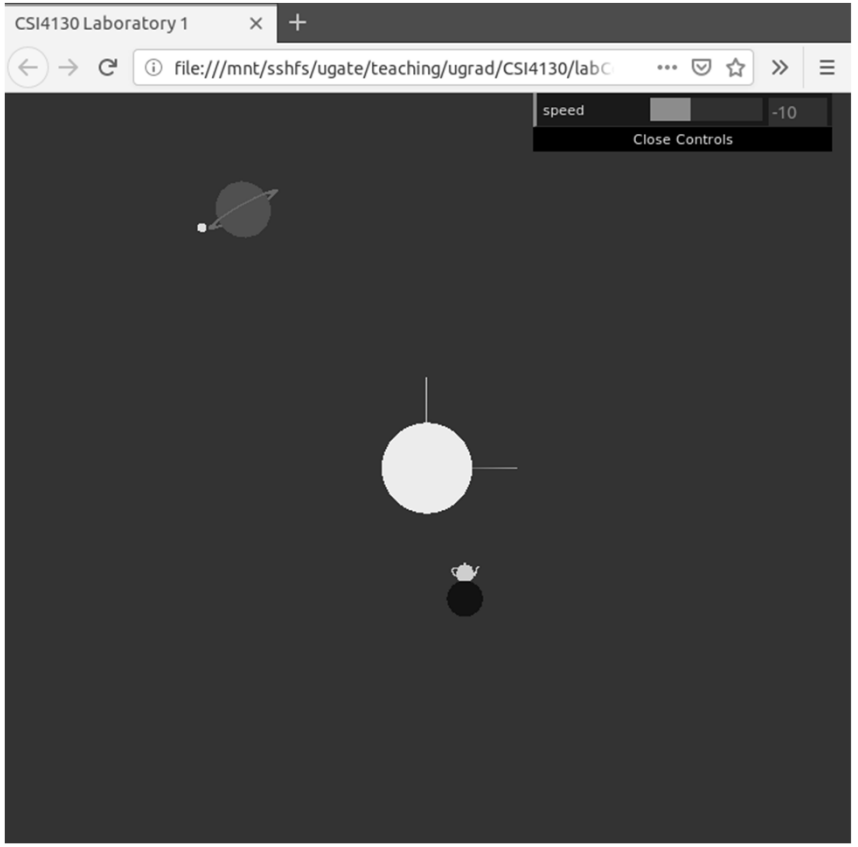
- `THREE.Scene` is organized a scenegraph
- `THREE.Object3D` is the parent class of most 3D objects
  - Each object has a parent field, and a
  - Children field which holds an array of children
  - Note however, the documentation says to use `Object3D` as leave nodes and use `Group` (see below) for building the graph
- `THREE.Group` is a node that serves as a parent for multiple nodes

Scenegraph Transforms in Three.js

- Each object in the scenegraph holds the following transforms
  - `.matrix` Local transform relative to the parent
    - This is the transform that is typically modified
  - `.modelViewMatrix` The model-view matrix for this object in the current image
    - This is needed to draw the object
  - `.matrixWorld` The transform from the object to the root
    - This is an intermediate step for the above
  - `.normalMatrix` The matrix to transform normals by
    - Technically it is the transpose of the inverse of the upper left 3x3 sub-matrix of the model-view matrix as discussed.

Tasks in this Lab

- Run the starter code
- Modify the starter code to create a simple solar system animation



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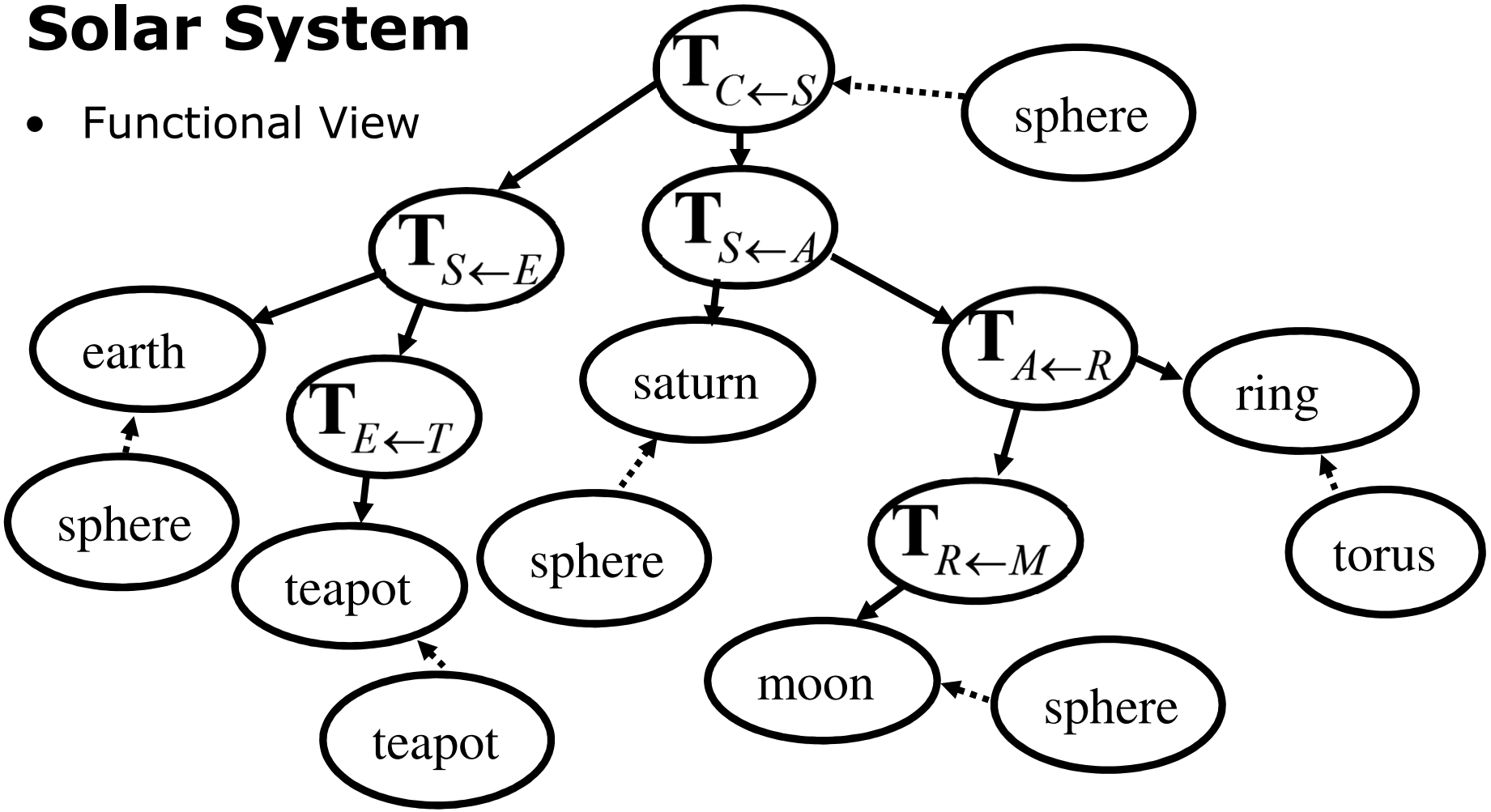
Hierarchical Modelling: Solar System

- Functional View



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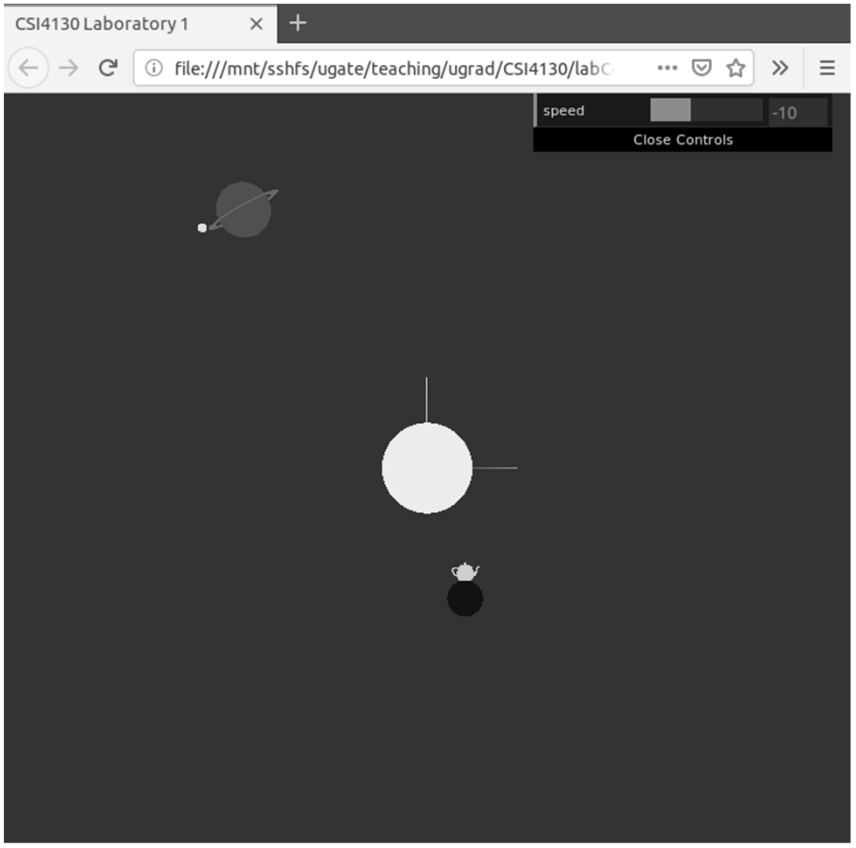
Description and Behaviour

- Earth rotates around the sun
- Teapot is placed on the top of the Earth
- Saturn rotates around sun but 30 deg (around z) offset from earth
- Ring (squished torus) and moon are rotating around Saturn at a "weired" angle
- Moon and ring are offset 15 deg to each other
- Animation is done with the requestAnimationFrame



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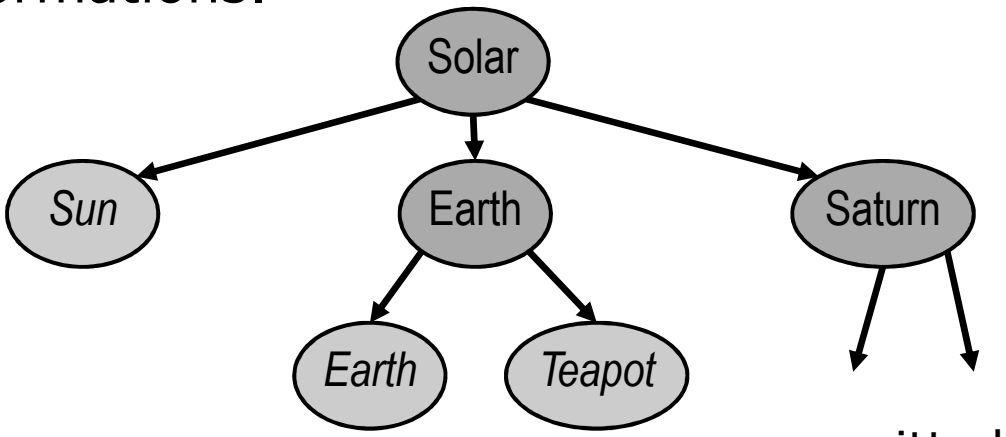
Use of Group

- The use of Group vs Object3D in Three.js will influence our organization. Note both types of nodes hold transformations.



Summary

- Scenegraphs enable hierarchical modelling
- They form the basis for many animations
  - Exceptions are keyframe based animations which are essentially just an image-based technique
- Groups simplify our task by allowing us to apply transforms affecting complete subgraphs

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