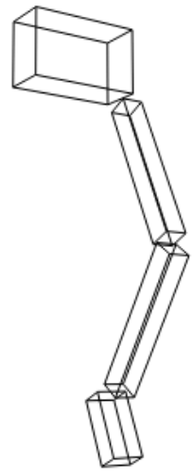
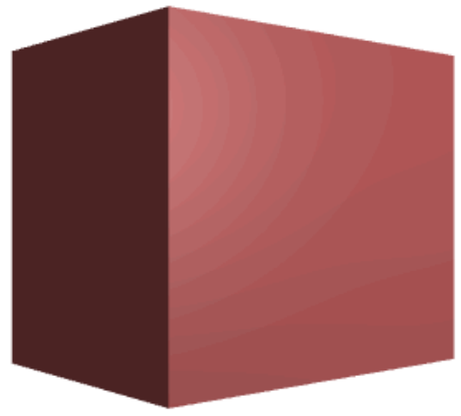
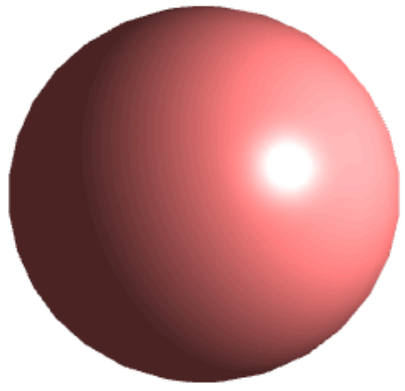






Hip rotation: 32 deg

Hip angle: -25 deg

Knee angle: 59 deg

Ankle angle: 32 deg

Computer Graphics

Lecture 21

Hierarchical Transformations

Scene Graphs

Announcements

- FP: groups by Wednesday, proposals Friday
  - Talk to me about project ideas!
- HW3: due Monday
- A3 out
  - you can do the first several parts now
  - you'll have all the tools by middle of next week.

Loose end

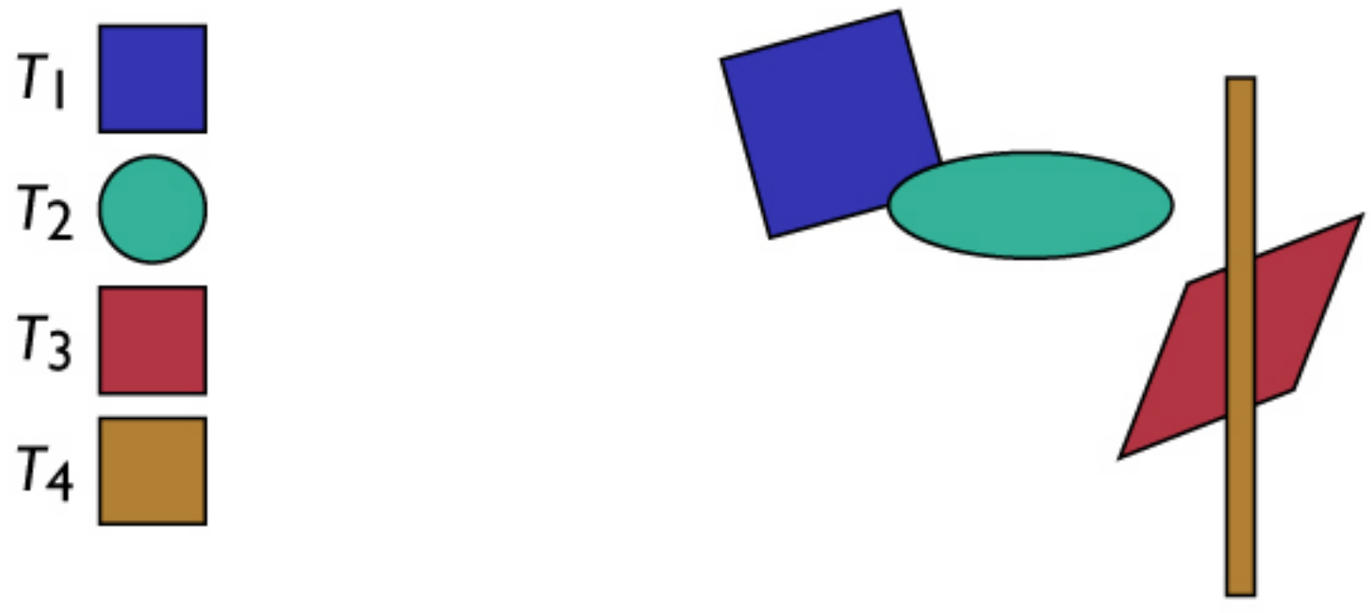
- From last time: projective transformation demo: https://iis.uibk.ac.at/public/piater/courses/demos/homography/homography.xhtml

Goals

- Know how to structure a collection of objects in a scene graph where transformations are applied hierarchically.

Transformation Hierarchies AKA Scene Graphs

- Represent a drawing ("scene") as a list of objects
- Transform for each object
  - can use minimal primitives: ellipse is transformed circle
  - transform applies to points of object



Example

- Can represent drawing with flat list
  - but editing operations require updating many transforms

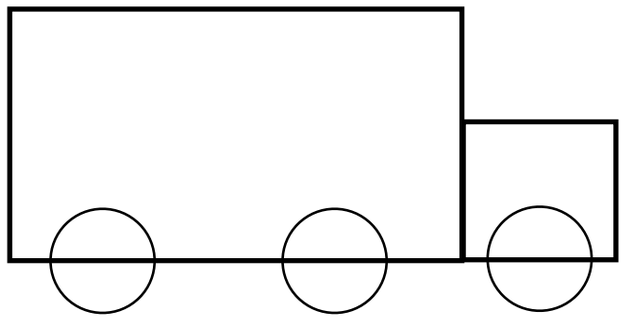
Example

- Can represent drawing with flat list
  - but editing operations require updating many transforms

Groups of objects

- Treat a set of objects as one
- Introduce new object type: group
  - contains list of references to member objects
- This makes the model into a tree
  - interior nodes = groups
  - leaf nodes = objects
  - edges = membership of object in group

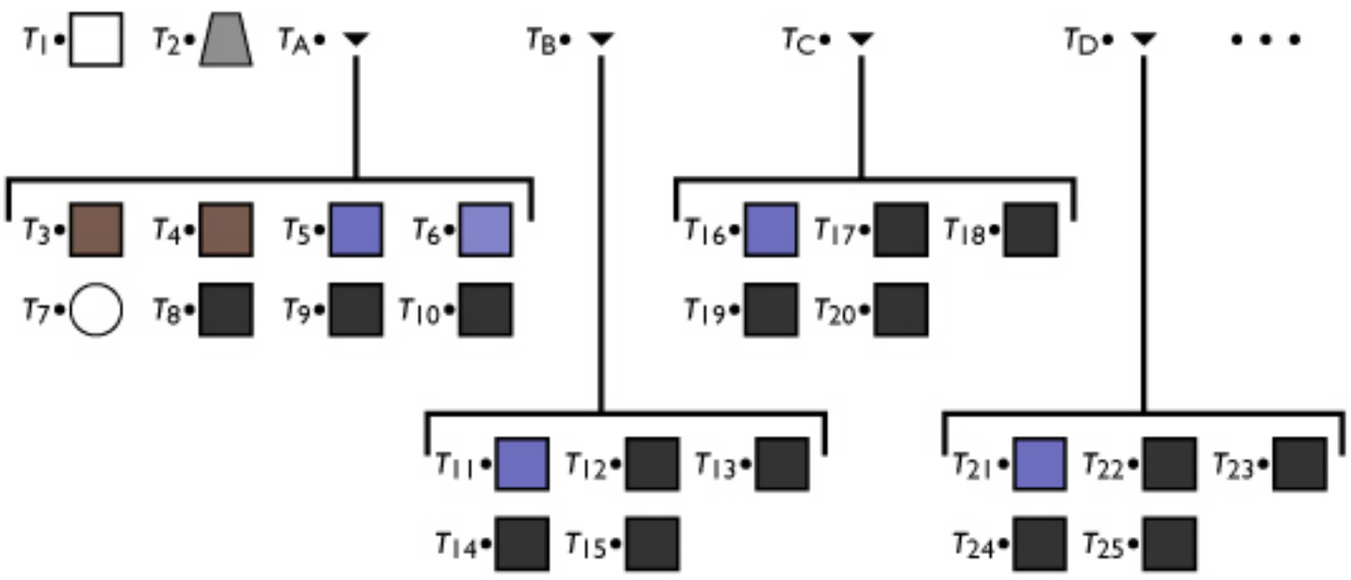
Demo: Drawing in Keynote



vroom!

Example

- Add group as a new object type
  - lets the data structure reflect the drawing structure
  - enables high-level editing by changing just one node



Example

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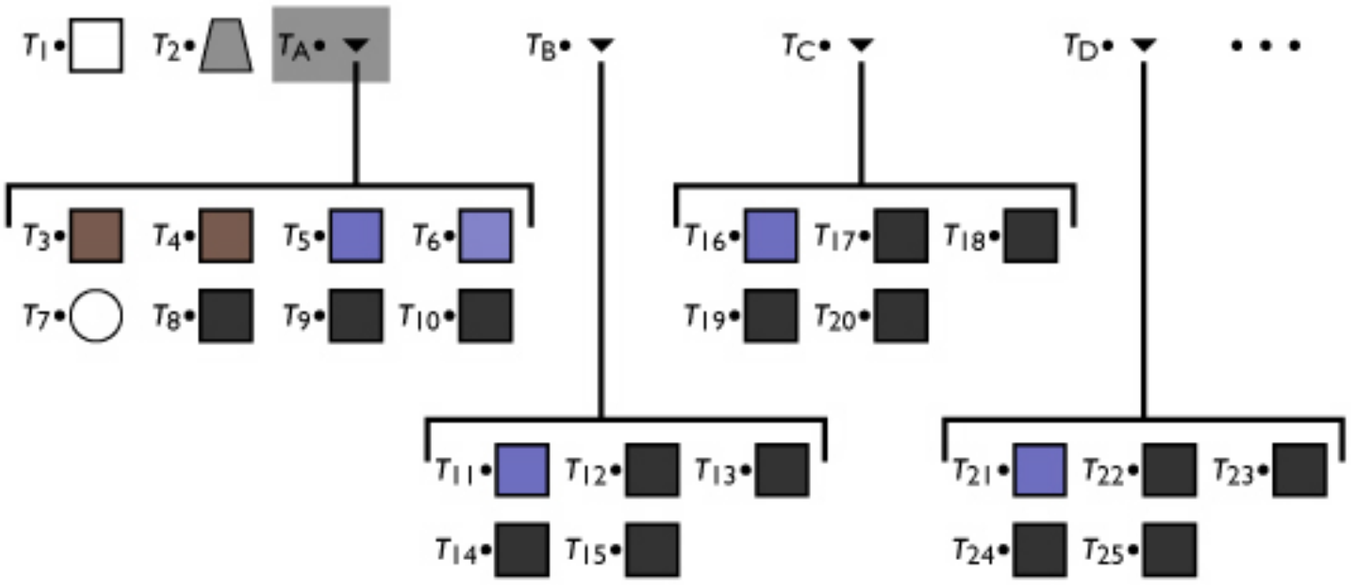
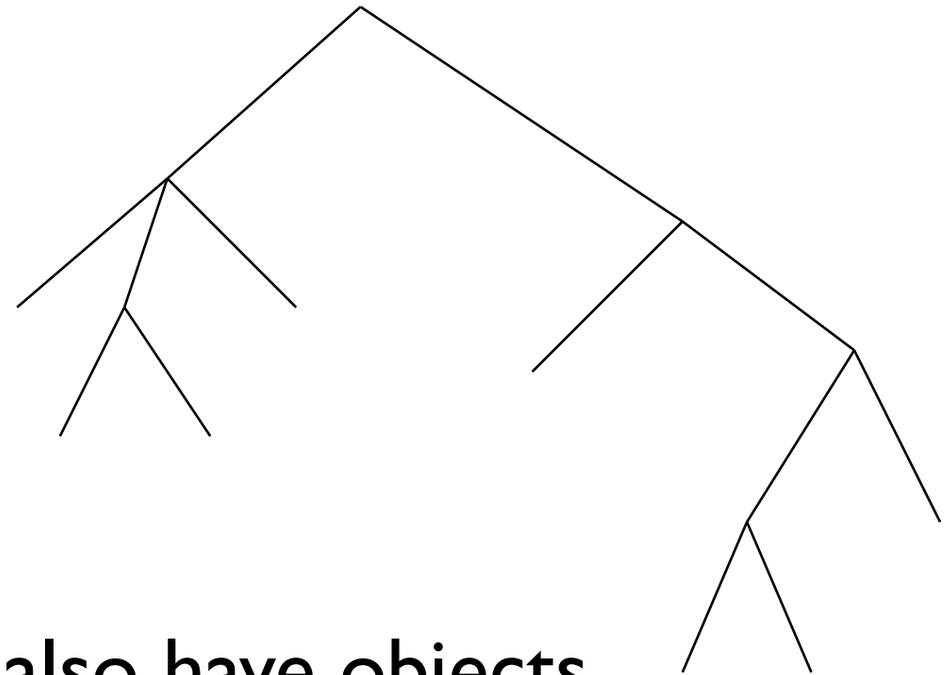


The Scene Graph (tree)

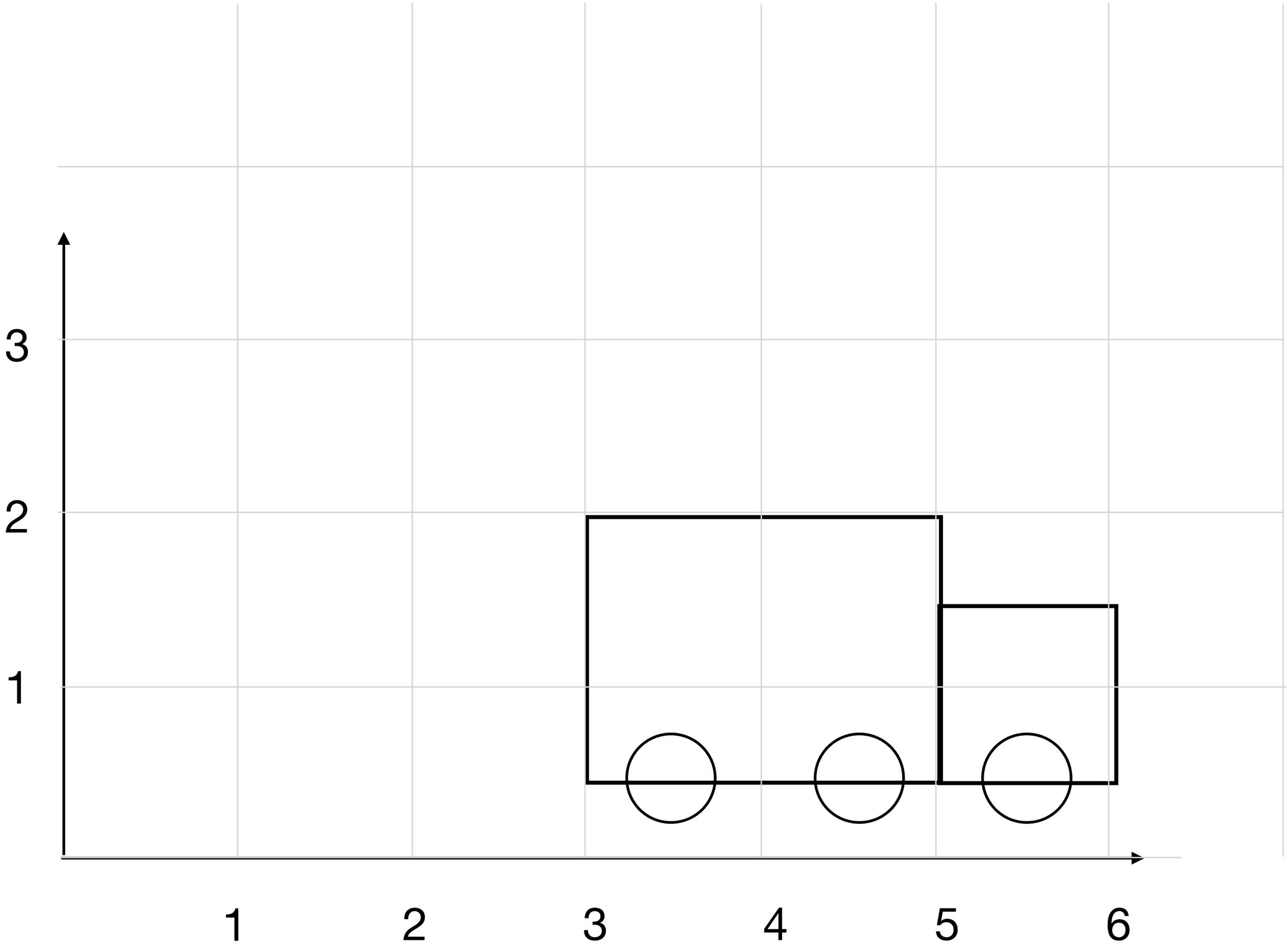
- A name given to various kinds of graph structures (nodes connected together) used to represent scenes
- Simplest form: tree
  - just saw this
  - every node has one parent
  - leaf nodes are identified with objects in the scene



  - alternate design: interior nodes can also have objects

Instances

- Simple idea: allow an object to be a member of more than one group at once
  - transform different in each case
  - leads to linked copies
  - single editing operation changes all instances


3
2
1
1
2
3
4
5
6

Questions?

Questions?

- That wraps up our discussion of transformations.
- We have an (almost) fully-featured wireframe rendering framework.
    - We haven't implemented clipping yet for geometry outside the view volume.
- Next up:
    - more realism: occlusion, shading
    - speed: using hardware