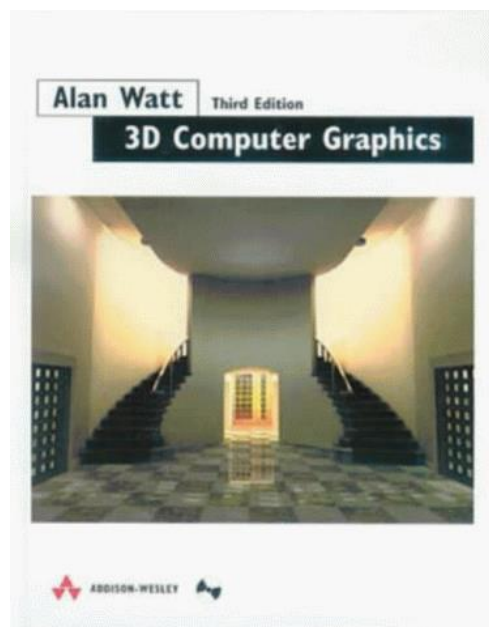




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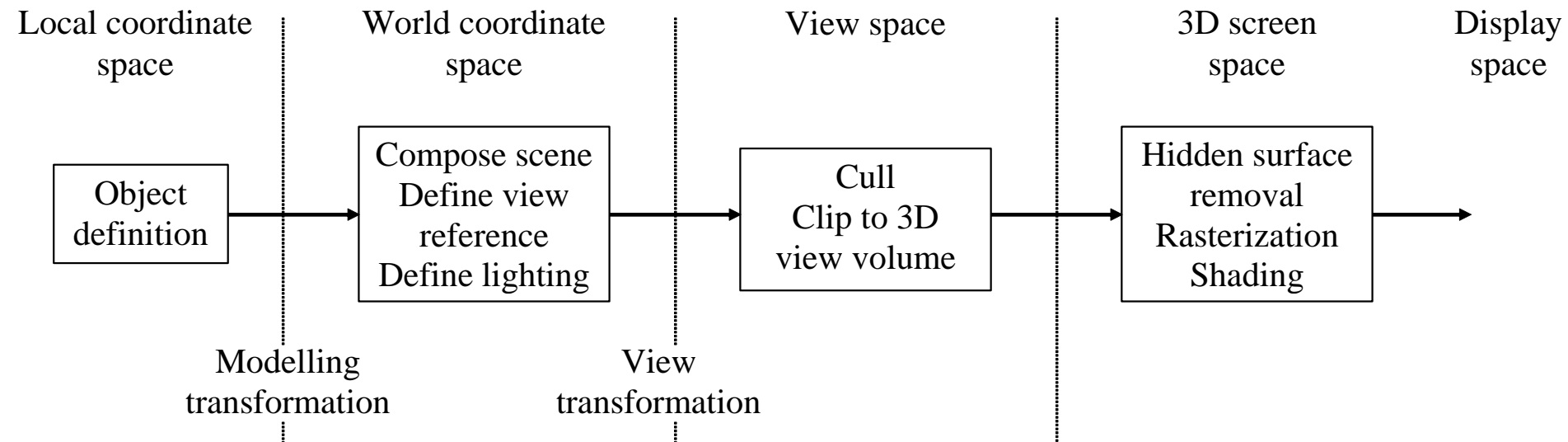
# COM3503/4503/6503: 3D Computer Graphics

## Lecture 20: From local to global illumination



Dr. Steve Maddock  
Room G011, Regent Court  
[s.maddock@sheffield.ac.uk](mailto:s.maddock@sheffield.ac.uk)

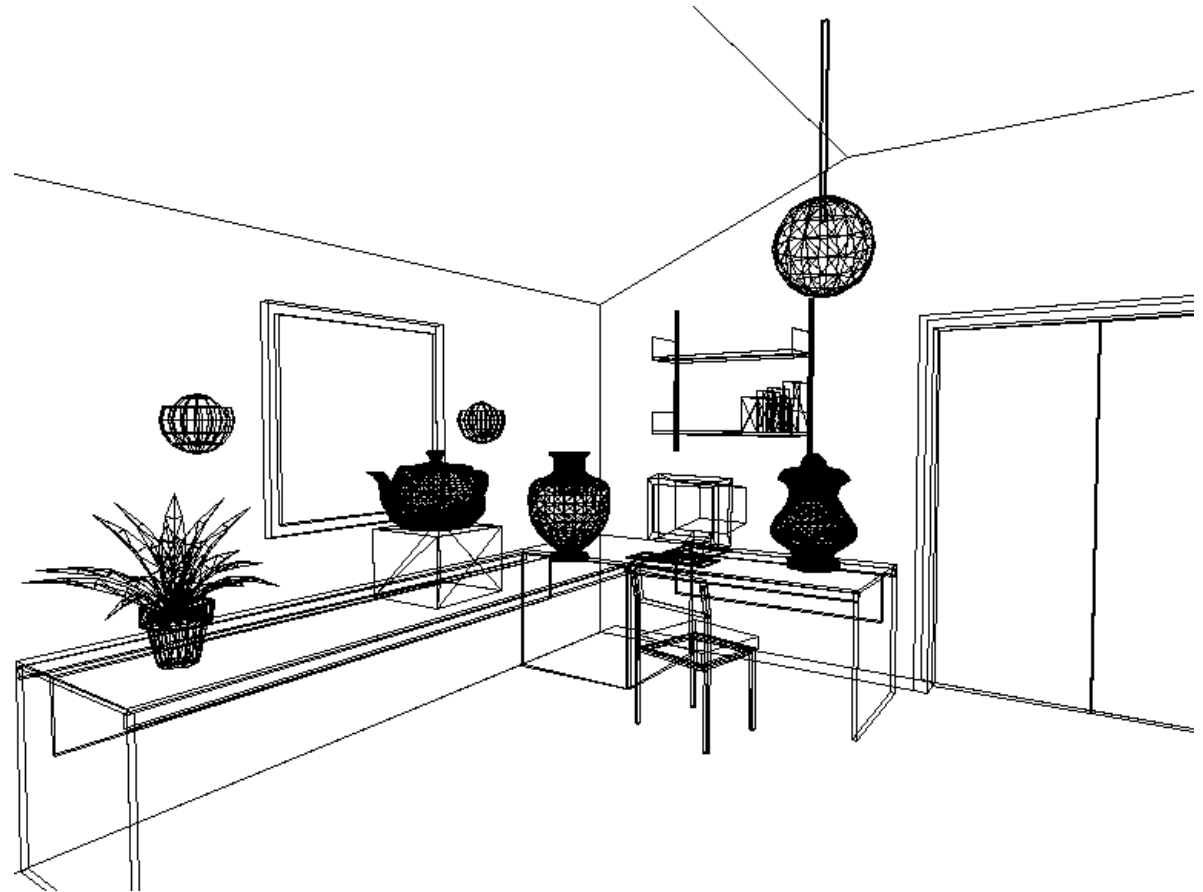
# 1. The graphics pipeline



- We will look at a range of images that illustrate the difference between local and global illumination.
  - Example scene: ~10000 polygons.

## 2. Local reflection models and interpolative shading

- $I = k_a I_a + I_i (k_d (\mathbf{L} \cdot \mathbf{N}) + k_s (\mathbf{N} \cdot \mathbf{H})^n)$
- Wireframe:



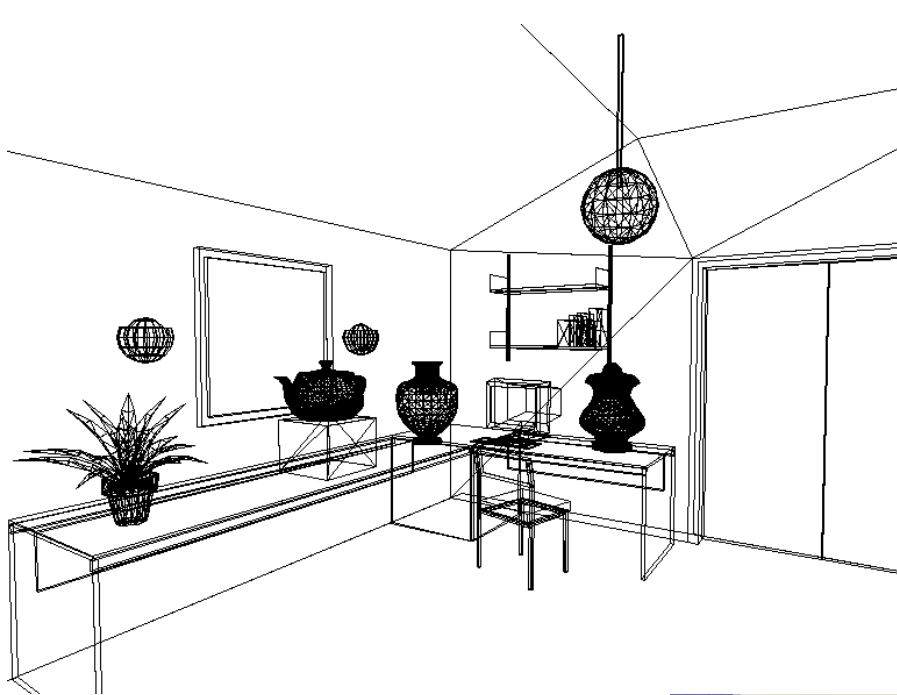
## 2.1 Ambient term only



## 2.2 Flat shading



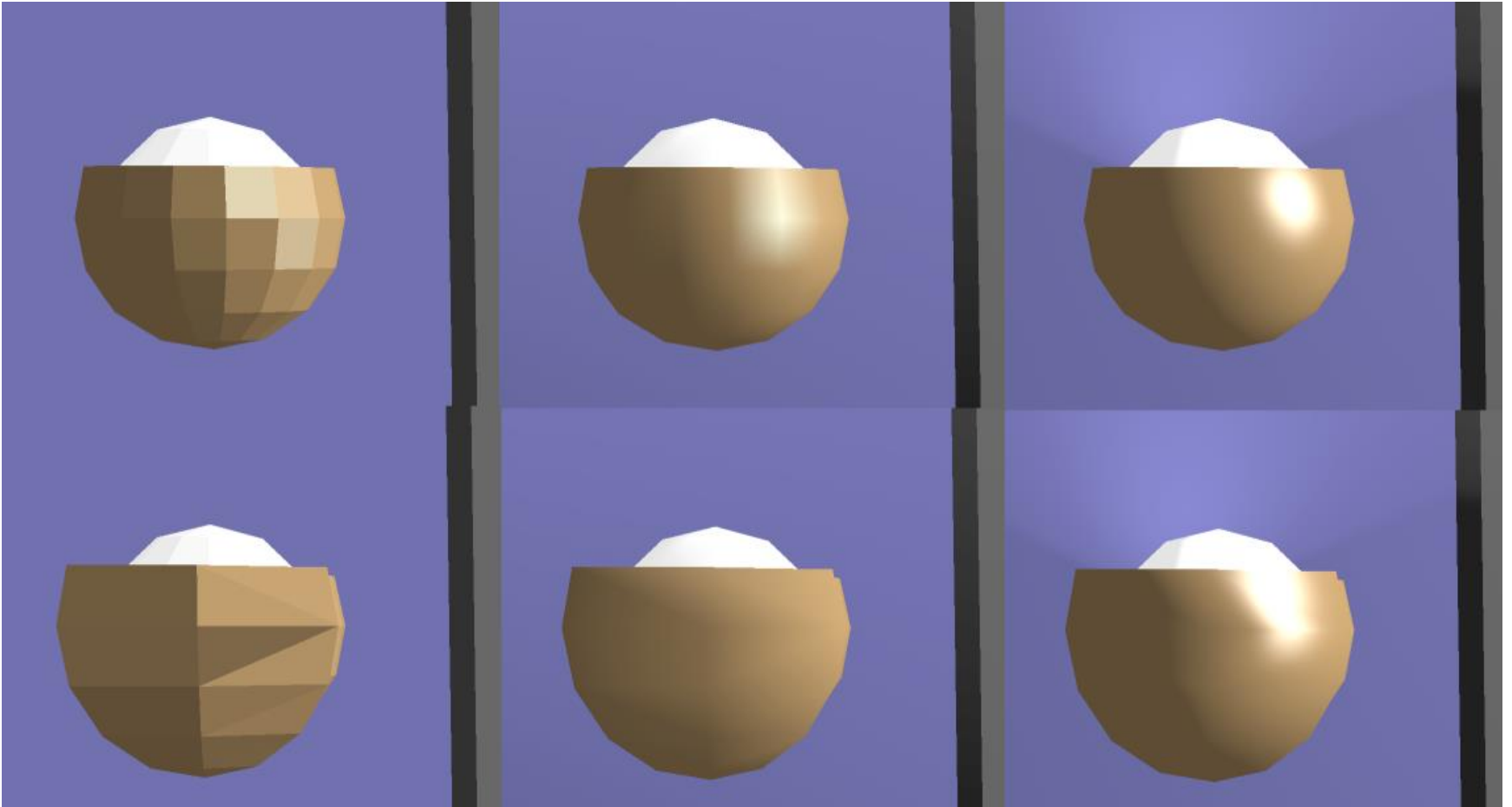
## 2.3 Gouraud interpolative shading – interpolate intensities



## 2.4 Phong interpolative shading – interpolate normals



## 2.5 Comparison





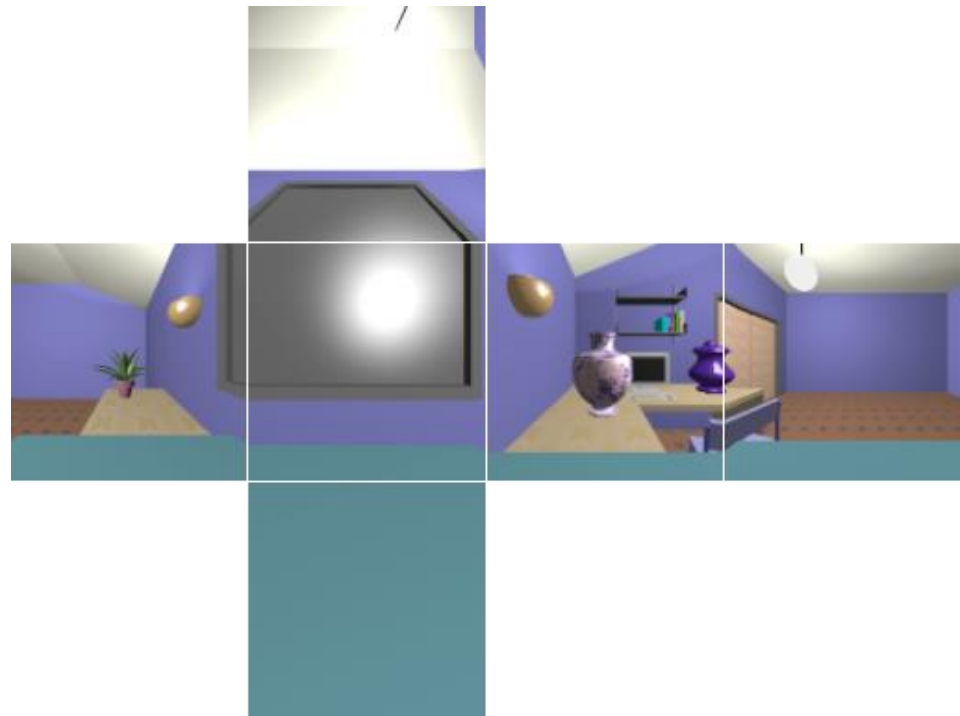
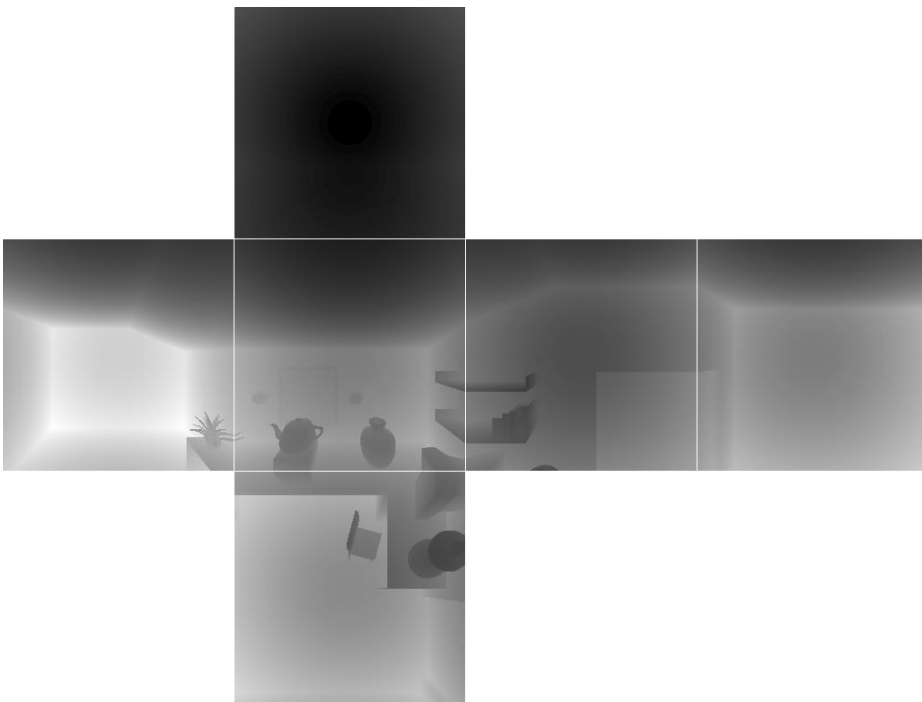
## 2.6 Traditional 2D texture mapping



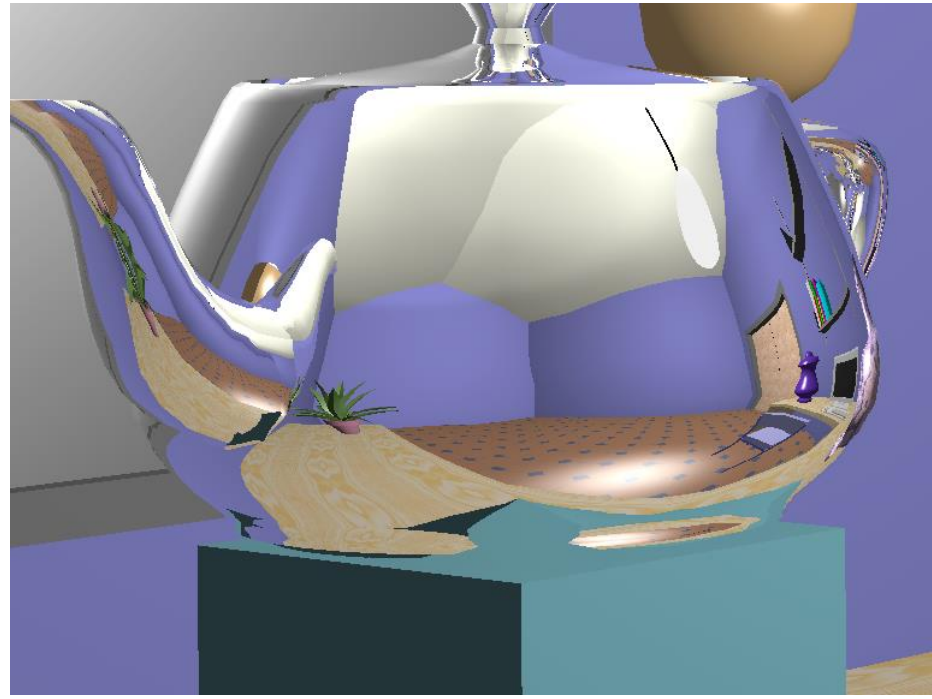
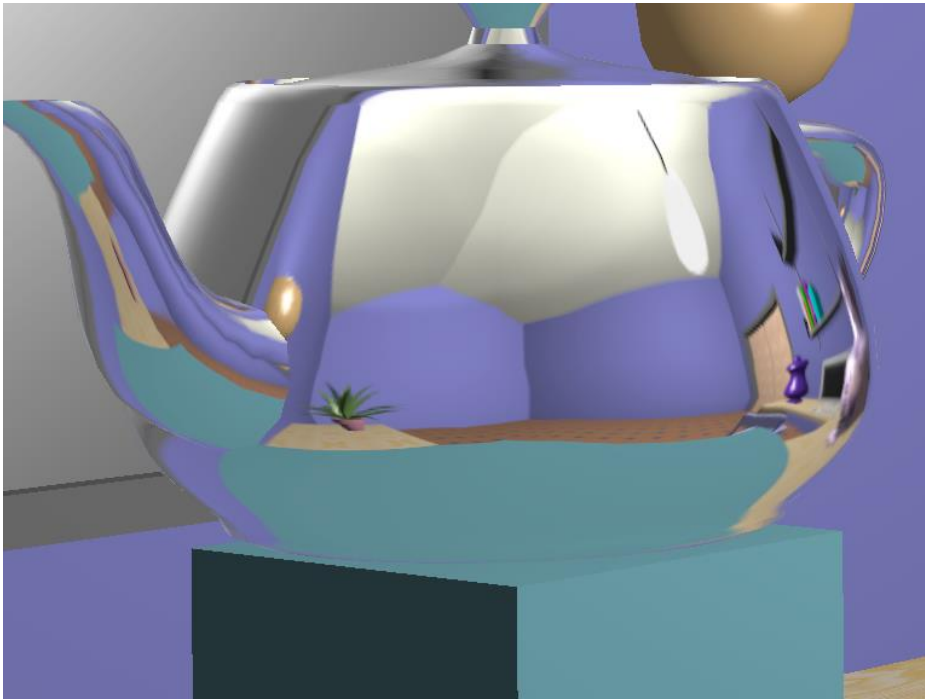
## 2.7 Shadow and environment mapping



## 2.7.1 The shadow and environment maps



## 2.7.2 Comparison of environment mapping with ray tracing



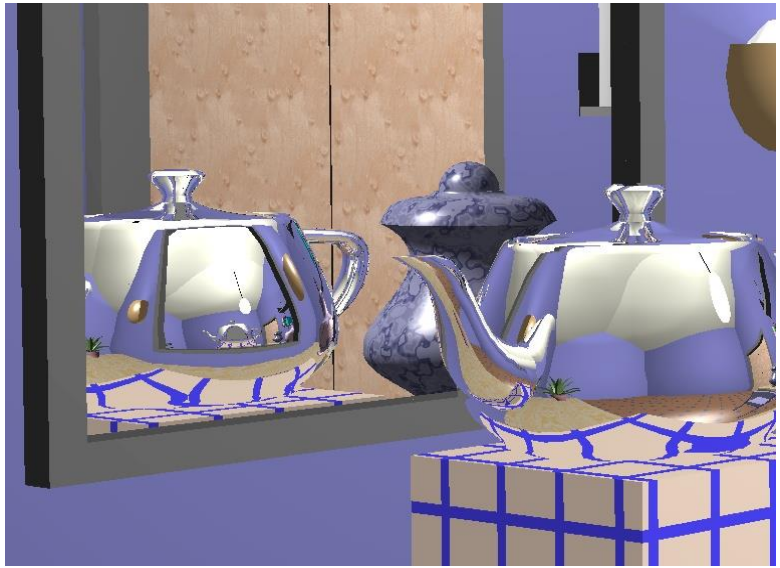
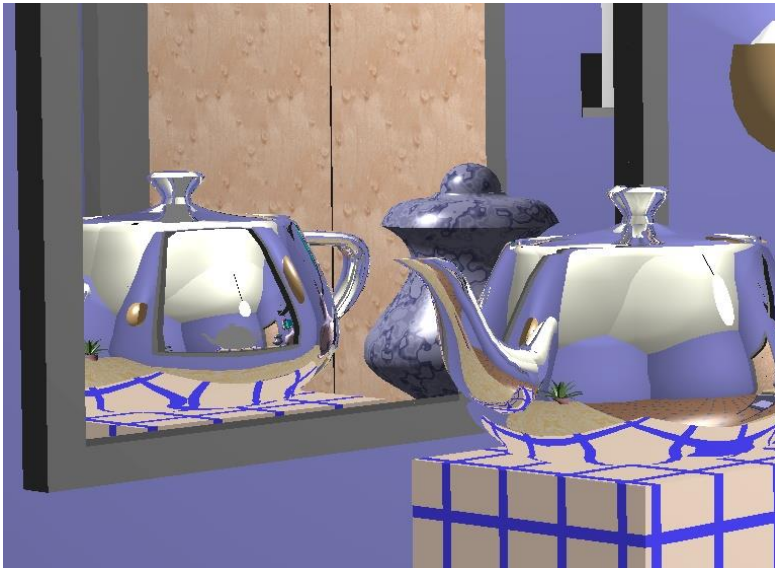
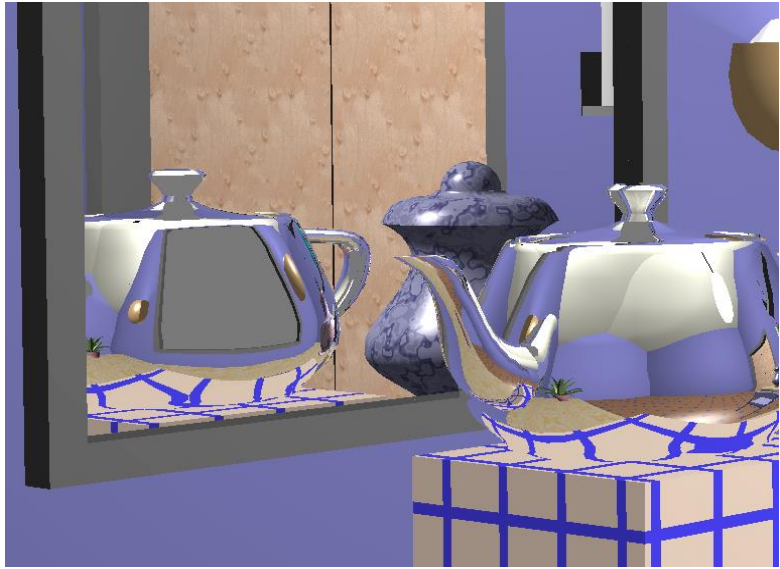
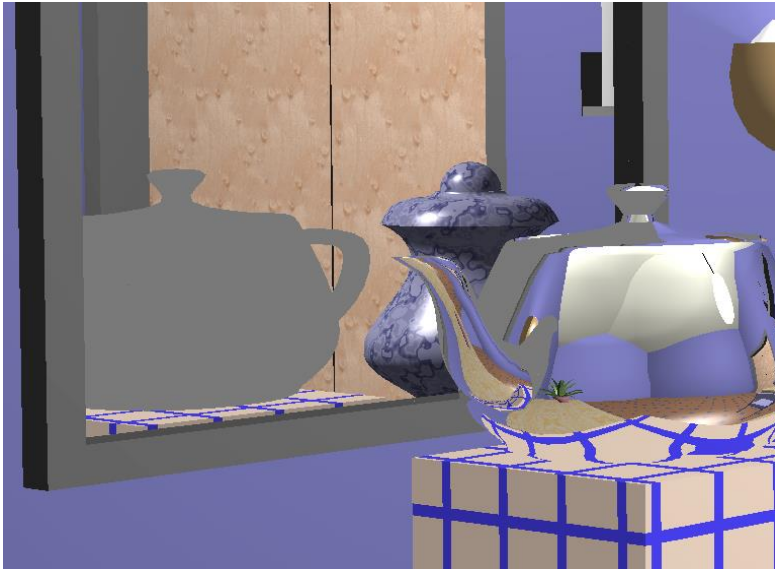
### 3. Ray tracing

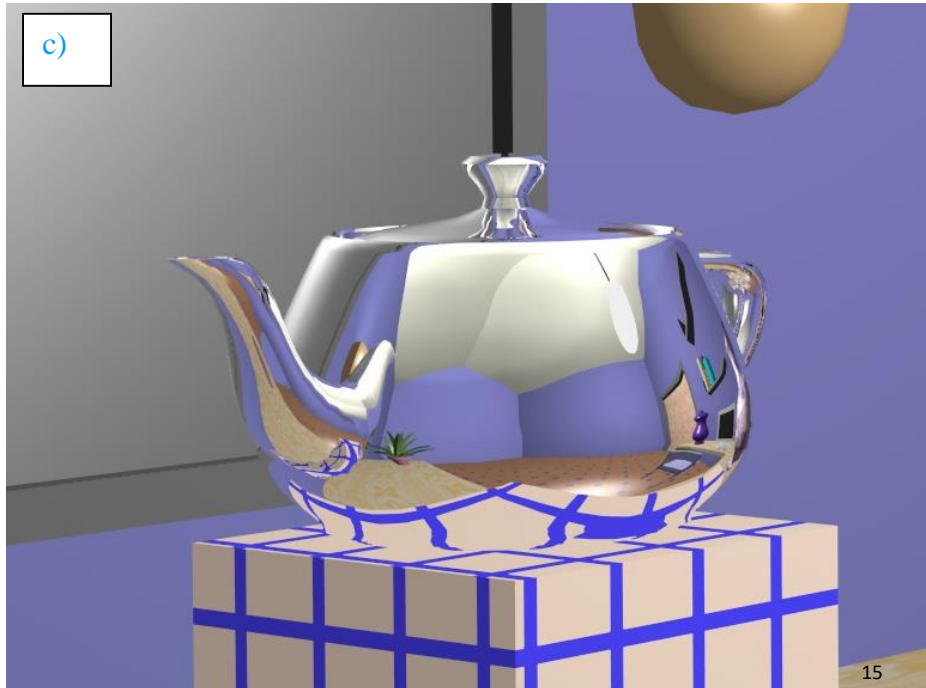
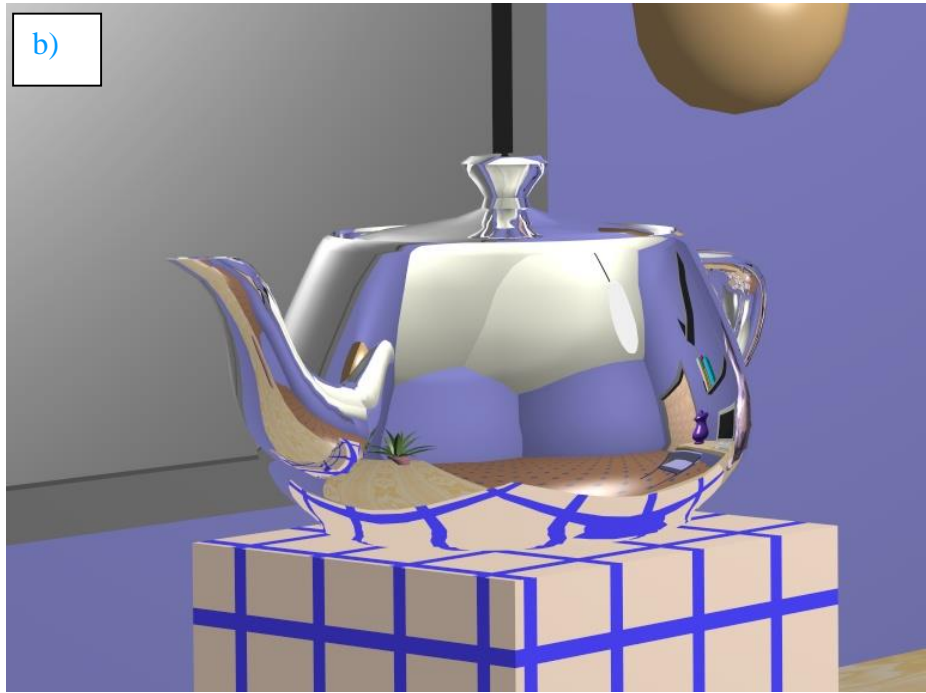
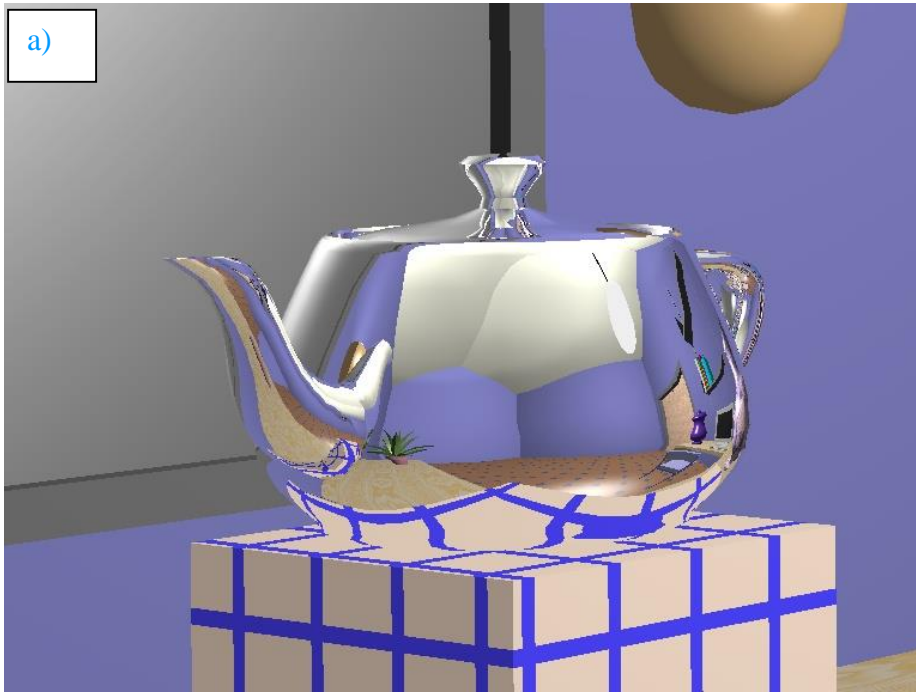
- Global illumination algorithms take into account both direct and indirect illumination





## 3.1 Levels of recursion





## 3.2 Anti-aliasing

a) none

b) supersampling (x3)

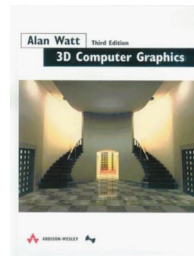
c) non-uniform sampling

# 9. Summary

In the course we have covered:

- Representation and modeling;
- Transformations;
- The graphics pipeline;
- The Phong local reflection model;
- Z-buffer;
- Textures;
- Shadows;
- Anti-aliasing;
- Intro to animation;
- Ray tracing;
- A brief look at global illumination;
- A recognized standard: OpenGL.

Hope you have enjoyed it.



COM3503/4503/6503: 3D Computer Graphics

Home Lectures Labs Assessment Resources

### Lectures

Lecture notes will be available here as the semester progresses. The lecture notes are a summary of the lecture and I expect you to spend extra time consulting other reference sources (see Resources) to broaden your knowledge.

### Timetable

- Mondays 11-11.50am, Broad Lane block L707
- Thursdays 12-12.50pm, Diamond LT2
- Weeks 1-5 are lectures and lab classes
- Week 6 is a reading week for this module
- Weeks 7-11 are lectures and lab classes
- Week 12 is reserved in case I miss a lecture in the earlier weeks

### Lecture notes

1. Introduction [1\_up.pdf, 4\_up.pdf]
2. Transformations and scene graphs [1\_up.pdf, 4\_up.pdf]
3. Transformations and hierarchies [1\_up.pdf, 4\_up.pdf]
4. Polygon meshes [1\_up.pdf, 4\_up.pdf]
5. Representation and modelling [1\_up.pdf, 4\_up.pdf]
6. Viewing pipeline [1\_up.pdf, 4\_up.pdf]
7. Rendering: part 1 [1\_up.pdf, 4\_up.pdf]
8. Rendering: part 2 [1\_up.pdf, 4\_up.pdf]
9. Shadows [1\_up.pdf, 4\_up.pdf]
10. Texture: part 1 [1\_up.pdf, 4\_up.pdf]  
Texture mapping demo
11. Anti aliasing [1\_up.pdf, 4\_up.pdf]
12. Texture: part 2 [1\_up.pdf, 4\_up.pdf]
13. Texture: part 3 [1\_up.pdf, 4\_up.pdf]
14. Parametric curves (for animation) [1\_up.pdf, 4\_up.pdf]
15. Animation: part 1 [1\_up.pdf, 4\_up.pdf]
16. Animation: part 2 - see previous lecture for lecture notes
17. Ray tracing: part 1 [1\_up.pdf, 4\_up.pdf]
18. Ray tracing: part 2 [1\_up.pdf, 4\_up.pdf]
19. Ray tracing: part 3 [1\_up.pdf, 4\_up.pdf]
20. Review and exam prep

Errata

- Errata for all lectures