Graphic vs. Image

- An *image* is the graphic converted for 2d display.

- *Rendering* - an operation that takes graphics data and produces image data.

- A *graphic* is a representation of a 3D object.
Graphics

**Media type** Graphic

**Representation**
- Geometric models
- Solid models
- Physically based models
- Empirical models
- Drawing models
- External formats for models
Graphics - Geometric Models

- Geometric primitives
  - 2D (e.g. lines, rectangles, ellipses, polygons, and curves)
  - 3D (e.g. cubes, cylinders, and surfaces)
  - primitives are defined in local or object coordinates, arranged in common world coordinates by applying modeling transformations.
Graphics - Solid Models

- **Surfaces of revolution** - A solid is formed by rotating about an axis in 3D space (lathing).
- **Extrusion** - A 2D outline is extended in 3D space along an arbitrary path.
- **Constructive Solid Geometry** - Solids are combined using union, intersections and difference operations.
Graphics

- **Physically based models** - describing forces, stresses, and strains on objects.

- **Empirical models** - based on observation, rather than physical laws.

- **Drawing models** - describe an object in terms of drawing or painting actions.
Graphics

Operations
  - Primitive editing
  - Structural editing
  - Shading
  - Mapping
  - Lighting
  - Viewing
  - Rendering
Graphics - Operations - 1

◆ \textit{Primitive editing} -
modifying the parameters associated
with the model primitives.

◆ \textit{Shading} -
specifies how light interacts with various
objects within the model.
  – flat shading
  – phong shading
  – ray tracing
Mapping
used to modify an object's surface
- texture mapping
- bump mapping
- displacement mapping
- environment mapping
- shadow mapping
Graphics - Operations - 3

- **Lighting**
  - ambient light
  - point lights
  - directional light
  - spot lights

- **Viewing**
  allows one to calculate a varying viewing position

- **Rendering**
  converts a model into an image
Graphics

A 3D model; Circles indicate light sources
Graphics

Rendered model, with shading and texture mapping
Graphics

Rendered model, with displacement and shadow mapping