

# The camera analogy

- At first, it's hard to think of modelling a 3D world on a 2D screen.
- The camera analogy makes this a lot easier.
- The analogy is this:

"The process of transforming a 3D model into a 2D view is analogous to using a camera in the real world to take 2D-pictures of a 3D-scene."

The camera at any point is uniquely defined by

- Eye point  $(e_x, e_y, e_z)$
- Center of interest  $(c_x, c_y, c_z)$
- Up-vector  $\begin{pmatrix} u_x \\ u_y \\ u_z \end{pmatrix}$

## The 3D viewing pipeline in the camera analogy

Computer Graphics	Real world
① Set modelling transformation	Arrange the scene into the desired composition
② Set viewing transformation	Point the camera at the scene
③ Set projection transformation	Choose the camera lens and adjust the zoom
④ Set viewport transformation	Determine the size (cropped?) and shape of the final photograph

## The duality of modelling and viewing

When we say "changing camera location and orientation", we actually compute a viewing transformation which we then apply to the object.

- Remember that we don't actually have a camera, it is just an artefact to help us with our understanding.
- BUT: We can move around the model, i.e. adjust our modelling and achieve the same effect!
- "Moving the model by  $(x, y, z)$  is equivalent to moving the camera by  $(-x, -y, -z)$ ."

the same concept applies to rotations.