

Computer Graphics

Lecture 16

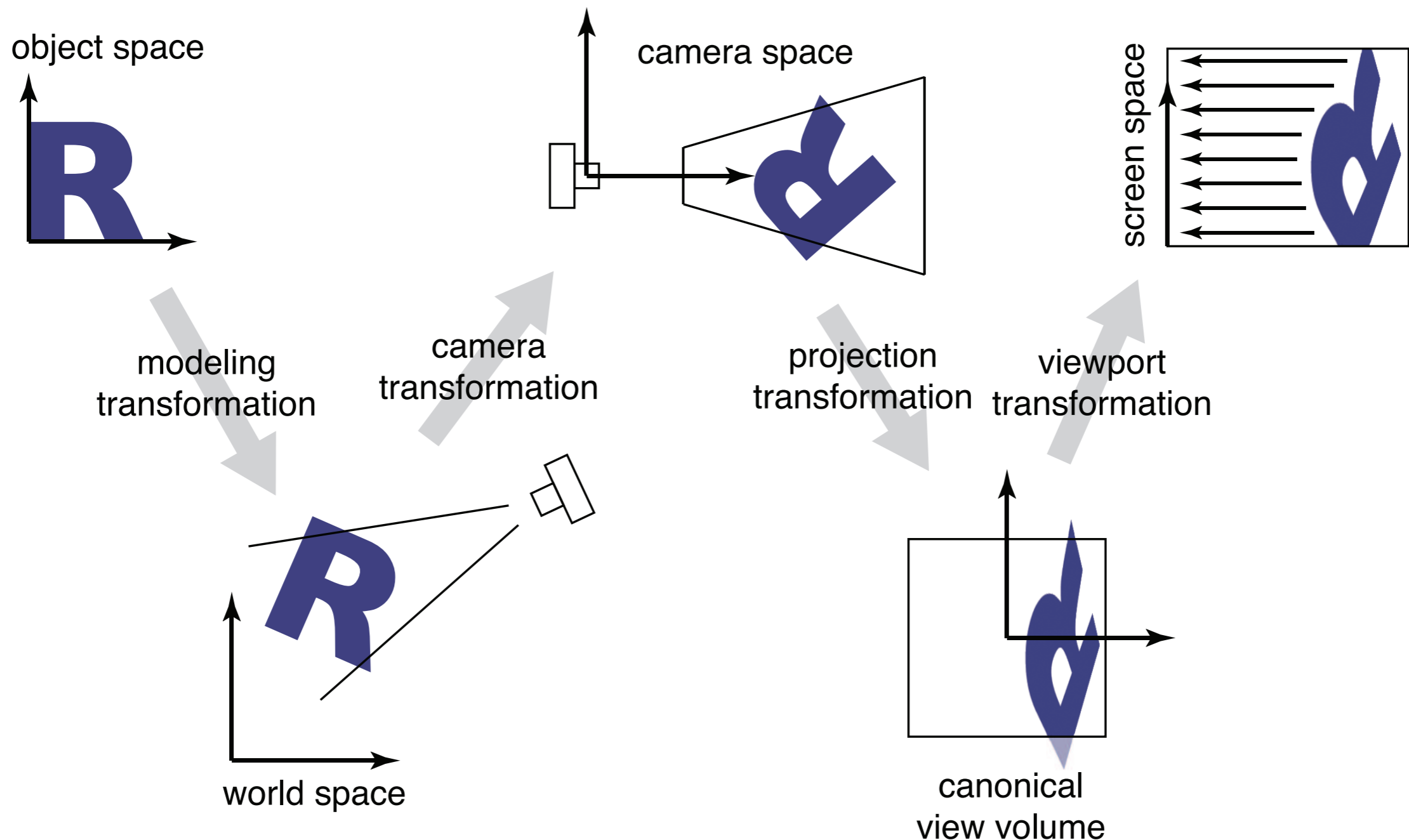
**Viewing Transformations: Orthographic
Perspective Projection**

Announcements

- A2 is in! Artifact showcase will happen later this week.

Viewing Transformations: Overview

A standard sequence of transforms to go from **object (model) space** to **screen (image) space**



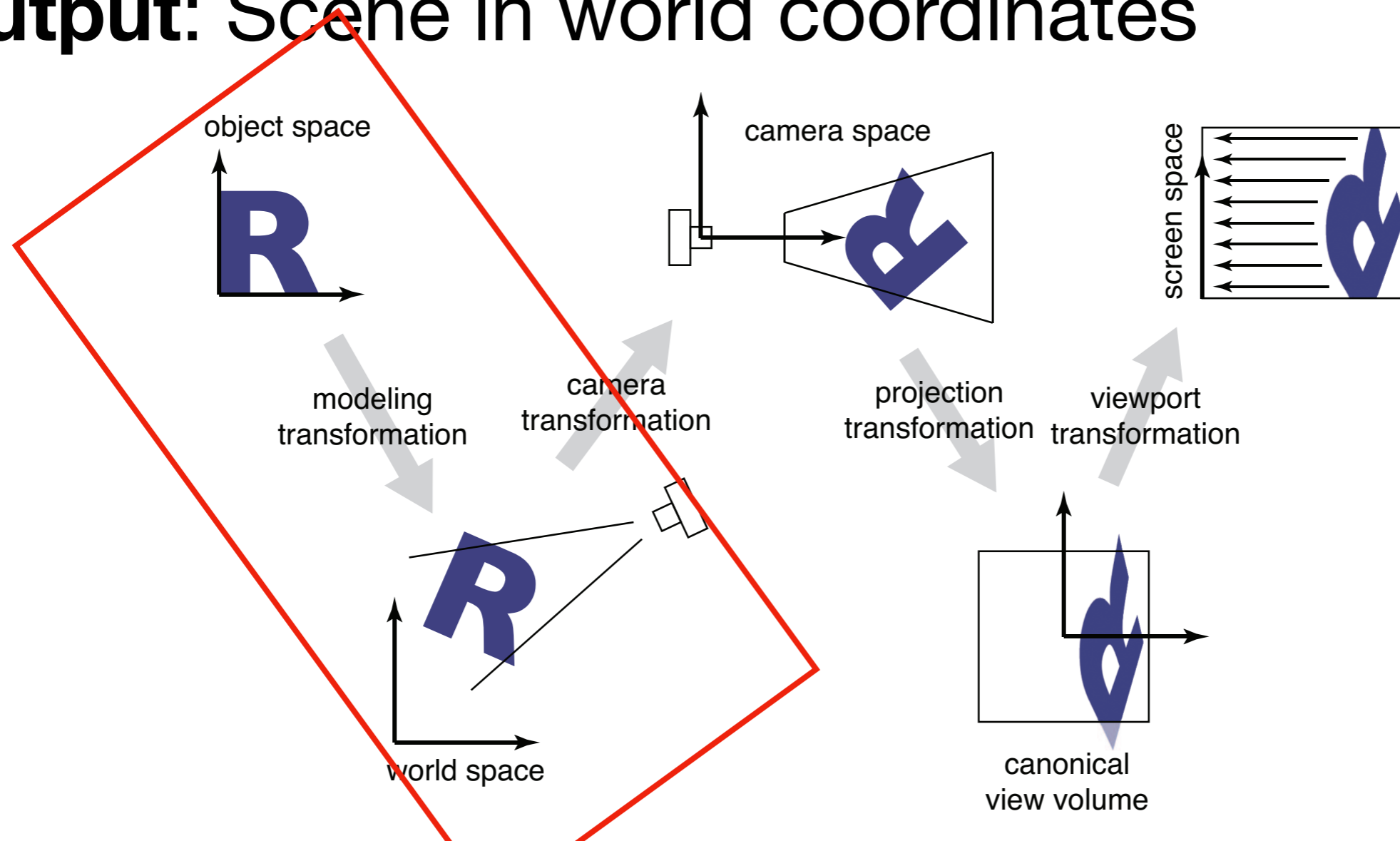
Wireframe Rendering

Model Matrix

Input: Scene in model coordinates

Parameters: Pose, scale, etc of model in scene

Output: Scene in world coordinates



Overview

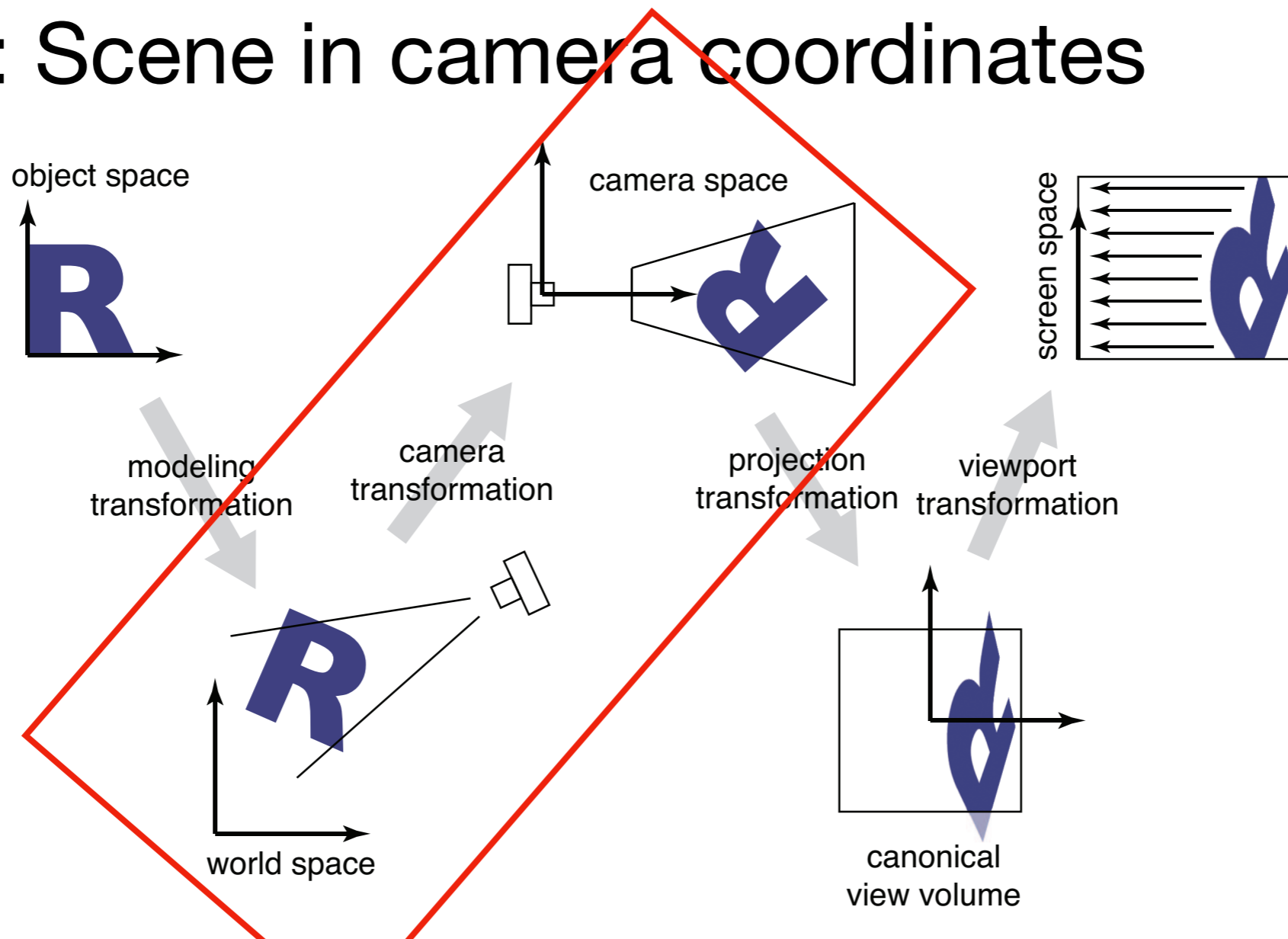
- https://www.cs.cornell.edu/courses/cs4620/2019fa/demos/view_explore/view_explore.html

Camera Matrix

Input: Scene in world coordinates

Parameters: Camera frame (\mathbf{u} , \mathbf{v} , \mathbf{w} , \mathbf{e})

Output: Scene in camera coordinates

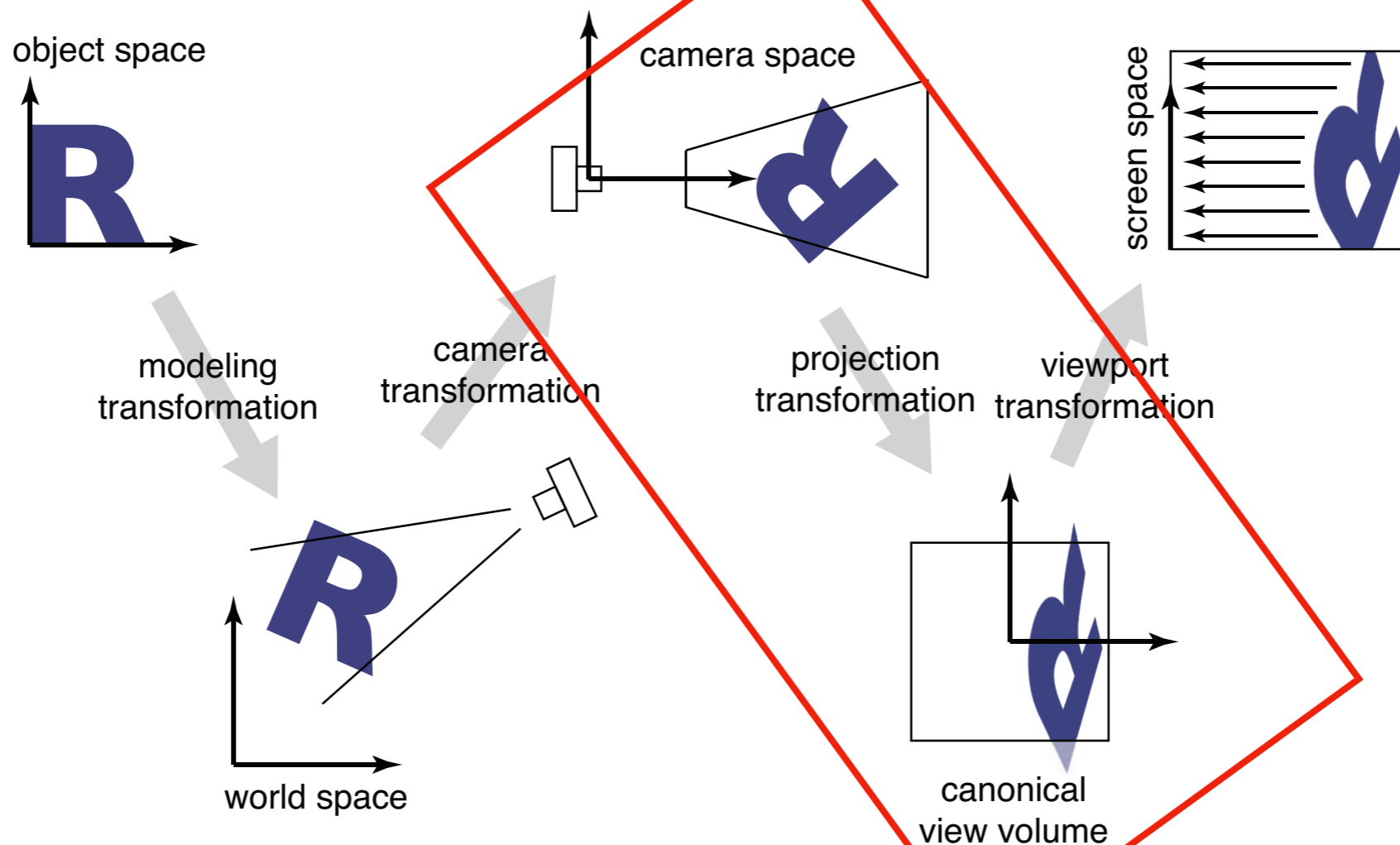


Projection Matrix - Orthographic

Input: Scene in (canonically-posed) camera coordinates

Parameters: Orthographic viewport dimensions

Output: Normalized device coordinates

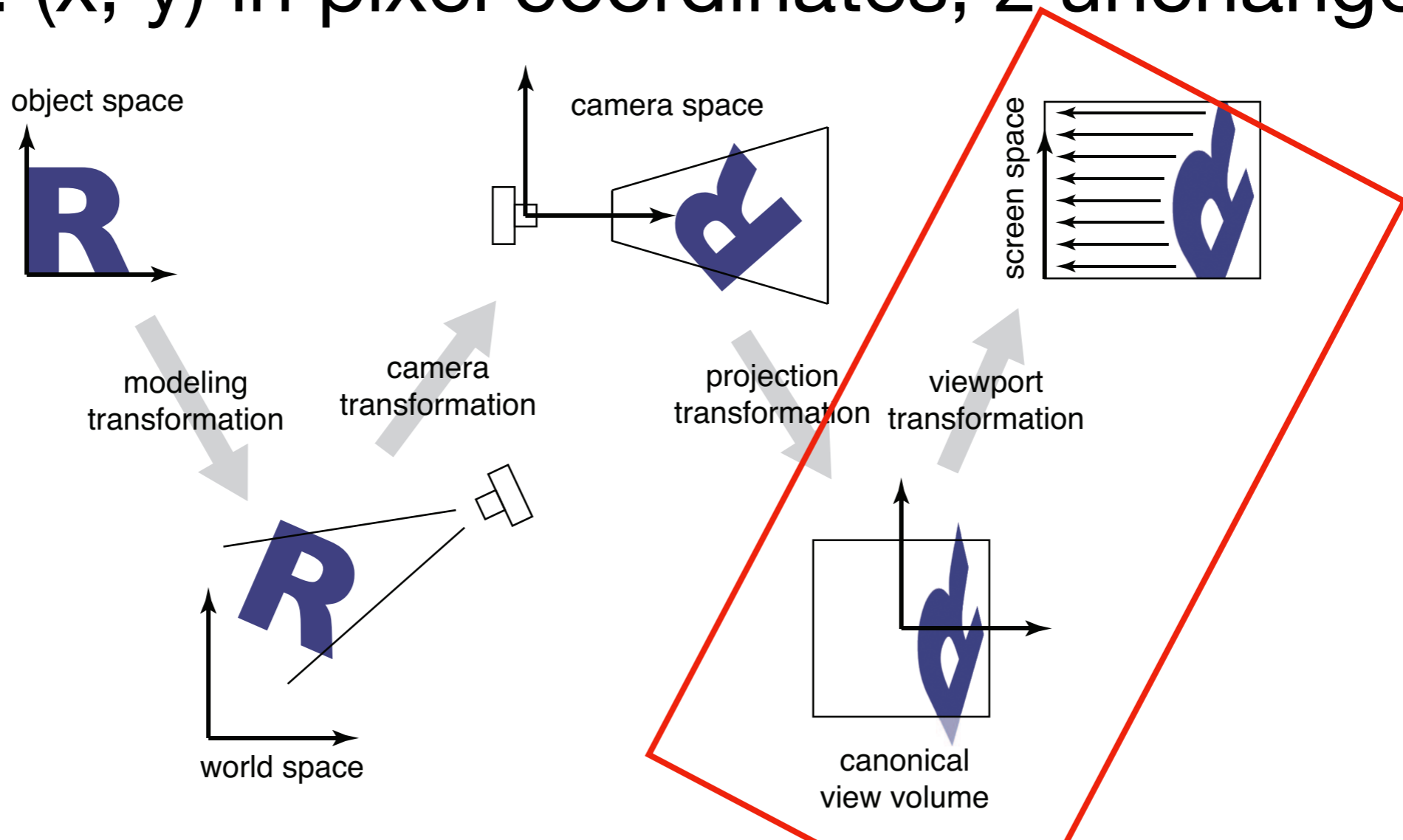


Viewport Matrix

Input: Scene in the canonical view volume

Parameters: W, H (image dimensions in pixels)

Output: (x, y) in pixel coordinates; z unchanged



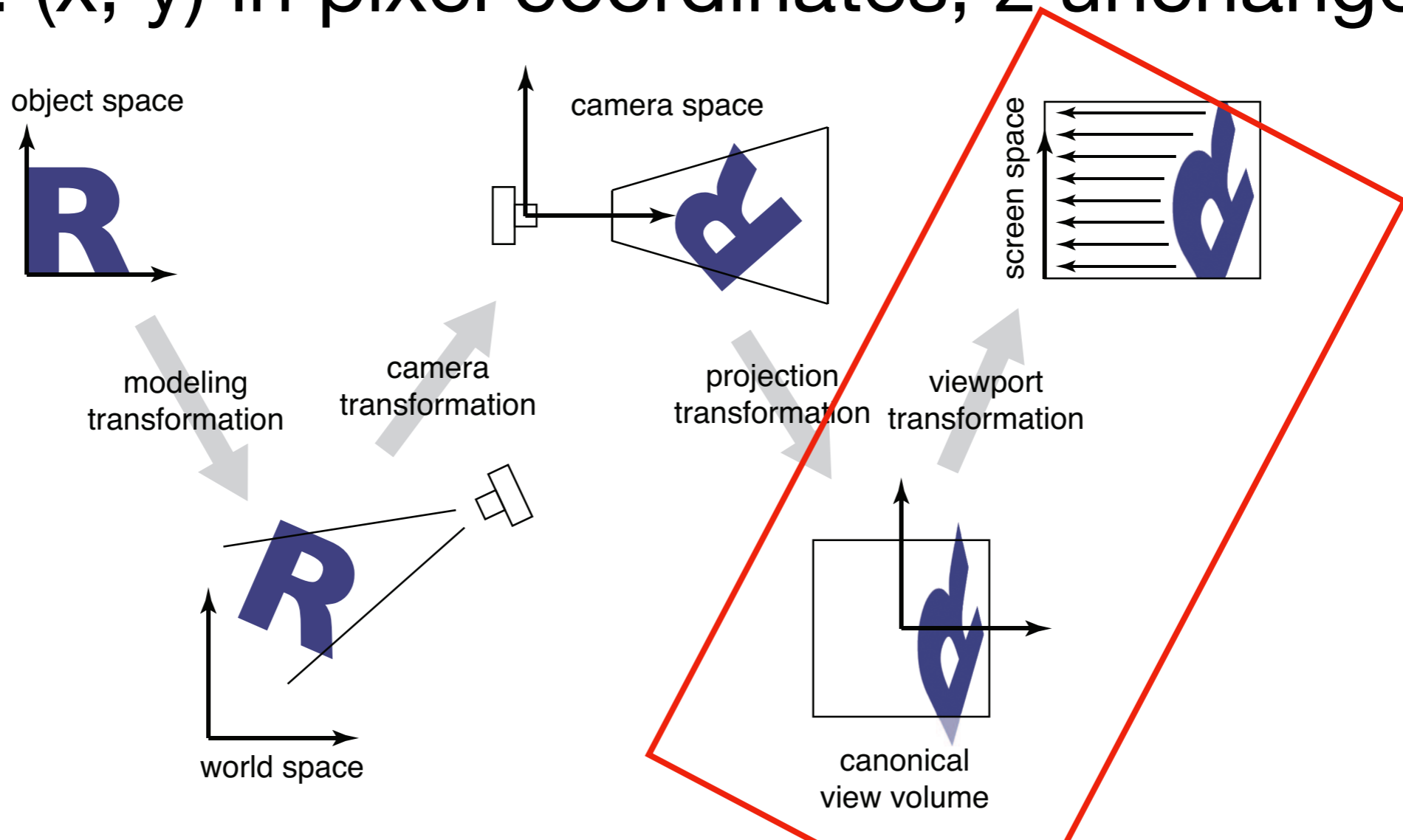
Let's build it

Viewport Matrix

Input: Scene in the canonical view volume

Parameters: W, H (image dimensions in pixels)

Output: (x, y) in pixel coordinates; z unchanged

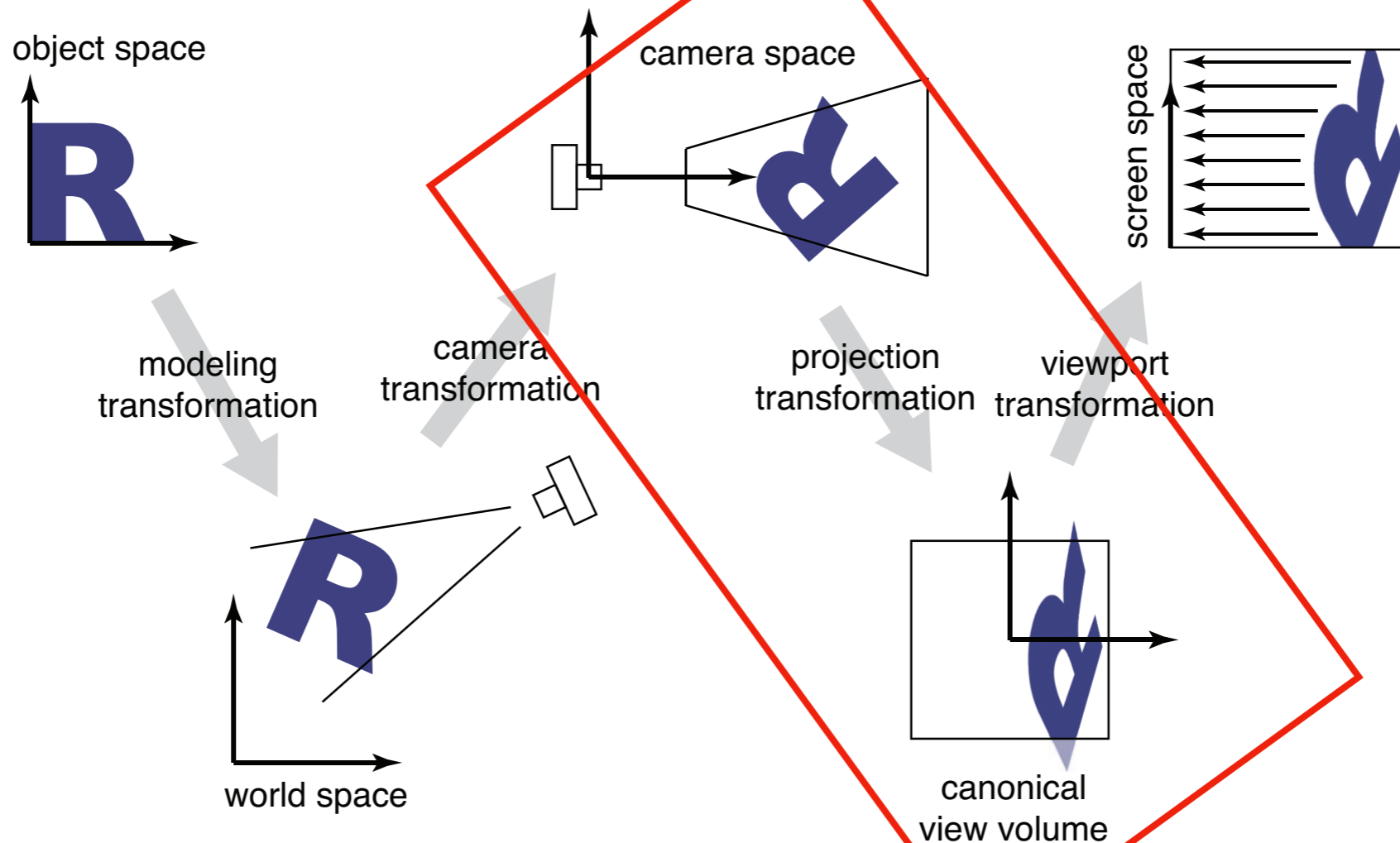


Projection Matrix - Orthographic

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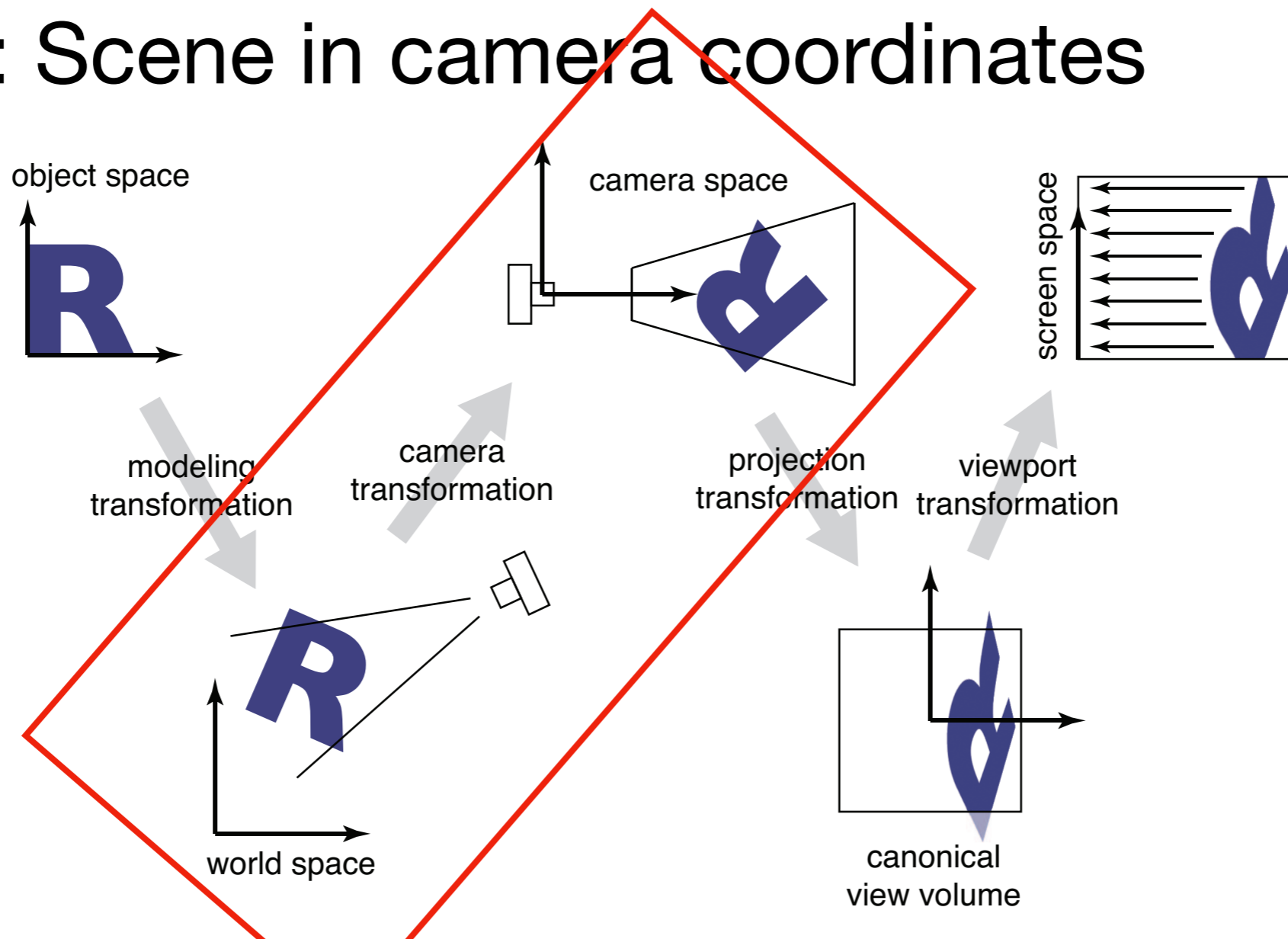


Camera Matrix

Input: Scene in world coordinates

Parameters: Camera frame (\mathbf{u} , \mathbf{v} , \mathbf{w} , \mathbf{e})

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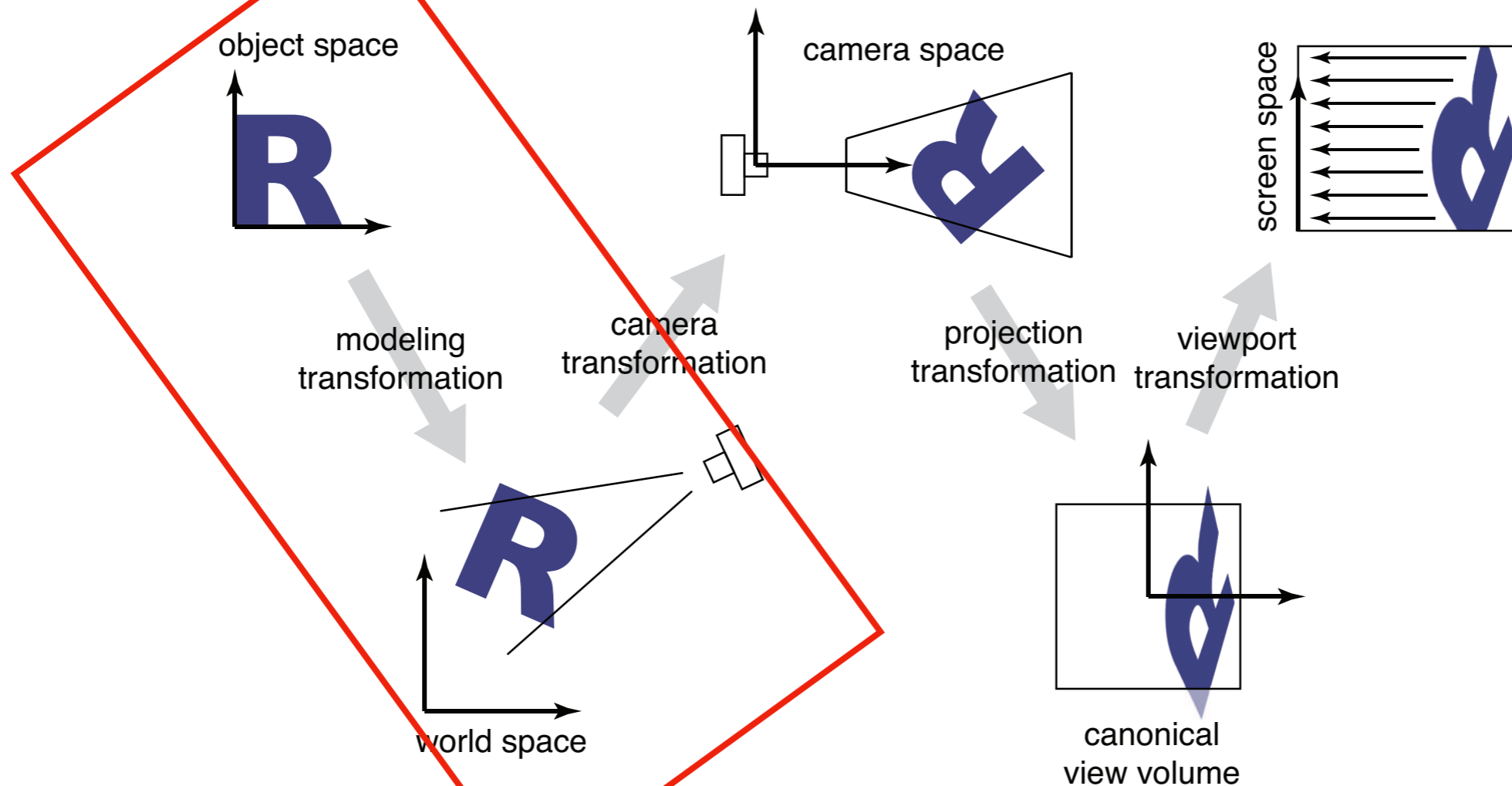


Model Matrix

Input: Scene in model coordinates

Parameters: Pose, scale, etc of model in scene

Output: Scene in world coordinates



What about perspective cameras?

- https://www.cs.cornell.edu/courses/cs4620/2019fa/demos/view_explore/view_explore.html

Perspective Projection

Exercise:

Find y_s , the y coordinate of the point where (x, y, z) projects onto the viewport.

