

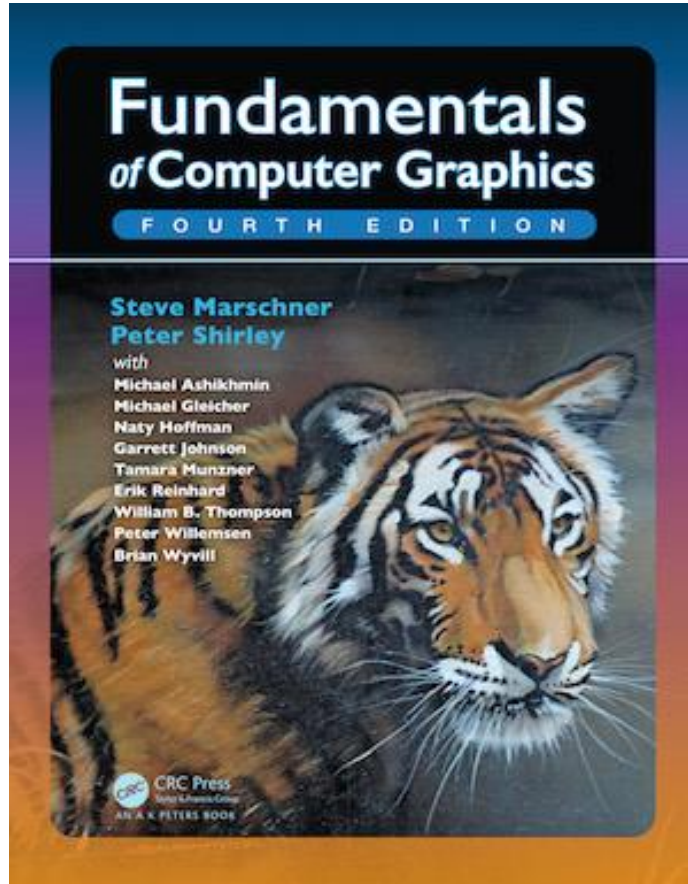
CSE4203: Computer Graphics
Chapter – 4 (part - A)
Ray Tracing

Mohammad Imrul Jubair

Outline

- Projection
- Parallel projection
- Perspective projection
- Vanishing point

Credit



CS4620: Introduction to Computer Graphics

Cornell University

Instructor: Steve Marschner

<http://www.cs.cornell.edu/courses/cs4620/2019fa/>

3D → 2D

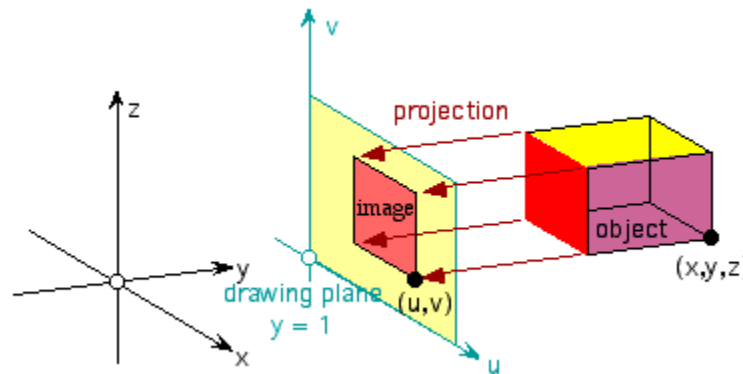
```
12221_Cat_v1_I3.obj x
10 v 0.6134 -21.9357 31.4441
11 v 0.6205 -21.8541 31.4935
12 v 0.5534 -21.8682 31.5159
13 v 0.5464 -21.9516 31.4643
14 v 0.6207 -21.7610 31.5371
15 v 0.5544 -21.7724 31.5613
16 v 0.4816 -21.8847 31.5310
17 v 0.4743 -21.9703 31.4781
18 v 0.4838 -21.7858 31.5776
19 v 0.6156 -21.6618 31.5749
20 v 0.6070 -21.5619 31.6064
21 v 0.5439 -21.5675 31.6330
22 v 0.5507 -21.6702 31.6005
23 v 0.4772 -21.5744 31.6514
24 v 0.4819 -21.6802 31.6178
25 v 0.3320 -21.5913 31.6699
26 v 0.3330 -21.7025 31.6343
27 v 0.4094 -21.6911 31.6286
28 v 0.4067 -21.5824 31.6631
29 v 0.3317 -21.8143 31.5926
30 v 0.4094 -21.8001 31.5875
31 v 0.3275 -21.9189 31.5447
```



3D model Source: <https://free3d.com>
Model viewer: <http://masc.cs.gmu.edu/wiki/ObjViewer>

Projection (1/2)

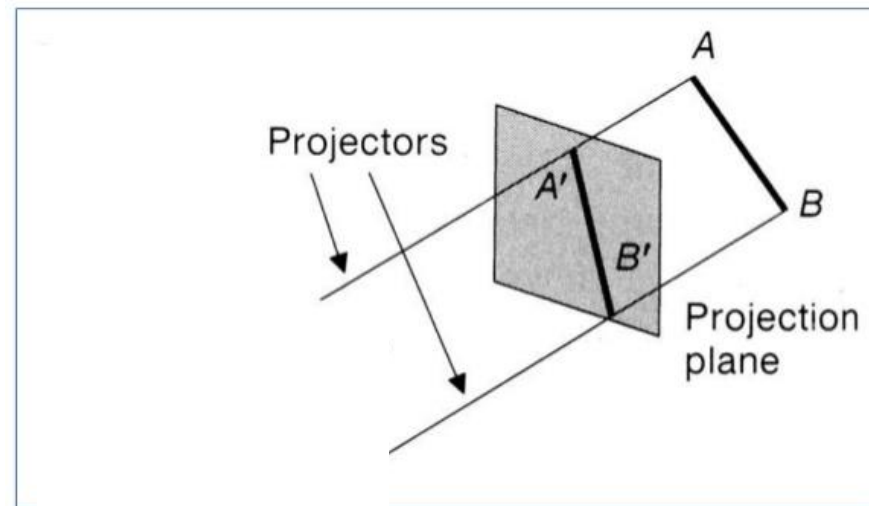
- Representing a 3D object
 - Photographs also represent 3D scenes with 2D images.
- In computer graphics, **Projection** is used.



Credit: Fundamentals of Computer Graphics 4th Edition by Peter Shirley, Steve Marschner | <http://www.cs.cornell.edu/courses/cs4620/2019fa/>

Projection (2/2)

- **3D points** are mapped to **2D image plane** by moving them along a *projection direction*
 - *until they hit the image plane*

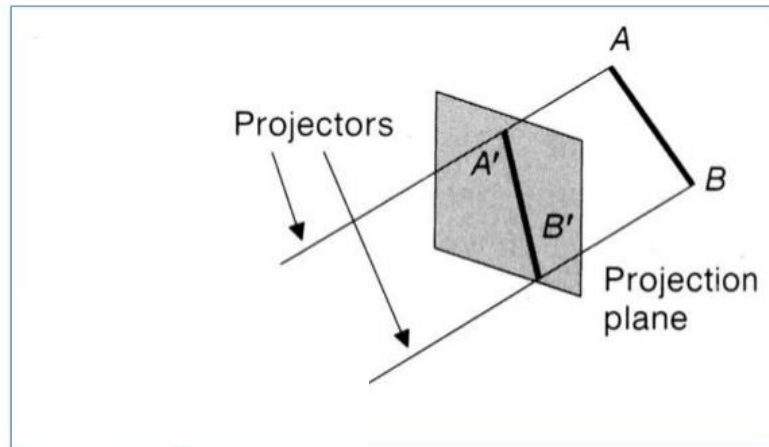


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Types of Projection (1/1)

Main types:

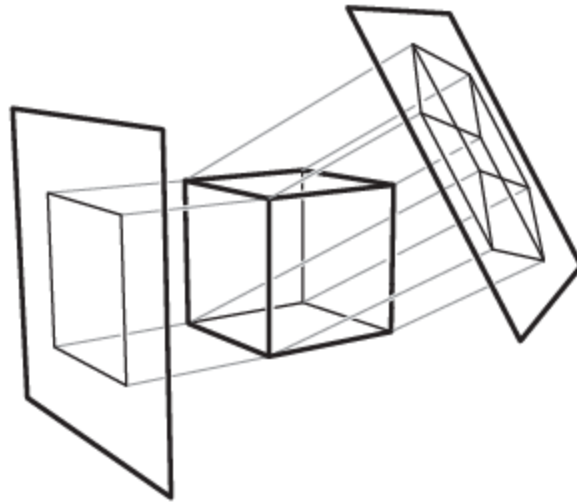
- Parallel
- Perspective



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Parallel Projection (1/3)

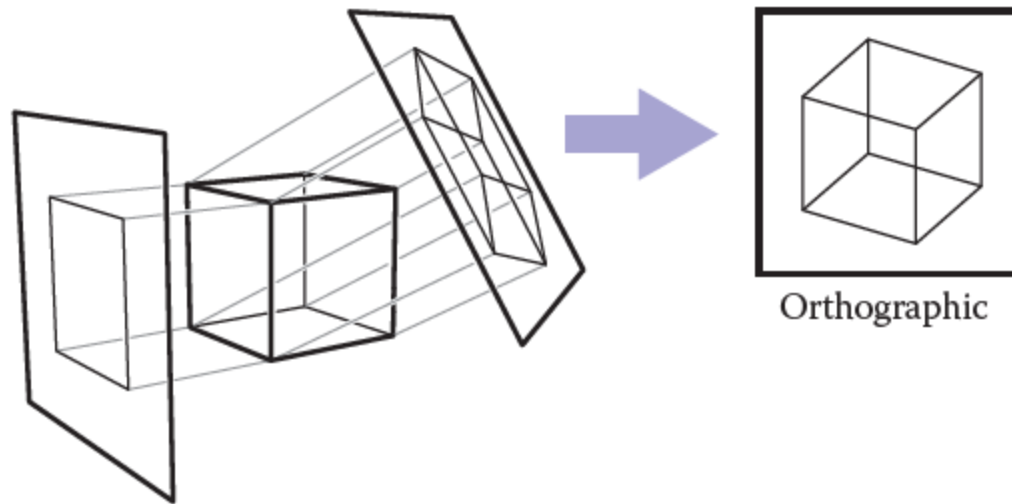
- Projectors are parallel
 - Meet at infinity



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Parallel Projection (2/3)

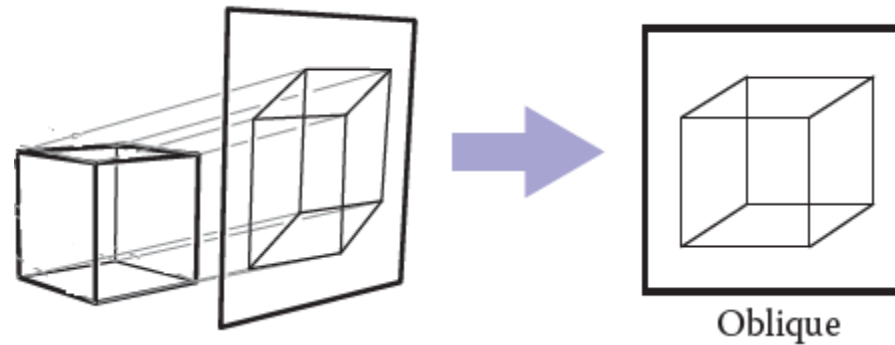
- Orthographic
 - Image plane \perp projector



Credit: Fundamentals of Computer Graphics 4th Edition by Peter Shirley, Steve Marschner | <http://www.cs.cornell.edu/courses/cs4620/2019fa/>

Parallel Projection (3/3)

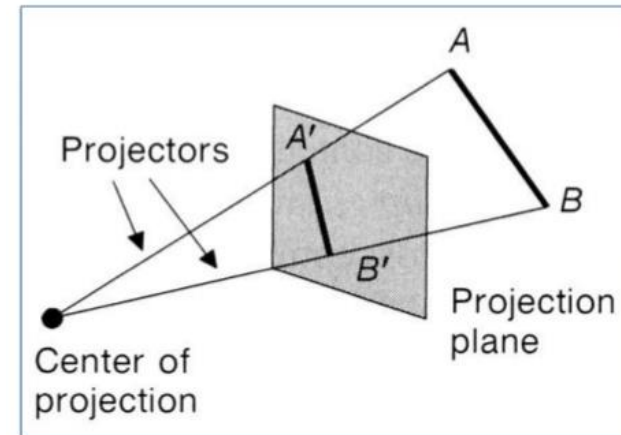
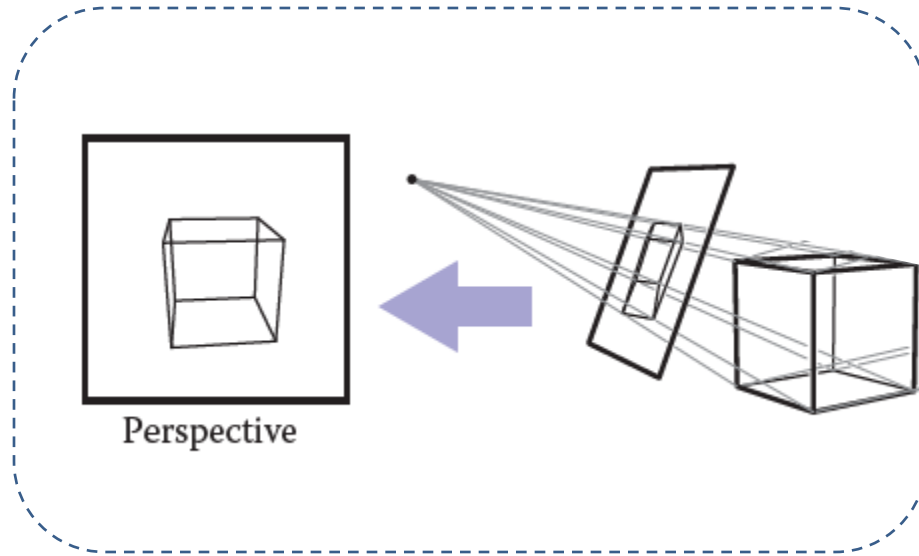
- Oblique
 - Image plane \nparallel projector



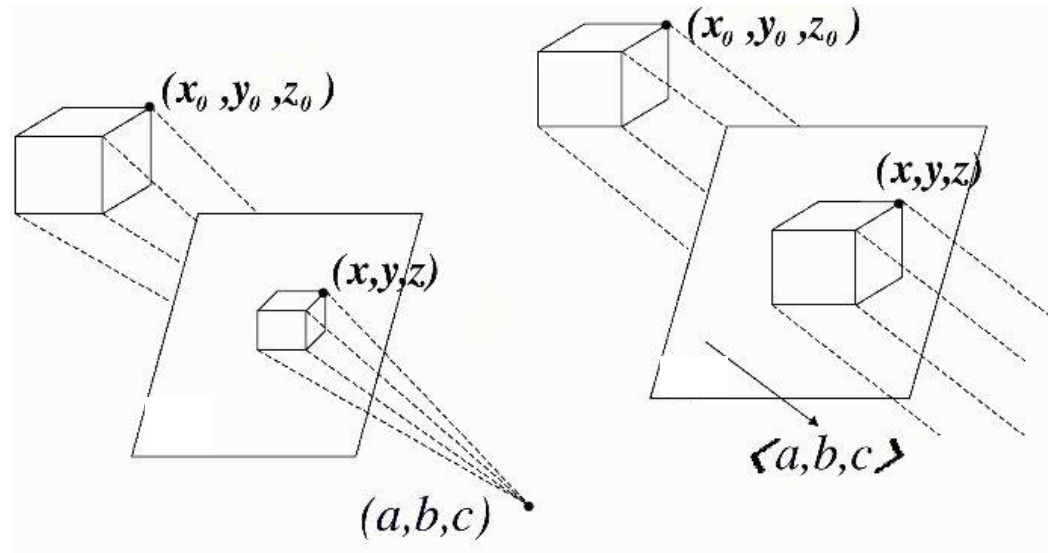
Credit: Fundamentals of Computer Graphics 4th Edition by Peter Shirley, Steve Marschner | <http://www.cs.cornell.edu/courses/cs4620/2019fa/>

Perspective Projection (1/2)

- Projector meet at a point



Perspective Projection (2/2)



- Does parallel project have a CP?
 - What will happen if the object moves near/ far?
- Play around:
http://www.cs.cornell.edu/courses/cs4620/2017sp/demos/view_explore/view_explore.html

Credit: Fundamentals of Computer Graphics 4th Edition by Peter Shirley, Steve Marschner | <http://www.cs.cornell.edu/courses/cs4620/2019fa/>

Parallel vs Perspective (2/2)

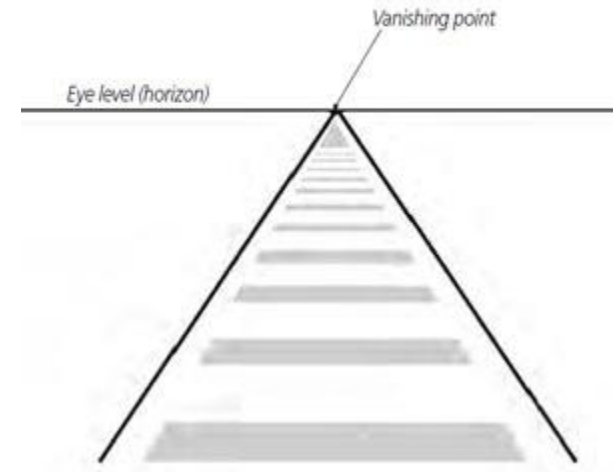
- In our everyday experience (and in photographs)
 - objects look smaller \leftrightarrow farther away



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Vanishing Point (1/1)

- Vanishing points:
 - where parallel lines meet.
 - Parallel horizontal lines meet at a point on the horizon.
 - Every set of parallel lines has own VP



Q: Which type of parallel lines does not meet at VP?

Image source: <https://www.artistsnetwork.com/art-terms/vanishing-point-perspective/>

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Additional Reading

- The *three-point* perspective.

Thank You