



Information Coding / Computer Graphics, ISY, LiTH

## Lecture 7

More VSD: More ray-casting, scan-line method

Rotation around arbitrary axis

The normal matrix

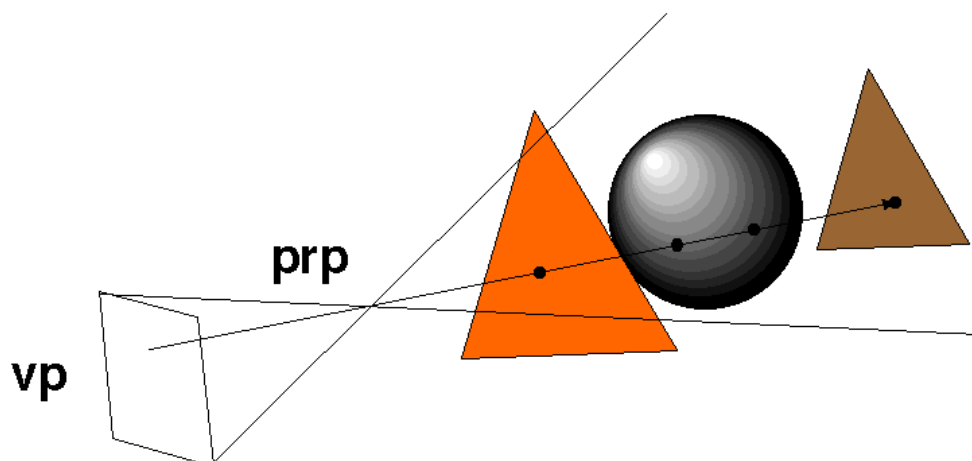
Some more about shaders



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## Ray-casting

Follow rays from each pixel through the scene





## Full 3D raycasting

for every pixel  $(x,y)$  in the image

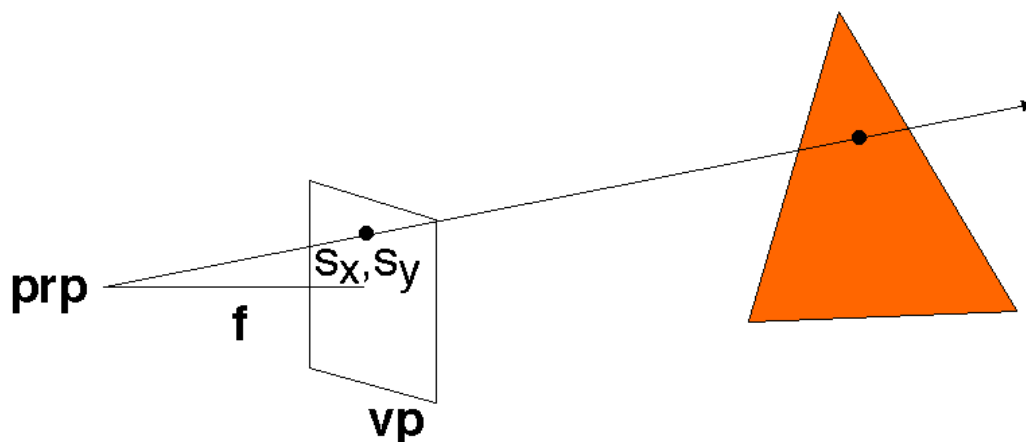
calculate a ray from the pixel through the camera (prp) and through the scene

calculate intersections with all objects in the scene

the pixel value is calculated from the closest intersection found



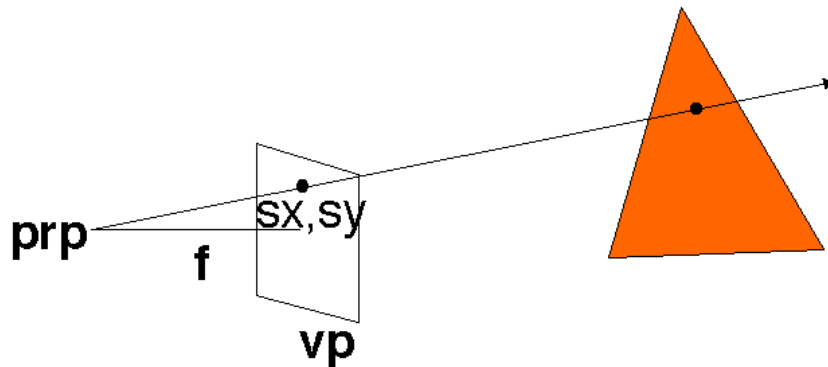
## The ray



$$\text{Line equation: } \text{prp} + \mu(s_x, s_y, -f)$$



## A ray through a polygon



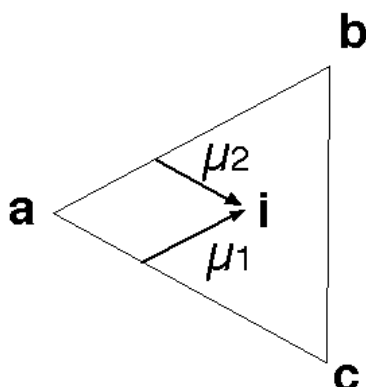
Line-plane intersection (last lecture)

Gives us an intersection point - for the *plane*



## Is the point in the polygon?

Triangle: Straight-forward  
Several methods possible.



$$\mathbf{i} = \mathbf{a} + \mu_1 \mathbf{ab} + \mu_2 \mathbf{ac}$$

$$0 < \mu_1$$

$$0 < \mu_2$$

$$\mu_1 + \mu_2 < 1$$

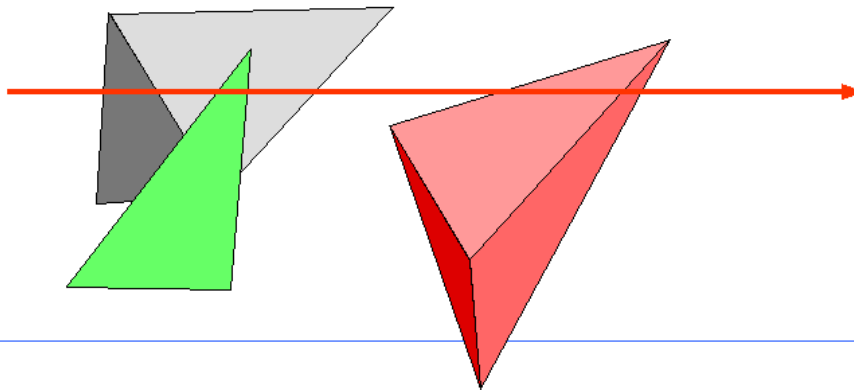


# Scan-line method

Drawing pixels only once

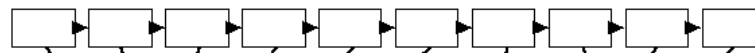
Like the polygon filling method:

- Work on one scan-line at a time
- keep a list of active edges/spans



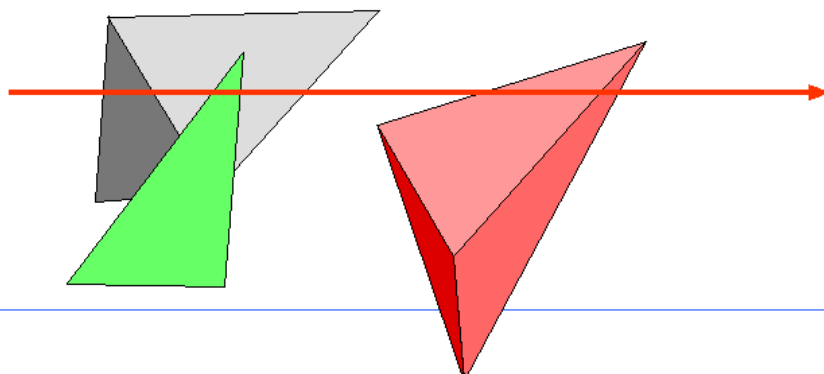
# Scan-line method

Active edge list



Active spans:

Active surfaces:





## Scan-line method

Highly efficient for 3D graphics with no GPU. Limited interest for modern GPU-equipped systems - at this time.

...but stay tuned...



**covered so far:**  
**Low-level VSD**  
(visible surface detection)

Backface culling  
Painter's algorithm  
Z-buffer  
Scan-line method  
BSP trees (as presented before)

All polygons are treated individually

Good for small scenes  
(small total number of polygons).



## High-level VSD

**Large scenes, large or very large polygon count.**

**Only a small part of the scene is visible at a given time!**

**Process polygons in groups, with some kind of spatial information! Remove many polygons with each decision.**

**BSP trees (revisited)  
Octrees  
Domain-specific culling  
Portals  
PVS**