



Lecture 11

Billboarding continued

Object representations

Animation



Implementing billboards

Variants:

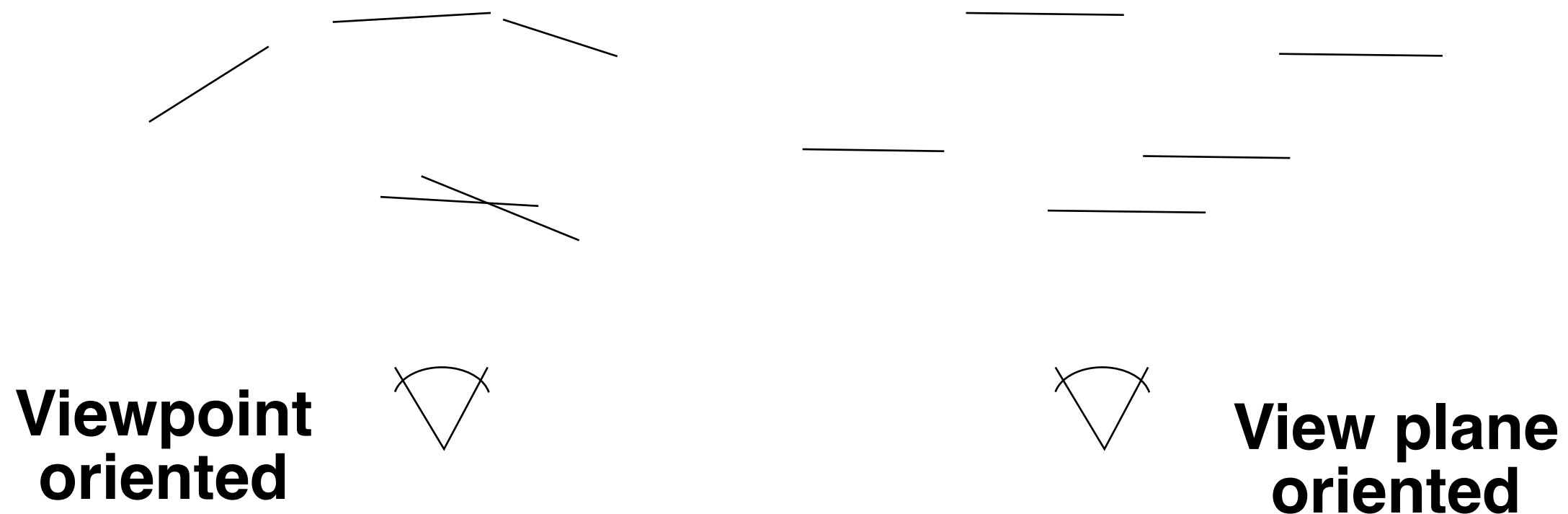
- **World oriented billboard**
- **Viewpoint oriented billboard (face the camera in full 3D)**
 - **Axial (viewpoint) billboard**
 - **View plane oriented billboard**
- **View plane oriented axial billboard**



View plane oriented billboard

Easy! Zero out rotation!

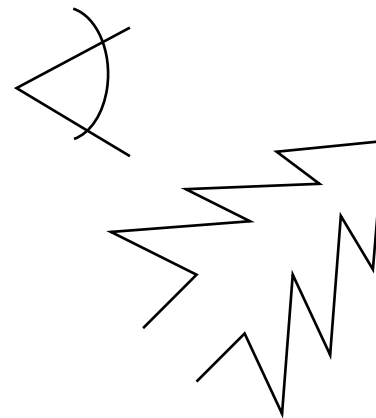
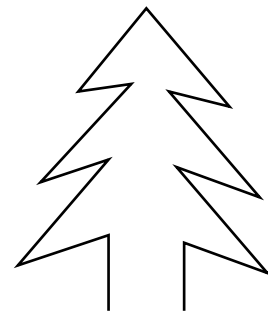
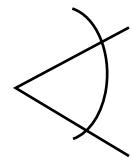
Good - no overlaps!



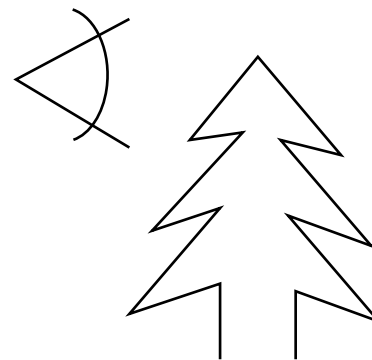
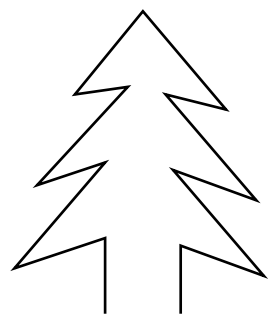
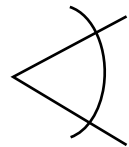


Axial billboard

Rotate around Y



Non-axial



**Axial
Suitable for
trees etc**



Full 3D viewpoint oriented billboard

Change of basis solution

Z vector from viewpoint, pick an up vector (usually Y axis), form basis with cross products



A grid of billboards

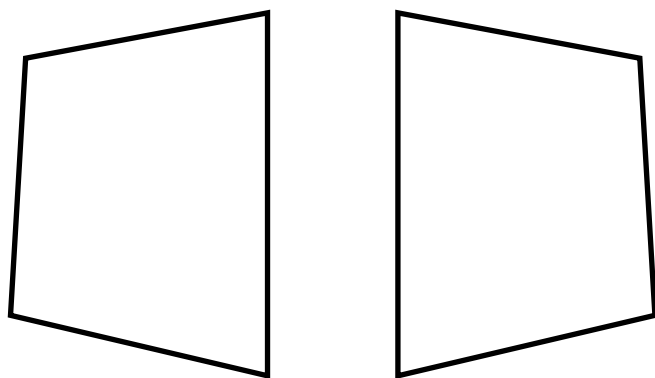
	Non-axial	Axial
Viewpoint oriented	Construct basis from camera-billboard vector	Project camera-billboard vector to XZ plane, form rotation around Y
View plane oriented	Clear rotations	Project forward vector to XZ plane, form rotation around Y

World oriented billboard not in grid

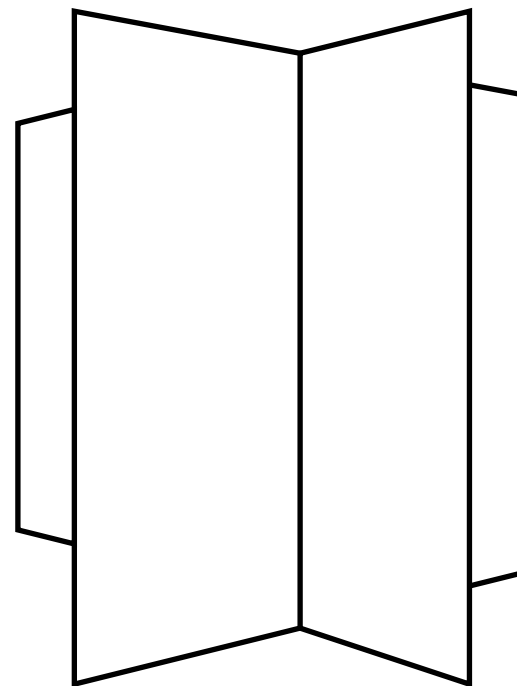


Billboard variants

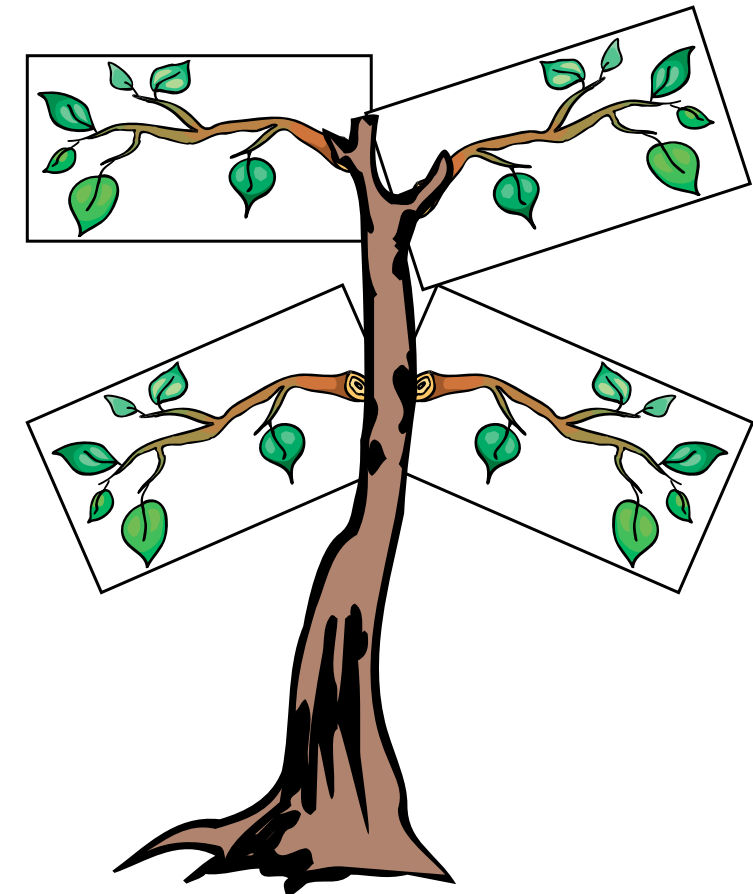
1) Always facing the camera.
One triangle or quad is enough!



2) A few polygons.
Good for world oriented billboards.



3) Multiple billboards.
Simplify complex objects
on moderate distance.





Impostors

”Live” billboards

Render to texture, update sometimes

Render as other billboards

Decide when to update

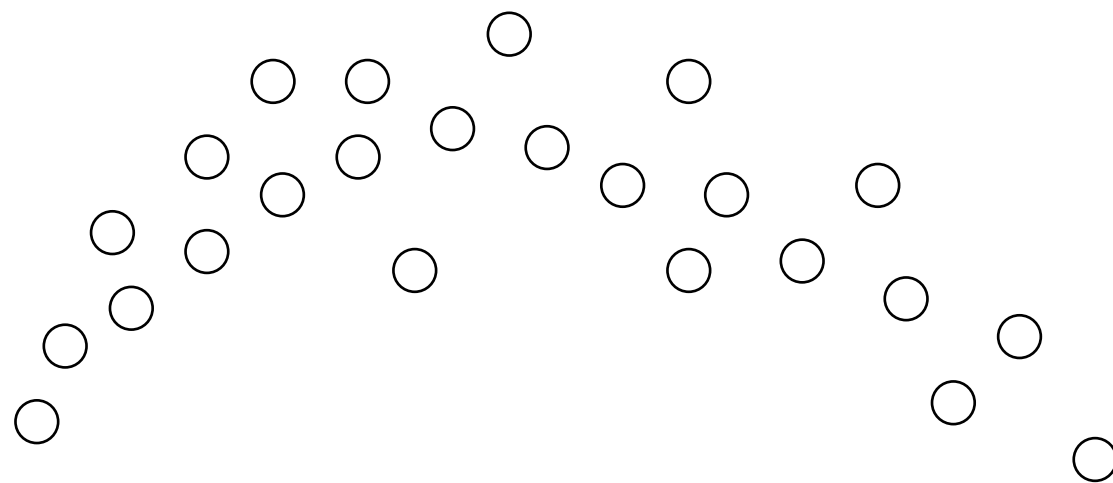


Application: Particle systems

Explosions, rain, fountains, smoke...

Excellent billboarding application

**Many small objects - good opportunities to "cheat"
with transparency problems**



**More about this in the
Animation part!**



Large worlds, conclusions

**High-level VSD to limit processing to visible parts -
start with frustum culling**

**Level-of-detail to reduce unnecessary processing of
detailed models**

**Use billboards for extreme simplification on large
distance, particle effects etc**

If we can't see the difference, use the cheaper solution!