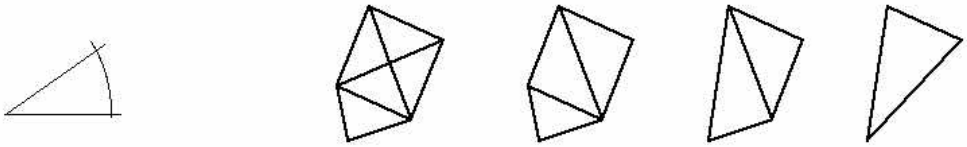
Level-of-detail LOD

Multiresolution representations
Reducing the polygon count for distant objects



Example: Stanford bunny

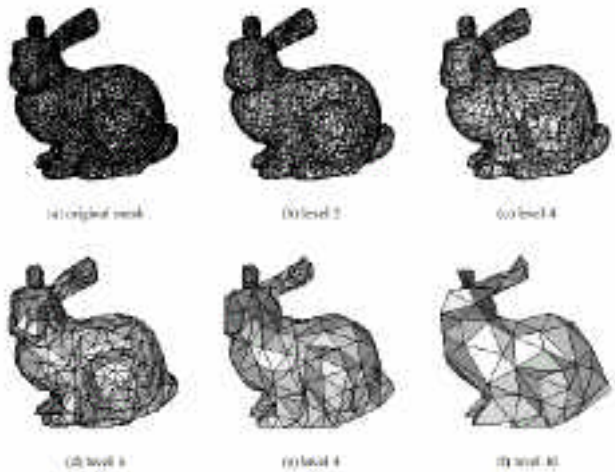


Figure 6. Stanford Bunny. Simplified meshes with 69666, 4577, 2166, 988, 403, 245 triangles

Level-of-detail LOD for models

1. Pre-generate in different detail

Risk for noticable "popping" when switching model

2. Progressive mesh

Continuous deformation, no "popping"

Non-trivial to select the polygons to reduce

At very low resolutions, we may switch to impostors (billboards)

Reduction methods

Collapse edges

Insert new vertex, remove neighbors, re-triangulate

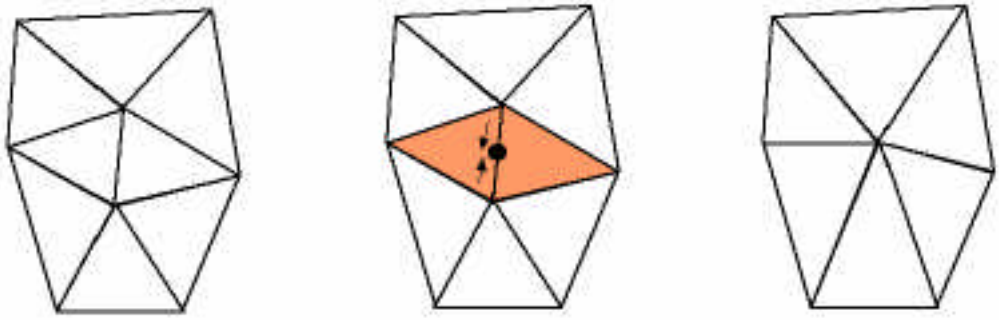
Remove vertices

Remove vertices, re-triangulate (similar)

Find neighbor polygons in the same plane (or near), and merge them.

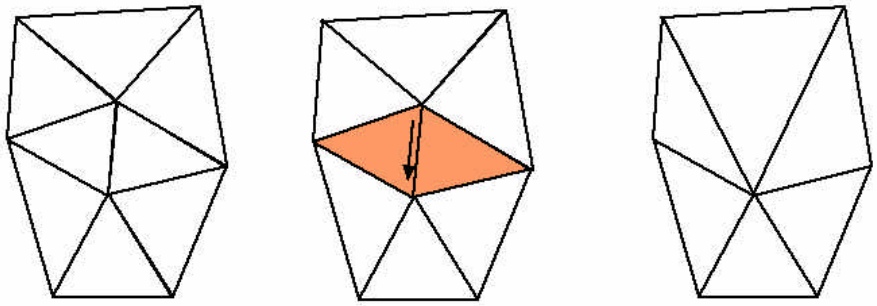
Note that only some can be progressive!

Edge collapsing



Simple - but vertex attributes (normals, texture coords) must be recalculated

Vertex removal



Simple - no recalculation of vertex attributes

Problem in LOD: volume reduction

The mesh is a sampling of a continuous surface

Careless removal or interpolation will cause errors

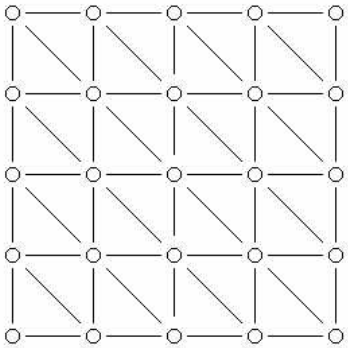
Level-of-detail LOD for terrains

Geometrical mip-mapping

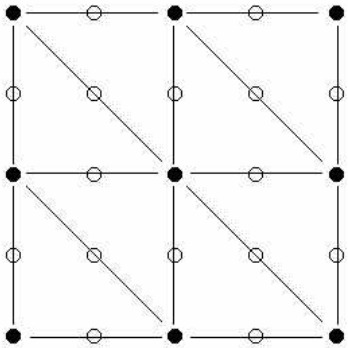
Produces a polygon terrain with approximately constant polygon size in screen coordinates

Reduces the polygon count effectively to what is actually needed.

Geometrical mip-mapping



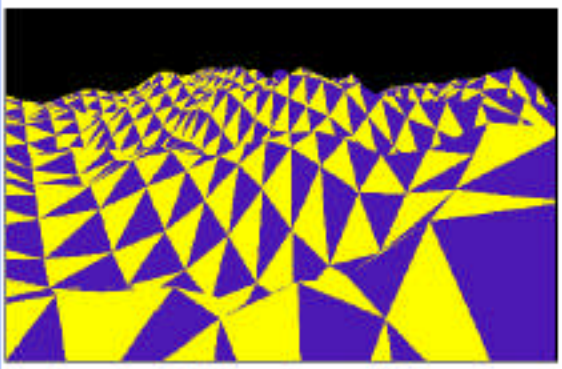
Level 0 - full resolution



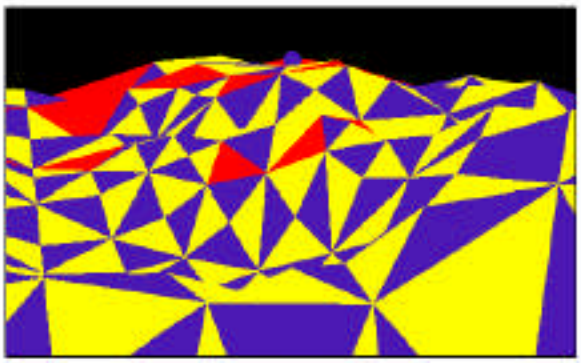
Level 1

Geometrical mip-mapping

No geomipmapping - polygon density grows with distance

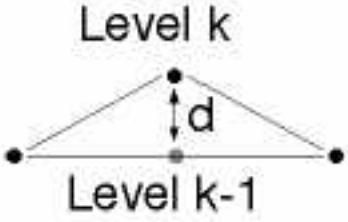


With geomipmapping - polygon density similar on all distances



Decide resolution level

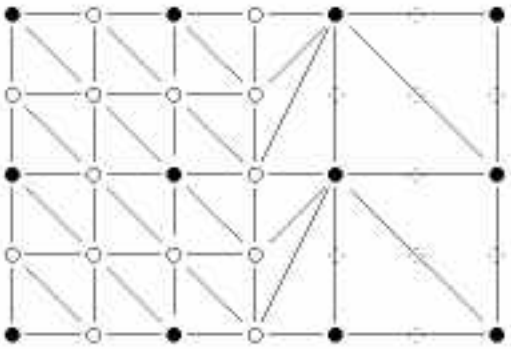
- distance
- screen-space error measures



Problems to solve in geomipmapping

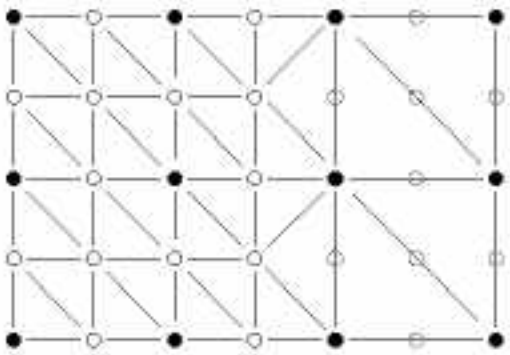
- Popping
- Gaps
- Sliding textures bug

Patching edges between different levels



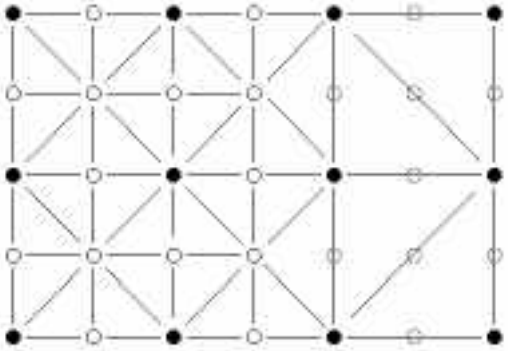
Patching edges between different levels

Second approach



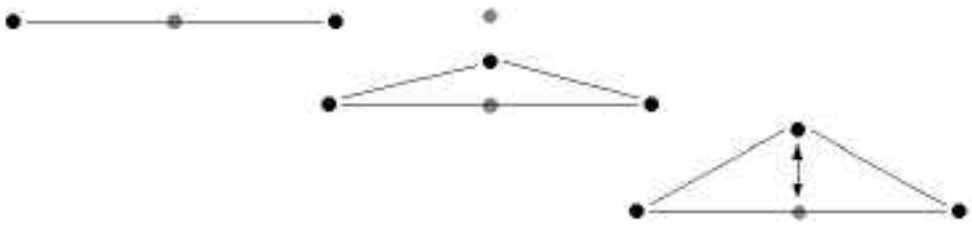
Patching edges between different levels

Ingemar's favourite

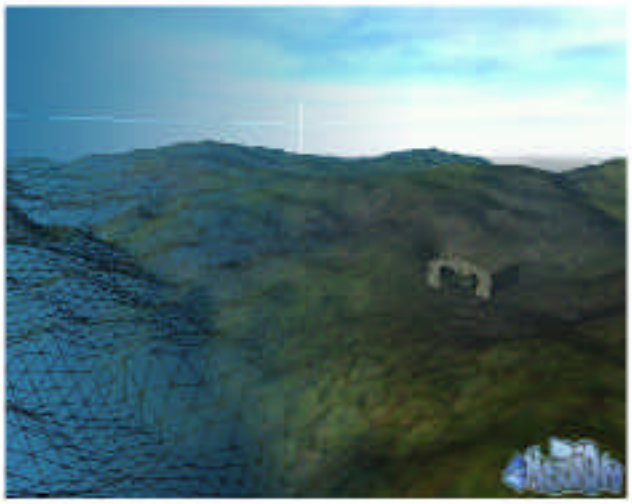


Popping is solved by "morphing" between levels.

Interpolate vertices that are close to removal with the average between neighbors



Geometrical mipmapping, example
(from paper by de Boer)



Geomipmapping

- should produce polygons with roughly the same size on all distances
- will greatly reduce polygon count on very large terrains with large “far” distance