Level-of-detail LOD

Multiresolution representations
Reducing the polygon count for distant objects

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.

Geomipmapmapping

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