Wrath Of The Titans - Complex Models With Voxel Greeble

Daniel Seddon, Tomas Zaveckas, James Kirk
Method Studios

1 Introduction

Our work on Wrath Of The Titans featured an environment on a massive scale, much of which would be destroyed or interacted with by an equally massive Titan. Shots contained multiple models with hundreds of millions of polygons each, which then needed to be shattered, whilst retaining all their detail, in an art-directable fashion. Techniques involving voxelised geometry and Ptex displacements were devised. These methods allowed for the procedural creation and reconstruction of very heavy models, without loss of detail, that could still be modified in a sculpting package after the procedural step.

Figure 1: S*tills of detailed environments from Wrath of the Titans*

2 SDF Volumes

Initially, high resolution sculpts were made, usually of several million polygons and up to about eight million. These models were then voxelised at resolutions high enough to capture all the detail.

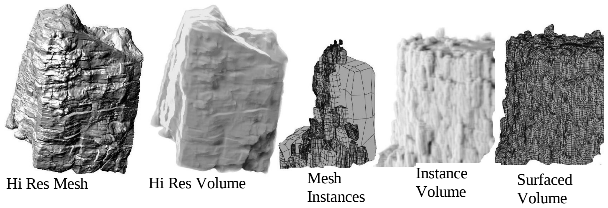

Figure 2. *High resolution sculpt and resulting voxelised model.*

A low-resolution SDF representation of each model was also generated. These SDF volumes are insufficient for capturing fine surface detail, but will be used as a starting point from which to project high-resolution detail.

3 Projecting To Ptex

Because storing a high resolution version of the model in memory would be prohibitive and would involve the equivalent of billions, if not trillions, of voxels, the model will be built by dividing the hi-res volume into tiled cells to be processed independently.

The lo-res SDF's bounds are divided up into containers, from which the faces of a low-res quad mesh are partitioned. For each container, a high resolution volume slice is instantiated and used to project its detail onto the container's faces.

The high detail volumes are projected on to the low resolution surface by progressively subdividing the surface and snapping to the isocontour. This ensures a good surface distribution and guides the high resolution surface onto the high resolution SDF.

Figure 3. P*rojection stages, from low to high resolution surface.*

If done crudely by moving along the SDF gradient, this method can result in missed surface detail. Thin protruding regions are ignored because "sinks" in the SDF create discontinuities in the gradient field, causing a jump from one point on the isocontour to another on the other side of the feature. A more elegant solution is to march along the isocontour from the vertices of the previous iteration until an approximate mid-point is reached.

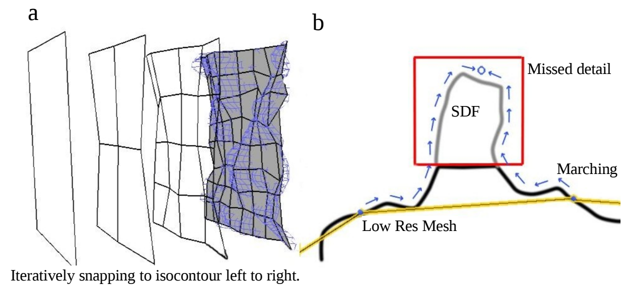

Figure 4: *a. Snapping to isocontour b. Marching to solve errors.*

The output from the tiling process is a set of high resolution chunks of the subdivided mesh. These can be combined together to create a very high resolution surface that captures all of the detail of the instanced high resolution volumes. It forms one continuous surface, derived from the low resolution input mesh. This data is now baked down to a Ptex displacement map, convenient because it does not require parametrization of the procedural mesh. From there, the lo-res mesh and Ptex can be take in to sculpting packages and further edited.

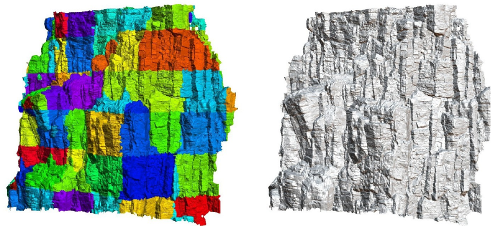

Figure 5: P*rocessing each cell creates hi res tiles which combine to form a hi res continuous surface.*

SIGGRAPH 2012, Los Angeles, California, August 5 – 9, 2012.
ISBN 978-1-4503-1435-0/12/0008