RESOLVING THE CONFLICT BETWEEN HIGH VISUAL QUALITY AND HIGH PERFORMANCE IN VIRTUAL REALITY APPLICATIONS

KEYS TO ROME PROJECT AS CASE STUDY

Mohamed Khalil, Sameh Oransa and Karim Omar

3D modeling and visual effects unit, computer graphics section

Center for documentation of cultural and natural heritage / Bibliotheca Alexandrina

mokhalil@mcit.gov.eg
<table>
<thead>
<tr>
<th>INTRODUCTION</th>
<th>CHALLENGES/ PROBLEM STATEMENT</th>
<th>PROBLEM SOLVING METHODOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Aim of the work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• What Is “Keys to Rome“ ..?</td>
<td>• Digitizing the Objects</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Optimizing the Objects</td>
<td>• What Is “Topology“ ?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Using Re-topology Technique.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Re-topology Examples</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Normal Maps</td>
</tr>
</tbody>
</table>

Resolving the Conflict between High Visual Quality & High Performance in VR Apps
INTRODUCTION

Aim of the work

The 3D unit at the Center for Documentation of Cultural and Natural Heritage (CULTNAT) aims to tackled the conflict between High visual quality and high performance in Virtual reality application by implementing a set of techniques in order to reach the highest performance and visual quality, Keys to Rome project as an example of this practice.
INTRODUCTION

Aim of the work

The challenge was on two levels. The first level was optimizing the scanned museum objects making it look realistic and in the same time small in data size, level two was the 3D scene/location were the user will navigate.
INTRODUCTION

What Is “Keys to Rome“ ..?

Keys to Rome is an international exhibition on Roman culture that was launched simultaneously in Rome, Sarajevo, Amsterdam and Alexandria on September 23, 2014.

The exhibition focused on the use of immersive virtual reality technology to present and connect these regional cultures within the Roman Empire, highlighting their diversity and commonality over centuries of Roman rule.
The main challenge was how to meet the high demands of virtual application with reference to performance while achieving high visual quality. There is an inverse relation between high visual quality and its cost on performance, date size and hardware. The challenge was to deliver the highest visual quality possible, with smooth fast performance and low data size.
Digitizing the objects

The First step was how to transform the Museum objects into zeros and ones in order to be able to process them. This was done with photogrammetric processing of digital images to generate 3D spatial data.

Photogrammetry is the science of obtaining reliable information about the properties of surfaces and objects without physical contact with the objects, and of measuring and interpreting this information.
CHALLENGES/ PROBLEM STATEMENT

Optimizing the objects

The results from Photogrammetric Processing come with a very high poly count objects even with the simplest object forms.

This cause a poor performance and the need of the highest cost hardware in order to reach acceptable performance so we need to simplify the object.

The figure show a sample for a scanned museum object “round seal cross” using Agisoft photoscan the result is a 500000 high density polygon count.
CHALLENGES/ PROBLEM STATEMENT

**Optimizing the objects**

Using simplification modifiers found in any 3D modeling program was not the efficient method because the percentage of decrease within the polygon count once exceeded a certain percentage (90%) the model deforms, producing Irreparable or the least multiple errors, fixing that would have been total waste of time.
What Is “Topology“?

Topology is the term used for the pattern of polygons that make up a mesh. People talk about ‘good topology’ for when a mesh is well made for a particular task such as animation, or ‘bad topology’ for a mesh that may result in problems in certain situations.”
PROBLEM SOLVING METHODOLOGY

Re-topology Technique

The 3D artist will be the judge on which surface to be covered by one polygon and which areas that needs several polygons, putting in mind the use of normal maps to complement the details needed to deliver visually accurate model plus normal reaction to light. The mix between the 3D low but smart poly and Normal maps generated from the high poly model plus AO maps as well as the main texture map help achieve real life scene.
PROBLEM SOLVING METHODOLOGY

Re-topology Examples

“Head of Serapis”

on the left side (A) the high poly mesh 805180 polygon count and (C) the same object in the textured state on the left side (B) the low poly mesh 8870 polygon count and (D) the textured model of the same low poly object.
PROBLEM SOLVING METHODOLOGY

Re-topology Examples
“round seal cross”

on the left side (A) the high poly mesh 500000 polygon count and (C) the same object in the textured state on the left side (B) the low poly mesh 418 polygon count and (D) the textured model of the same low poly object.

Resolving the Conflict between High Visual Quality & High Performance in VR Apps
PROBLEM SOLVING METHODOLOGY

Normal Maps

Generating normal maps for all the sophisticated elements that were optimized using re-topology like columns crowns or the scanned museum objects to complete the process of visual optimization and complement the details needed to fake the shape details missing and enhance model reaction to light,

Resolving the Conflict between High Visual Quality & High Performance in VR
CONCLUSION

Maintaining high visual quality while achieving high performance and smoothness help enrich the user experience with the application resulting in higher understanding and enjoyment of the purpose of the application.