Uncharted 2 Character Pipeline: An in-depth look at the creation of U2's characters.





Who Are We?

Rich Diamant Lead Character Artist

Judd Simantov Lead Character TD





Presentation Overview:

- Pipeline & Process Overview
- What we wanted to fix from Uncharted 1
- New challenges specific to Uncharted 2
- Outsourcing
- Conclusion
- Questions & Answers



Modeling Process:

Base Sculpt Mesh

Arbitrary Game Mesh

Texturing/Sampling

Shader Setup



Base Sculpt Mesh:

Good Topology for sculpting Uv's for texturing



Arbitrary Game Mesh:

Game Resolution Topology (As low as possible) Correct Uv's for texturing





Arbitrary Game Mesh:

Game Mesh

Base Sculpt Mesh

High Res Sculpt

OG



Texturing/Sampling:

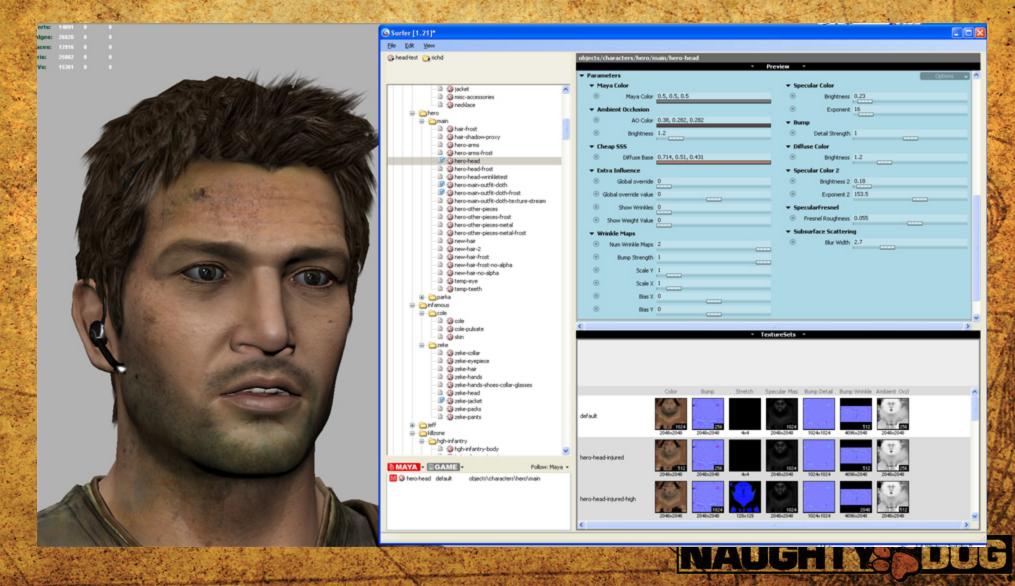
- Sample High resolution details from sculpt mesh to Arb game mesh (Normal Map)
- If high mesh was used to texture, sample color info, otherwise texture game mesh



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Shader Setup:

Create shaders and assign the maps using our custom shader tools



Rigging Process:

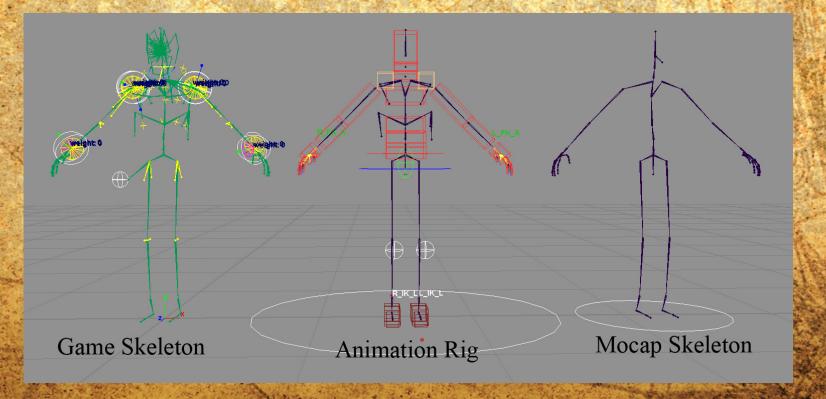
- Rig Pipeline
- Deformation & Helper Joints
- Skinning Process
- Face Pipeline





Rig Pipeline:

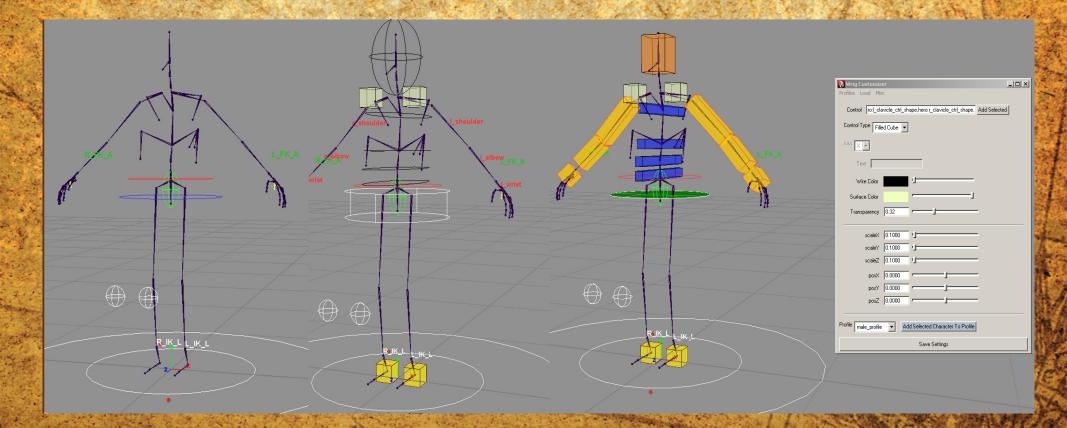
- 3 seperate skeletons:
- Skeleton Sharing: Males, Females, Children, Creatures
- All rigs have the same general orientation and naming conventions
- Main Character Joint #: 246



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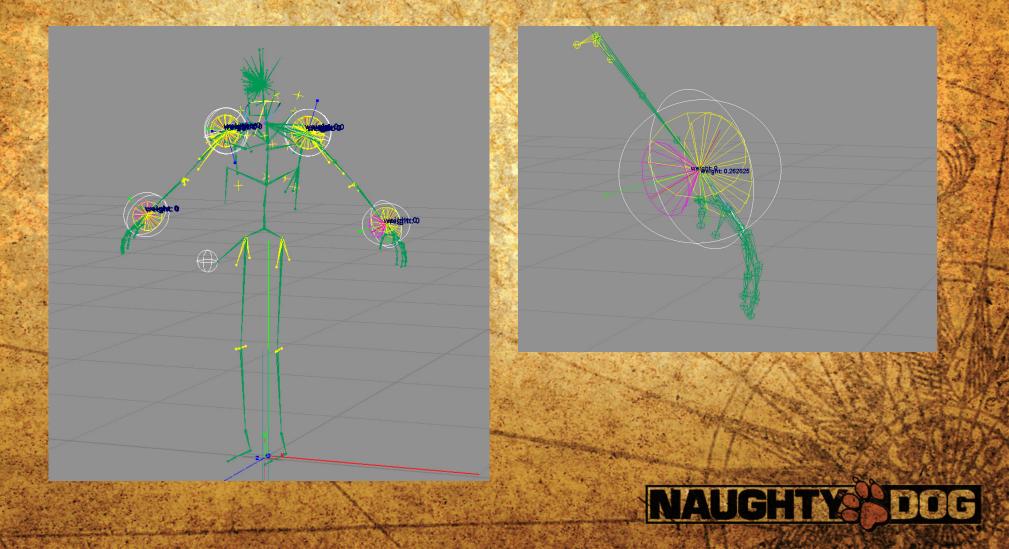
Animation Rig:

- Standard Control Setup kept simple to work with Motion Capture.
- Custom DG Node links between Motion Capture and Control Rig
- All Controls are custom openGL locators for customization



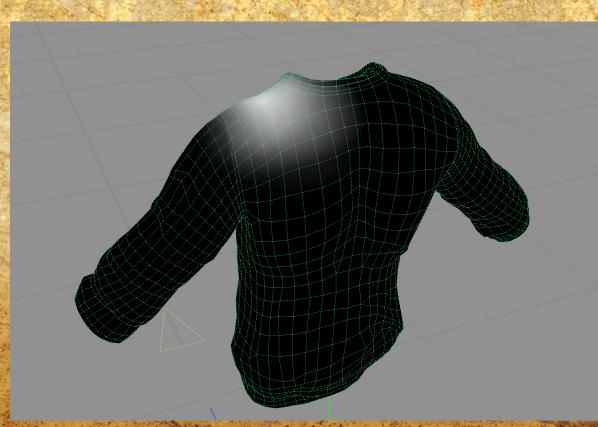
Deformation & Helper Joints:

- All deformations are joints
- Helpers are run-time Set Driven Keys no animation exported, saves memory. Limited use because of Gimbal.
- Use "Vector" cones to handle twists and more complex deformations.



Skinning Process:

- Default Linear Blend Skinning
- Use Maya's "Copy Skin Weights" to get a basic start to new meshes
- History Tool allows modelers to modify topology video
- 3-5 influences per vertex more than this becomes unmanageable.
- Use a motion capture range of motion to test the first pass, but the game itself is the best range of motion test.





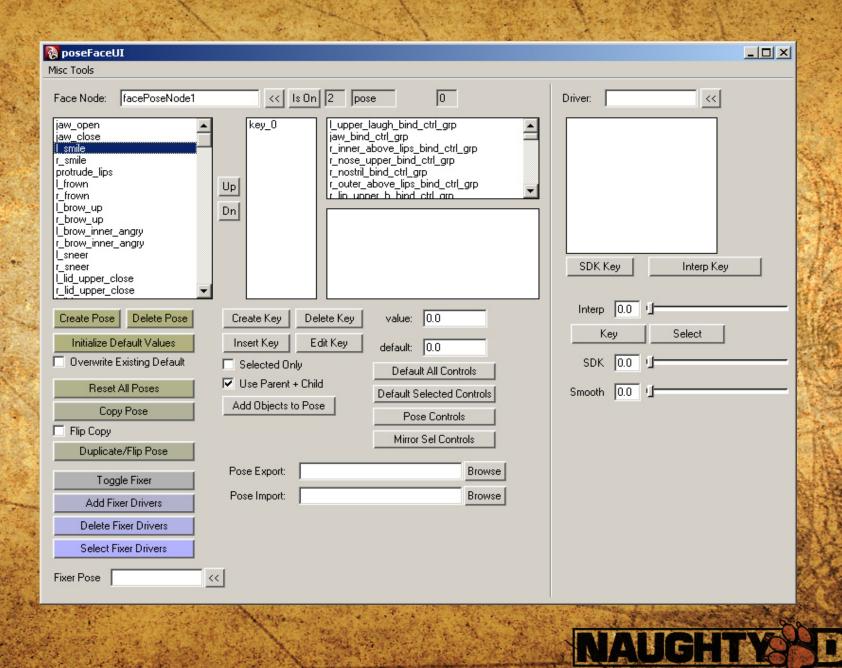
Face Pipeline:

- Face Rig is all Joints
- 97 joints in the face
- Same facial rig In-Game & Cinematics
- Custom API node to hold all the pose data and do all the backend calculations
 UI that interfaces with the node and allows you to
 - manage all the data

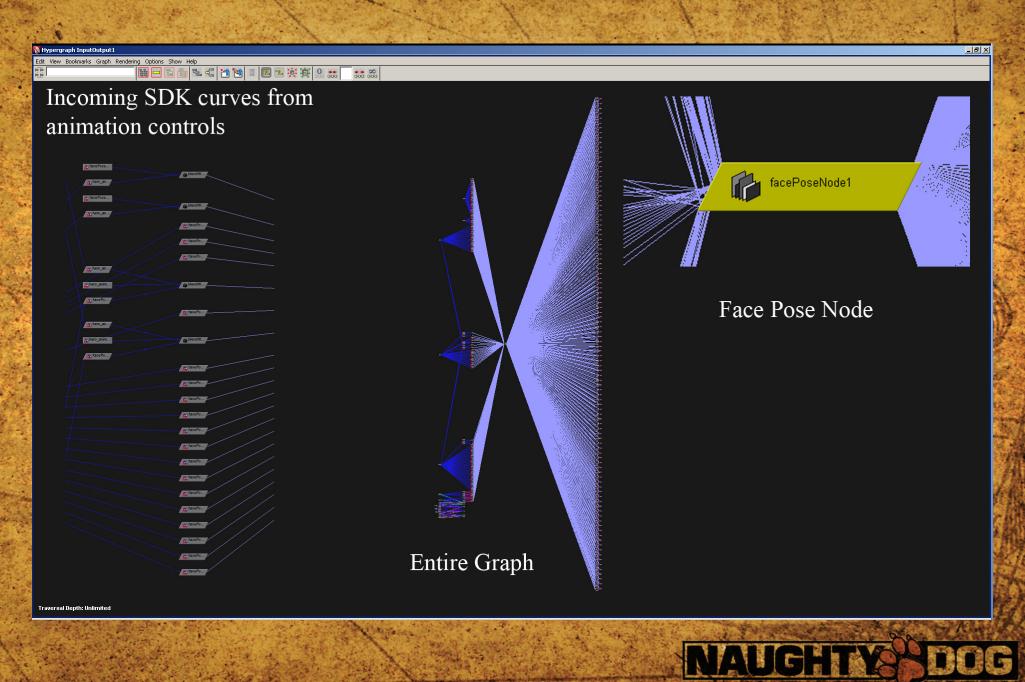




Face Pipeline:



Face Pipeline:





History Tool

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Auto Rig Builder

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PM LOD Tool

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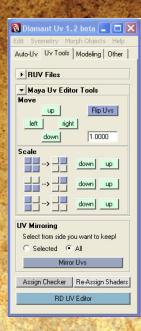
NAUGHTYSDOG

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NAUGHTYSDOG

Diamant UV:

 Very fast uv creation and editing -automatic uv generation
 -custom uv modifiers



 Transfering single uv sets to models with multiple uv sets -does not override both sets

 Realtime shrink wrapping of in game models to high res models

 Topology transferring and uv transferring from one mesh to another that has the same topology but different point order



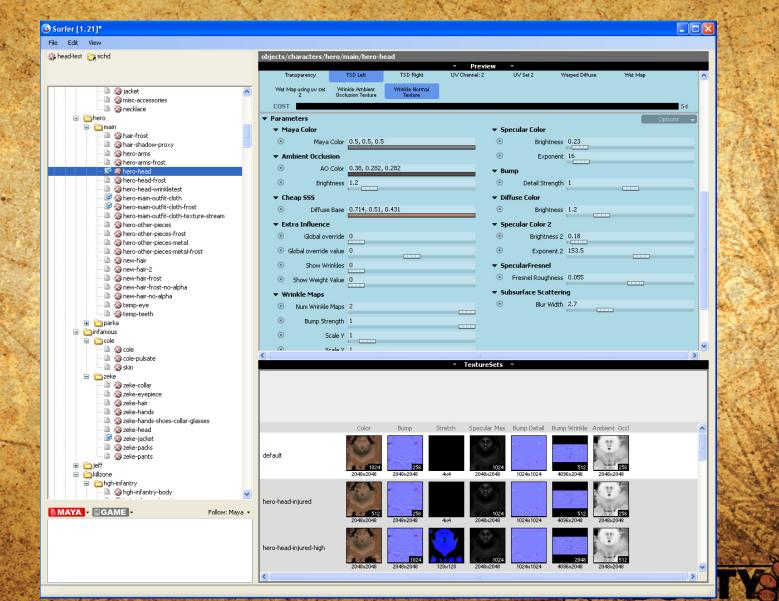


Browser:

Used to quickly browse and manage .obj files -quickly import and export multiple files at once

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Surfer



What we wanted to fix from Uncharted 1



Arbitrary Mesh Pipeline was too convoluted:

The Problem:

Uncharted 1 had two separate meshes for every part.

Problems when updating either of the two meshes which caused inconsistencies and management issues.

Major issue when dealing with the creation of wrinkle maps since the poses were created on the game mesh



Arbitrary Mesh Pipeline was too convoluted:

Partial Solution:

Used the same base head for the high res sculpt and the game mesh.

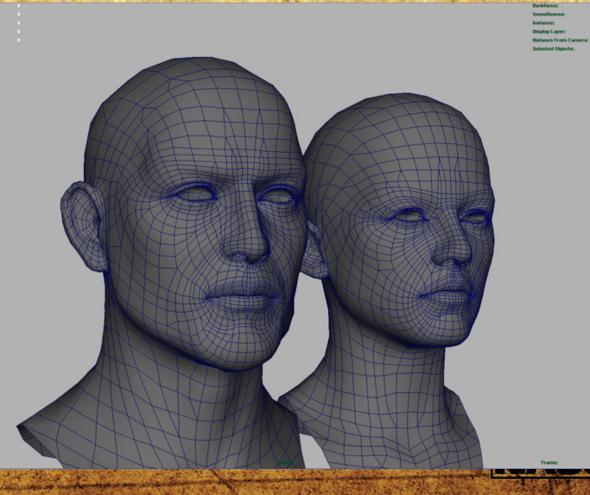
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Different topology for each of the characters heads:

Problem:

Each character had different topology

 each character had to be rigged from scratch
 creating the arbitrary game meshes took a long time



Different topology for each of the characters heads:

Solution:

- Created a standard Head mesh that every character used. (base section)
- made creating the game mesh extremely fast
- allowed us to transfer weighting to all main characters



Video: Transferring process using Diamant UV tool

🔞 Diamant Uv 1.2 beta 🔳 🗖 🔀			
Edit Symmetry Morph Objects Help			
Auto-Uv Uv Tools Modeling Other			
Topology Transfer			
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Re-topologizing game mesh :Video



Rigging Problems:





Building a rig from scratch was a nightmare:

The Problems:

We had no easy way of automating the setup.
No way of keeping consistent info across all the joints and the control setups (orientation of controls and joint orientation).

Animators can't transfer animation across skeletons.



Solution:

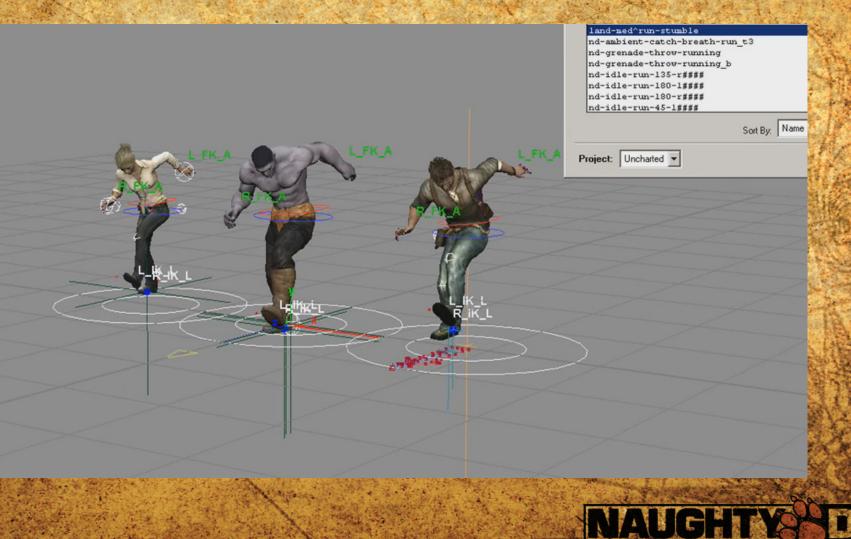
Generalized the rig setup to allow for automation.
Wrote orientation procedure that would calculate consistent orientation across all skeletons.
Created general rig control system to simply curve control creation.

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Rig Builder and Animation on different Skeletons:

Video:



Character Faces:





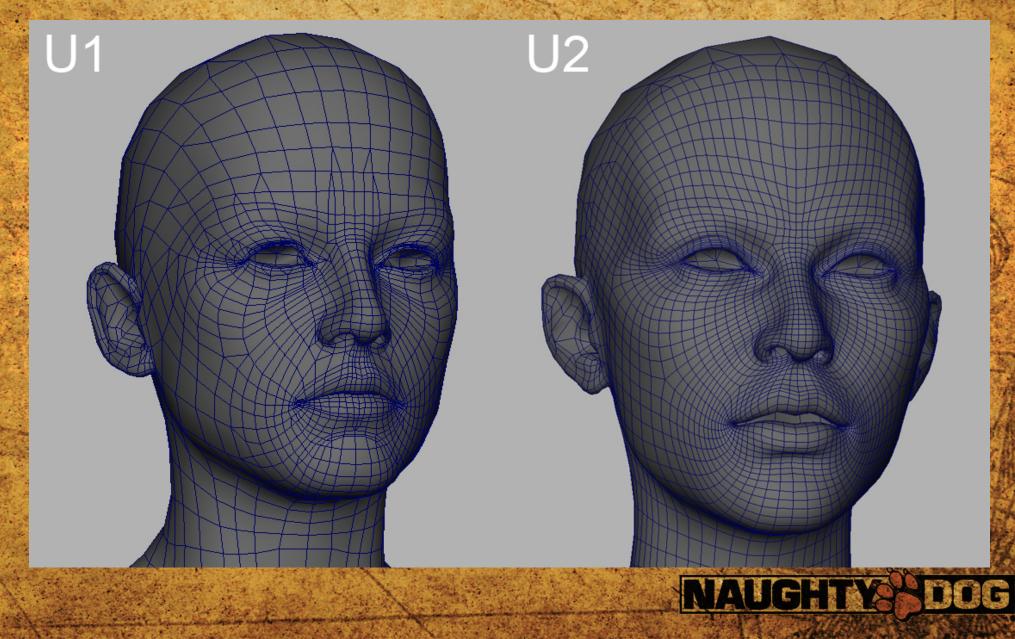


Geometry in the faces and expressions:

- Wanted to achieve a higher level of fidelity with the faces and expressions.
- Needed to add more geometry and new topology
- New facial rig with significantly more bones



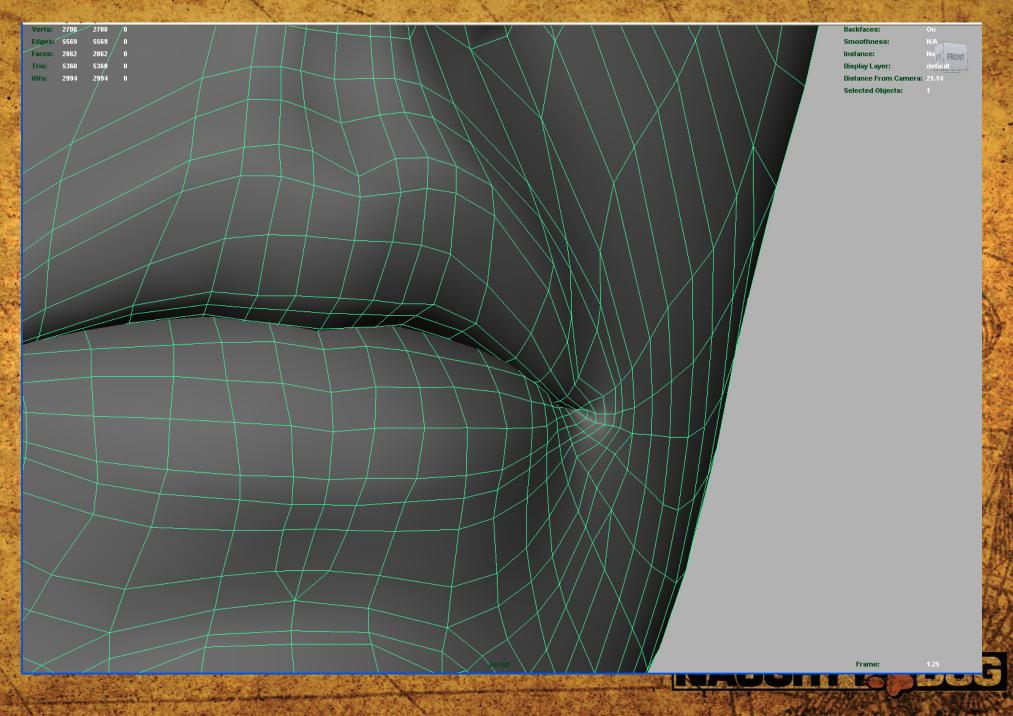
Geometry in the faces and expressions:

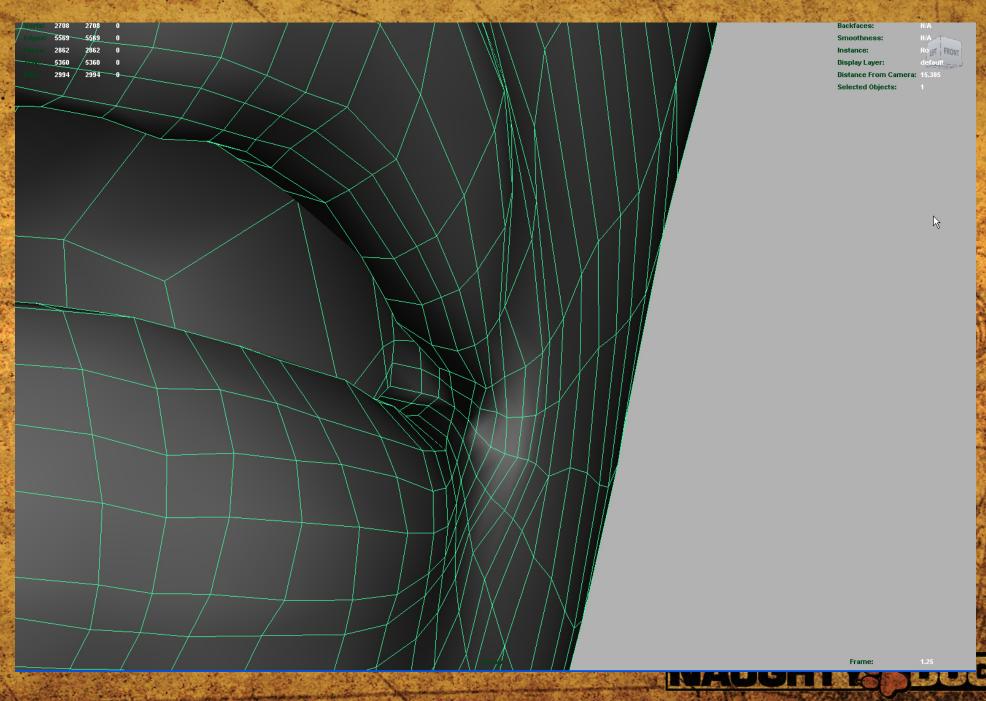


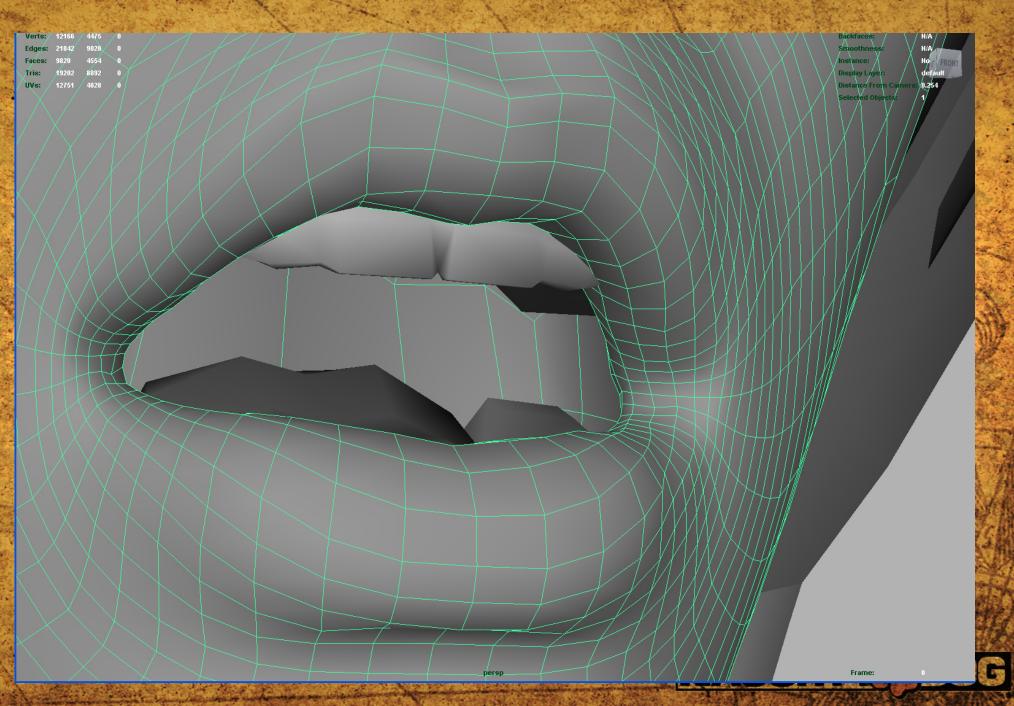
Mouth area:

- Uncharted 1's mouth area was very hard to weight and didn't look very good.
- Changed to an open mouth start pose
- Added more geometry that flowed better for deformation
- Used custom tools to smooth the noise between verts









Facial Controls:

Problem:

- Uncharted 1 had Viewport Controls
 - Animators couldn't easily see what was on and what the values are
 - Selection is annoying
 - Doesn't scale up well

Solution:

Switched to Channel Box sliders.



mouth ctrl Mouth_Overall -----Jaw_open 0 Jaw open relaxed corners 0 Jaw jut 0 Jaw left right 0 Mouth_back_forward 0 Mouth_left_right 0 Mouth _left _right _no _twist 0 Mouth_up_down 0 Close_lips 0 Tighten_lips 0 Mouth _Emotion ---L_smile 0 R_smile 0 L_frown 0 R_frown 0 Pucker_Shapes -----Pucker 0 Potrude_pucker 0 Tighten_protrude 0 Ssh_mouth 0

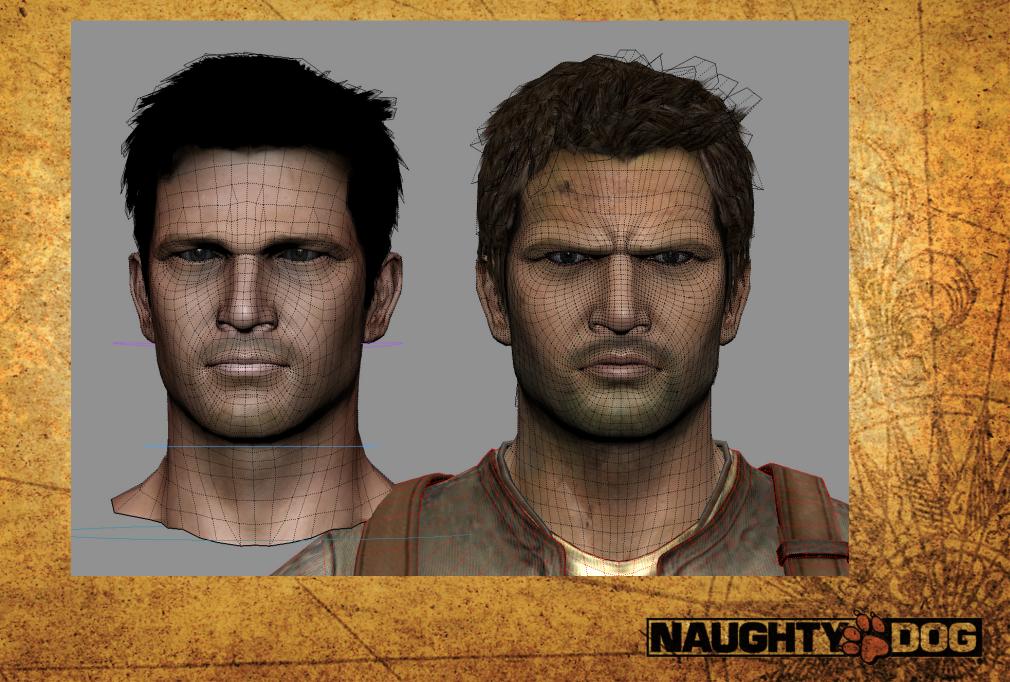


Facial Rig/Shapes:

Spent some time researching more anatomy
Try to maintain bone structure and give the feeling of skin and muscle moving over bone
Better understanding of how the face works
Give more control to the animators



Face Comparison:



Face Comparison:



Face Comparison:



Fixer Shapes:

 Use more fixers to make sure when poses come together we get more anatomically correct shapes and more appealing shapes - Video





Improve the eyes:

Uncharted 1 Eye: Not Grounded



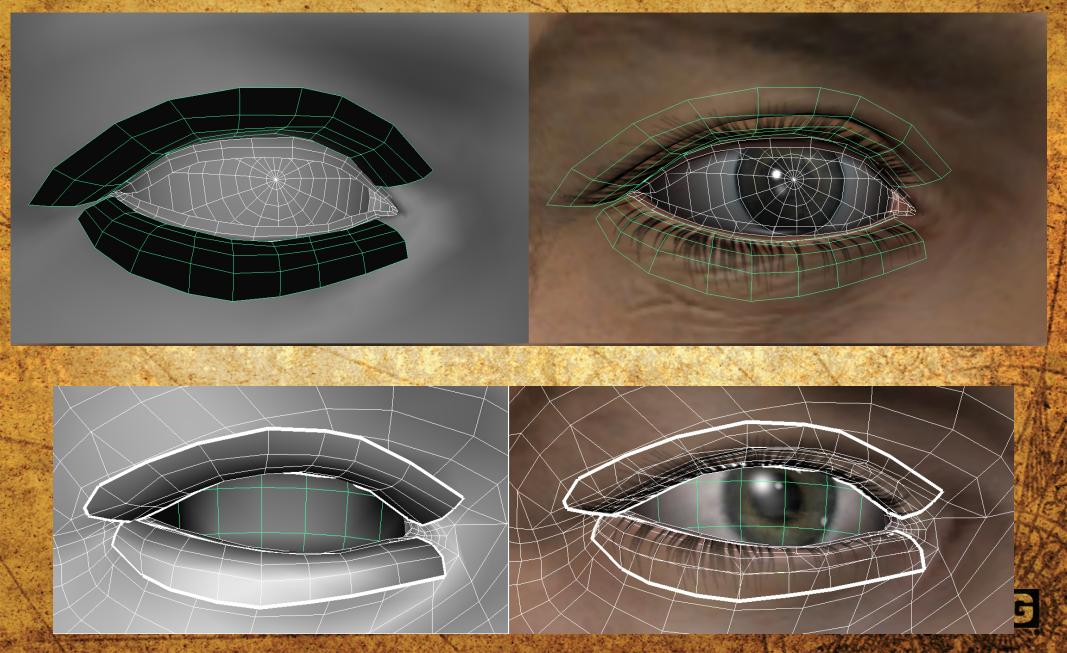


Uncharted 2 Eyes:



Improve the eyes:

Uncharted 2 Eyes





Uncharted 1

Uncharted 2



Quick iteration times between sculpting and in game:

Experimented with getting the quaded Zbrush mesh skinned quickly and in game for approval before building the game mesh.

Pros:

-we didn't go too far into the character without seeing it in game first

Cons:

-Often didn't keep track of this and had to reskin things too many times



Quick iteration times between sculpting and in game:



Quick iteration times between sculpting and in game:



New challenges specific to Uncharted 2



New challenges specific to Uncharted 2:

- LODs
- Multiplayer skins
- Optimization
- Outsourcing
- Villagers last minute
- Normals not transforming based on translation for the eyes
- Improved Hair



LODs:

Had not used lods in Uncharted 1.
Had to keep vertex sets low for Uncharted 2.
Decided to do this late in production.



LODs:

First started manually creating Lods
Used Maya PM Lod Tool to generate Lods.
Used Maya "Copy Skin Weights" from base geometry to all Lods. - Video

The Completely Unexpected









ICC

Needed Lods for each Multiplayer skin.
 Had tons of Build Assets to manage

 Separate actor for each MP skin and LODs

 One skeleton for all characters
 Needed facial animation shared



 Roughly 50 MP skins generated
 Had tons of Build Assets to manage

 Separate actor for each MP skin and LODs

mp-hero-skeleton-ghengis mp-hero-skeleton-ghengis-lod1 mp-hero-skeleton-ahenais-lod2 mp-hero-skeleton-marco mp-hero-skeleton-marco-lod1 mp-hero-skeleton-marco-lod2 mp-hero-skeleton-sir-francis mp-hero-skeleton-sir-francis-lod1 mp-hero-skeleton-sir-francis-lod2 mp-bero-sol-med-h-1a mp-hero-sol-med-b-1a-frostv mp-hero-sol-med-b-1a-frosty-lod1 mp-hero-sol-med-b-1a-frosty-lod2 mp-hero-sol-med-b-1a-lod1 mp-hero-sol-med-b-1a-lod2 mp-hero-sol-med-b-1a-v2 mp-hero-sol-med-b-1a-v2-lod1 mp-hero-sol-med-b-1a-v2-lod2 mp-hero-sol-med-b-1b mp-hero-sol-med-b-1b-frostv mp-hero-sol-med-b-1b-frosty-lod1 mp-hero-sol-med-b-1b-frosty-lod2 mp-hero-sol-med-b-1b-lod1 mp-hero-sol-med-b-1b-lod2 mp-hero-sol-med-b-2a mp-hero-sol-med-b-2a-frosty mp-hero-sol-med-b-2a-frosty-lod1 mp-hero-sol-med-b-2a-frosty-lod2 mp-hero-sol-med-b-2a-lod1 mp-hero-sol-med-b-2a-lod2 mp-hero-sol-med-b-2b mp-hero-sol-med-b-2b-frostv mp-hero-sol-med-b-2b-frosty-lod1 mp-hero-sol-med-b-2b-frosty-lod2 mp-hero-sol-med-b-2b-lod1 mp-hero-sol-med-b-2b-lod2 mp-hero-sol-med-b-3a mp-hero-sol-med-b-3a-frosty mp-hero-sol-med-b-3a-frosty-lod1 mp-hero-sol-med-b-3a-frosty-lod2 mp-hero-sol-med-b-3a-lod1 mp-hero-sol-med-b-3a-lod2 mp-hero-sol-med-h-3h mp-hero-sol-med-b-3b-frosty mp-hero-sol-med-b-3b-lod1 mp-hero-sol-med-b-3b-lod2 mp-hero-sullivan mp-hero-sullivan-frostv mp-hero-sullivan-lod1 mp-hero-sullivan-lod1-frosty mp-hero-sullivan-lod2 mp-hero-sullivan-lod2-frosty mp-hero-sullivan-lod3 mp-hero-sullivan-lod3-frosty B mp-hero-udf B mp-hero-udf-lod1 mp-hero-udf-lod2

NAIGHTY

One skeleton for all characters

 Females proportions were really hard to handle

 Needed facial animation shared - video





Optimization:

• Did not anticipate having to optimize as much

- weren't as tight on Uncharted 1.
- Vertex sets needed to be kept low.
 - o used Lods
 - combined geometry into single pieces
 - o used less shaders
 - combined textures to fit on single texture sheets
- Turned off shadow casting on smaller objects
- Turned off motion blur and other shader parameters on smaller objects



Villagers last minute:

Initially only meant to be used in the far background and not shown up close. Very last minute change to add facial expressions and up the quality for a better look.

Villagers last minute:

RD





Normals not transforming based on translation for the eyes:

Eye lids are driven by multiple joints right at the surface of the lid.

-Translation is used to transform the vertices.

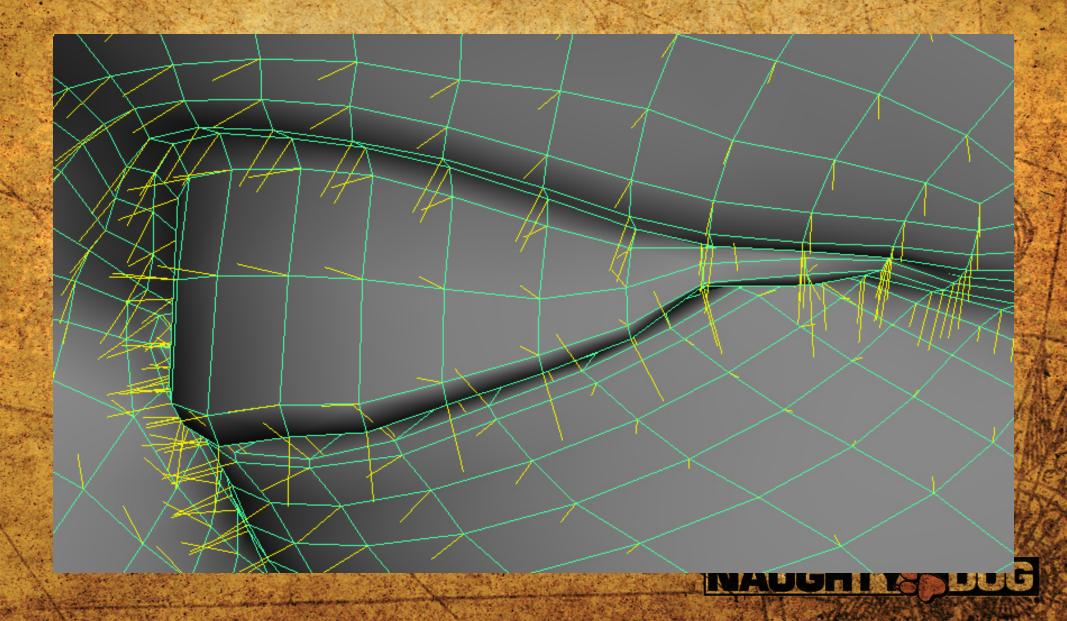
Causes artifacts due to normals not being transformed correctly.

Unavoidable due to technology limitations. -Only joint rotation modifies the vertex normal

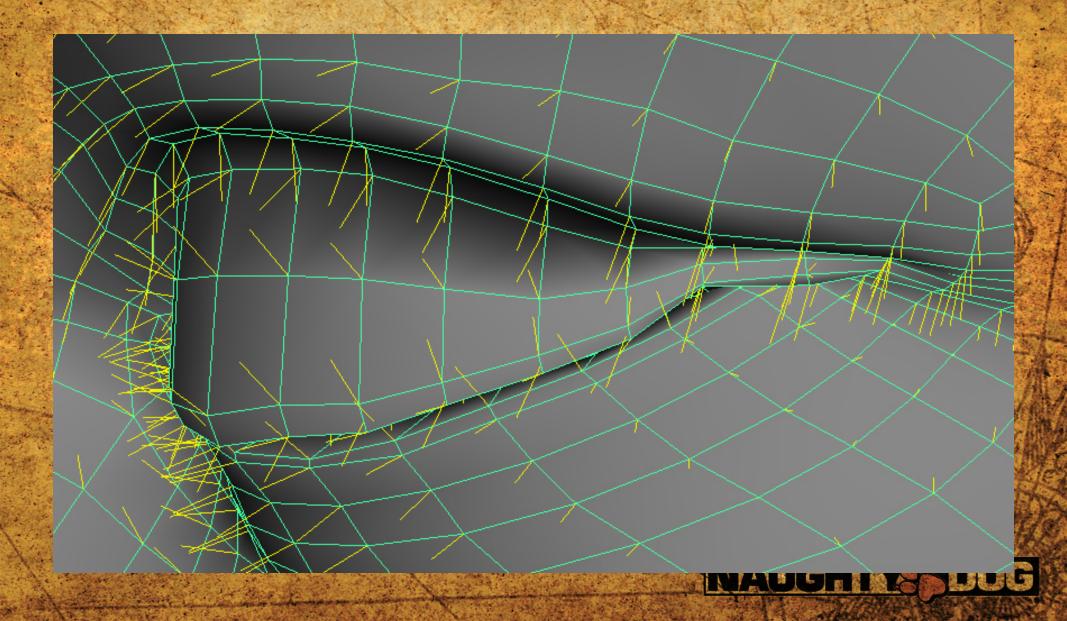
Tried some tricks which ultimately did not work.



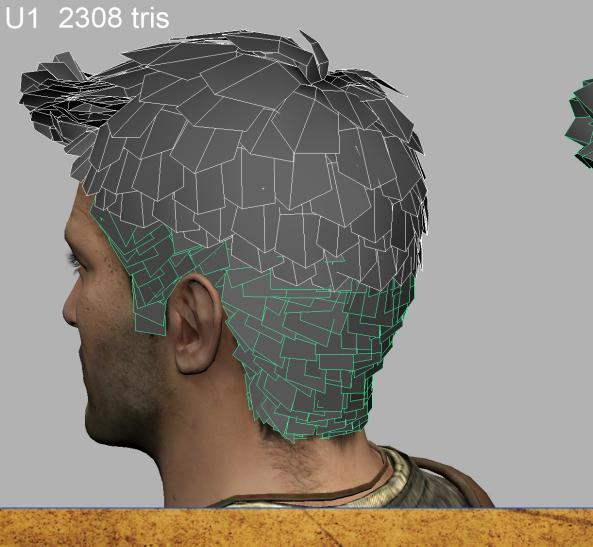
Normals not transforming based on translation for the eyes:



Normals not transforming based on translation for the eyes:



Improved Hair:

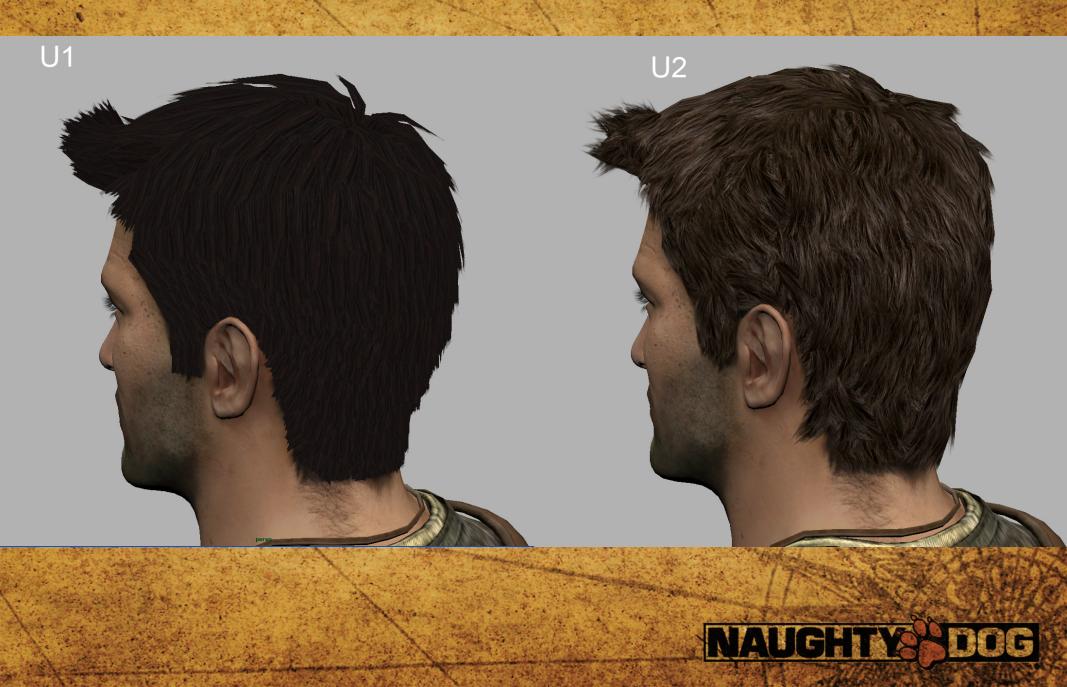


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Improved Hair:



Improved Hair:



Outsourcing:

JS



Outsourcing Characters:

- Turned out to be more work for high quality assets but was useful for smaller assets
- When things did work it allowed us to focus on the more important stuff
- We need to take the time up-front to really evaluate the companies properly
- Communication was tough at times



Conclusion:

- Better way to deal with LODs
- Possibly get rid of arbitrary mesh
- Manage actors in an easier way
 - o multiple costumes, texture sets, etc..
- Reference skinning
 - figure out a way to reference skinning information so you only update in one place

Eyes

- Eye's still feel creepy at time and don't always match the environment
- Tackling optimization earlier
- Find better solution for multiplayer faces and skeleton variation









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