CS 148 Final Project Report

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Our goal was to create a photorealistic rendering of a wallpaper inspired by the video game Dark Souls. The original image included a trio of knights, but we narrowed the scope and focused on only one knight character with his shield and sword. We modified the landscape using stone ruins, a lake, and included a smaller mushroom character to enhance the feeling of a late-night campfire.

Final Render

Reference Photo: Dark Souls Wallpaper

Variant A - Different Angle

Variant B - No Textures

Project Requirements

Ray Tracing

Lighting Techniques

The final world scene uses the light linking feature to isolate and customize the lighting on groups of objects in the environment.

- Fog
    - The fog box on the scene allows light to scatter throughout the fog and create a sense of depth and occlusion in the environment, as seen by the scattered moonlight.
- Bonfire Area and Point Lights
    - Due to the nature of how the fire effect was created, strong lights within its domain box wash out the fire's flames. To get around this, a circle of evenly spaced area lights were added to surround the fire and provide a uniform source of light to the environment. To light the items within the fire, three low power point lights were used to illuminate the sword and bones in the flames.
- Sun
    - A sun is used to light up the ground and simulate natural moonlight.

- Moon Point Light
    - A point light in the fog illuminates the fog and gives the illusion of an occluded moon behind clouds. A second point light above the lake simulates the reflection of the moon on water.
- Object front, back, and side area lights
    - The scene objects are split into groupings by location in the world and each grouping has at least a front light and a back light. These two lights help enhance warm firelight or cold moonlight to better illuminate details. Side area lights are used to balance out a softer light on the objects.
- HDRIs
    - We use two HDRIs in our scene, one HDRI (kloppenheim_07_puresky) is used for the lighting ambience and the second HDRI (Scattered Clouds Day) is used as the cloud image reference in the world background without lighting the world.

Effects of Lighting

After rendering using the Cycles engine, we see that the above techniques create reflections, color bleeding, and light scattering.

- Reflection
    - The knight armor, shield, and sword reflect the light and the hdri elements of the scene. The lake also reflects the mountain range and the moon.
- Color Bleeding
    - There is an intentional color bleeding of the camp fire onto the rest of the scene, using the orange lighting to highlight the details of our models. A more subtle color bleeding occurs from the moon's lighting, outlining and backlighting the scene elements.
- Light Scattering and Bloom
    - The fog effects in the environment allow for the scattering of elements and the creation of light bloom in the final render.
- Shadow
    - The bonfire causes the models to cast shadows onto the environment.

Main Geometry from Scratch

The majority of the models in the scene were modeled from scratch:

Ruins Models:

Ruins_Wall_Ring:

The ring of ruins was created from two cylinders combined into a walled ring using difference booleans. A deformed subdivided sphere with a cloud texture

displace was duplicated, stretched, and rotated to form a negative mask that was booleaned out of the wall.

Cobblestones:

The cobblestones are circular arrays of a single stone made from a deformed trapezoidal cube with beveled edges and smooth shading. Each ring is arrayed and rotated around a central beveled cylinder stone.

Cobblestone_Ground:

A cobblestone ground between the stones was made by grid filling a circle to create a disk shaped plane.

Knight:

Helmet:

The helmet was modeled from a sphere and shaped in edit and sculpt modes to resemble an onion form, with ridges pulled outward. Subdivision and solidify modifiers were added, the eye slit and tusks were created with booleans, and an ellipsoid sphere represents the interior head.

Pauldrons:

The pauldrons were made from mirrored planes with subdivision and solidify modifiers, then extruded and shaped using proportional edit. The ridges are scaled cross section copies of the pauldron that were solidified and joined back onto the plates.

Elbow Guards:

The elbow guards consist of a half ring, elbow bend, circular embosses, and ridges made primarily from planes (like pauldrons) and cylinders. Cylinders were shaped into triangular ridges and positioned manually to complete the ridges.

Gauntlets:

The gauntlets are composed of forearm upper and lower plates, hand plates, and a sculpted glove. The plates were built similarly to pauldrons, while the glove was sculpted from a highly subdivided sphere to resemble a closed mitt extending into the arm.

Torso:

The torso was built from stacked deformed spheres, neck cylinders, sculpted details, and booleaned dimples. Ridges were shaped from subdivided planes, and the skirt brim was extruded from a loop around the body and solidified.

Boots:

The legs consist of plate armor, cylindrical embosses, and modified sphere toes and heels. The armor plates follow the same construction as the pauldrons, while the foot shapes were sculpted from elliptical spheres.

Arms and Legs:

The arms and legs are spheres that have been sculpted using the grab, inflate, and smooth tools in the sculpting tab.

Belt:

The belt was created from a plane with subdivision and solidify modifiers, extruded around the torso. Straps and loops were extended from edges and reconnected using faces.

Shield:

The shield was made from a cut and scaled sphere with subdivision and solidify modifiers. The rim and ridges were created from duplicated geometry, and the spike is a flattened cone, all joined together with boolean operations.

Bonfire:

Ash Mound:

The ash mound was made from a subdivided plane shaped with proportional editing and refined with a subdivision modifier.

Various Bones, Ribs, Skull:

The bones were modeled from a cylinder shaped into a femur and duplicated at varying scales. Ribs were bent using a simple deform modifier, and the skull top was sculpted from a deformed sphere.

Marshmallow Model:

The marshmallow was modeled from a cube with subdivision modifiers and loop cuts, then sculpted to add organic imperfections.

Stick:

The stick is an extruded cylinder.

Trees:

The tree was created by extruding a single vertex into branches and roots, then applying skin and subdivision modifiers. Skin radii were adjusted per node using proportional edit to shape the tree.

Ground:

The ground is a subdivided plane sculpted with the grab tool to form rolling hills.

Lake:

The lake is a simple subdivided plane.

Small Mushroom Guy:

The mushroom character was imported from Thingiverse and heavily modified. The arms and legs were removed, repositioned into a sitting pose, and reattached using sculpting and boolean operations.

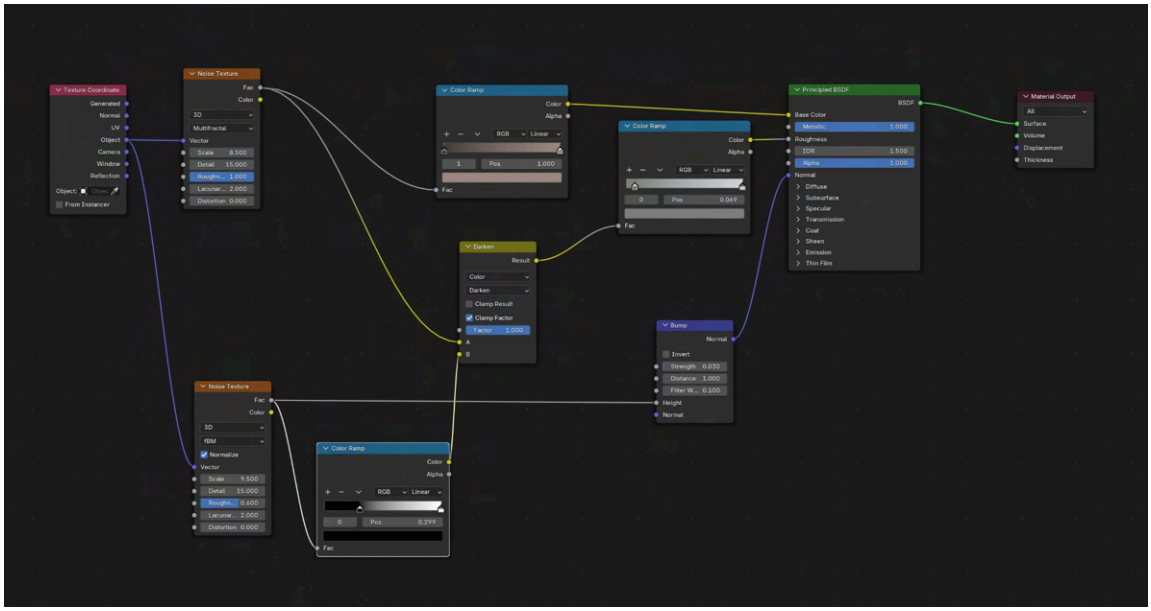
UV Mapping and Texturing from Scratch

For all models, and for textureless imported models, we used material nodes to create textures for the objects in the scene. For imported textured models, the textures were color matched using HSV nodes. Geometry nodes, texture masks, UV maps, and texture painting were used to add detail to the ground, marshmallows, and mushroom character.

UV Mapping and Texture Nodes

Dirty Metal:

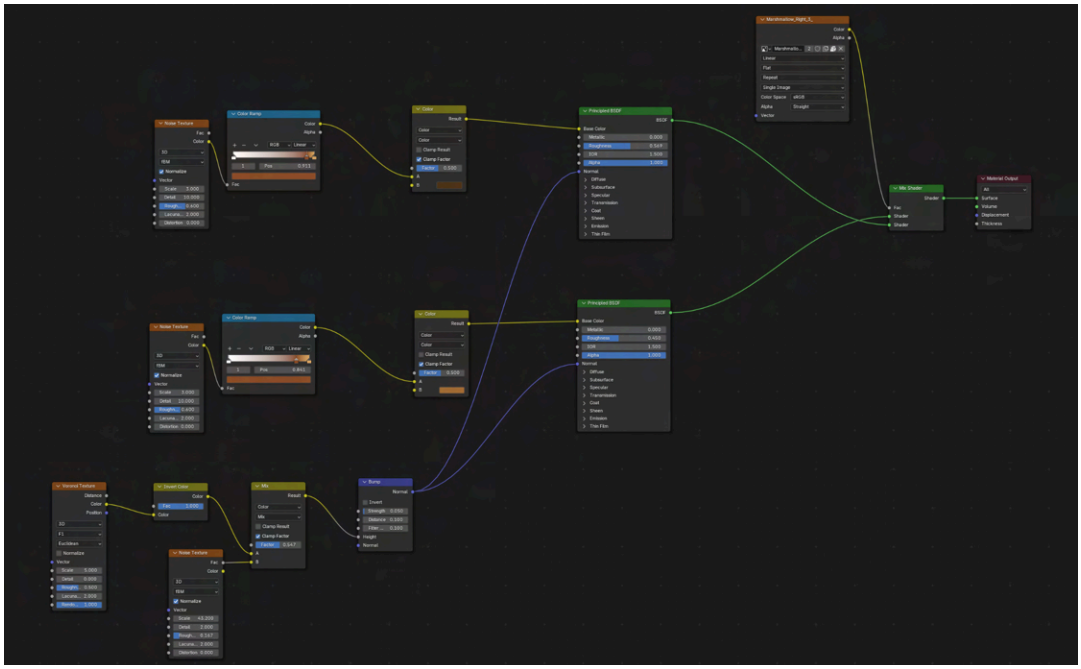
Deviations of the dirty metal texture are used for all metallic parts.



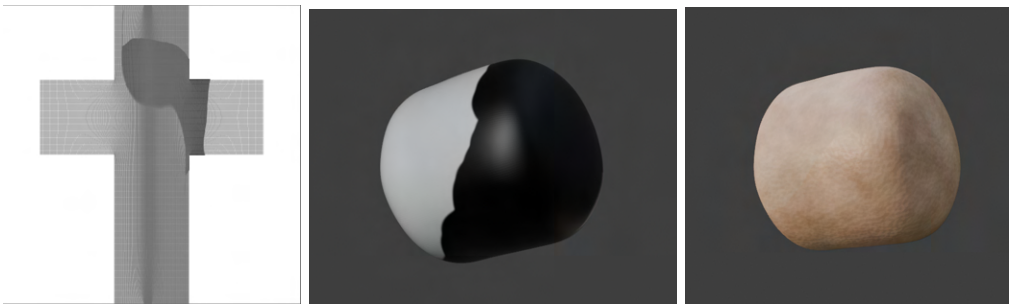
Dirty metal armor texture nodes

Cooked Marshmellow:

The marshmallow has a uv texture map to add a subtly darker noise texture.



Cooked marshmallow texture nodes



UV mapping for the marshmallows

Blender / Cycles Advanced Feature

Volumetric Fire

The fire was created using Blender's quick fire and smoke effect with a principled volume shader driving a baked physics simulation. Turbulence and color ramps were used to refine the smoke and flame edges for the final bonfire render.

Volumetric Fog

The fog was implemented using a large volumetric cube covering the scene with a principled volume shader. A cylinder was booleaned out of the volume to remove fog from the lake area.

Group Contributions

Gloria:

- Modeling trees, smores, cobblestones, ruins
- Found environment assets and laid out elements in scene
- Implemented materials and textures
- Created initial fog effects
- Optimized and set up the camera and scene composition.
- Detail work and final scene polishing

Tristan:

- Modeling the bonfire, knight, shield
- Implemented materials and textures
- Refined the lighting setup
- Optimized the volumetric effects for fog and fire simulations
- Final rendering
- Scene polishing

Imported Assets

Imported Models:

- Sword (Model) from CGTrader
  - https://www.cgtrader.com/items/1959901/download-page
- Cliff Rock (Model + Textures) from Polyhaven
  - https://polyhaven.com/a/namaqualand_cliff_02
- Boulder Variation 1 and 2 (Model + Textures) from Polyhaven
  - https://polyhaven.com/a/namaqualand_boulder_06
  - https://polyhaven.com/a/namaqualand_boulder_02
- Grasses and Shrubs Pack (Model + Textures) from
  - https://chuckcg.gumroad.com/l/joGTC
- Original Mushroom Child (Model) from Thingiverse
  - https://www.thingiverse.com/thing:2887491

Textures:

- Sea Worn Stone Tiles from Polyhaven
  - https://polyhaven.com/a/seaworn_stone_tiles
- Tree Bark from Polyhaven
  - https://polyhaven.com/a/bark_brown_02
- Ground Foliage from
  - https://chuckcg.gumroad.com/l/joGTC
- Imported Reference Images of Onion Knight from CGTrader
  - https://www.cgtrader.com/3d-model-collections/siegmeyer-of-catarina-full-armor-with-sword-and-shield-for-cosplay

HDRI:

- Kloppenheim_07_puresky HDRI from Polyhaven
  - https://polyhaven.com/a/kloppenheim_07_puresky
- Scattered Clouds Day HDRI Lighting from Poliigon
  - https://www.poliigon.com/hdri/scattered-clouds-day-outdoor-sky-hdri/3515

Tutorials

Material Tutorials:

- Dirty Metal: Procedural Dirty Metal (Blender Tutorial)
- Leather: Blender: Easy procedural leather material
- Stone: Procedural Rock Shader (Blender Tutorial)

Model Tutorials

- Tree Tutorial: Artistic Trees In Blender
- Marshmallow Tutorial: 4 MINUTE MARSHMALLOW TUTORIAL in Blender 3.0
- Scattered Grass and Foliage:
  3 Techniques To Scatter Nature in Blender (Free Assets)
- Water: How To Create Realistic Water in Blender
- Fire Still Render Tutorial: https://www.youtube.com/watch?v=rzATaYyCf9Q