



Substance Painter

# Overview

- Shortcuts
- Online Resources
- Physically Based Materials
  - Base Color
  - Roughness
  - Metal-ness (Metallic)
- Substance Painter
  - Height (grayscale) & Normal
  - Materials
  - Masking
  - Decals
  - Export Maps
- DirectX vs OpenGL

# SP Keyboard Shortcuts

## File

- **^N** New Project
- **^O** Open
- **^S** Save
- **^Z** Undo
- **^Y** Redo
- **^ Shift E** Export Textures

## Viewports

- **F1** Both 3D / UV (2D) Layout
- **F2** 3D Only Layout
- **F3** UV (2D) Only Layout
- **F5** Perspective (3D) View
- **F6** Orthographic (2D) View
- **F** Fit to view
- **M** Material
- **C** Next Channel
- **B** Next Map
- **TAB** Hide UI

## Navigation

- **Alt + LMB** Orbit (Rotate View/Cam)
- **SHIFT + ALT + LMB** Orbit SNAP
- **ALT + MMB** Pan (Move View/Cam)
- **SHIFT + ALT + MMB** Pan
- **ALT + RMB** Zoom (Scale View/Cam)
- **Shift + RMB** Pan/Orbit LIGHT

## Toolbar

- **1** Paint Tool
- **2** Erase Tool
- **3** Projection Tool
- **4** Polypaint Tool
- **5** Smudge Tool
- **6** Clone Tool
- **P** Pick Material

## Paint/Tool

- **LMB** Paint/Tool
- **Shift LMB** Straight Lines
- **^ Shift LMB** Straight Snap
- **^ RMB Drag Up/Dwn** Tool Size
- **^ RMB Drag Rt/Lft** Tool Hardness
- **^ LMB Drag Up/Dwn** Tool Flow
- **^ LMB Drag Rt/Lft** Tool Rotation
- **[** Decrease Tool Size
- **]** Increase Tool Size
- **L** Symmetry
- **D** Lazy Mouse
- **X** Invert Grayscale
- **T** Quick Mask Toggle
- **Y** Clear Quick Mask
- **I** Invert Quick Mask

# SP Keyboard Shortcuts (Print Me)

## File

- **^N** New Project
- **^O** Open
- **^S** Save
- **^Z** Undo
- **^Y** Redo
- **^ Shift E** Export Textures

## Viewports

- **F1** Both 3D / UV (2D) Layout
- **F2** 3D Only Layout
- **F3** UV (2D) Only Layout
- **F5** Perspective (3D) View
- **F6** Orthographic (2D) View
- **F** Fit to view
- **M** Material
- **C** Next Channel
- **B** Next Map
- **TAB** Hide UI

## Navigation

- **Alt + LMB** Orbit (Rotate View/Cam)
- **SHIFT + ALT + LMB** Orbit SNAP
- **ALT + MMB** Pan (Move View/Cam)
- **SHIFT + ALT + MMB** Pan
- **ALT + RMB** Zoom (Scale View/Cam)
- **Shift + RMB** Pan/Orbit LIGHT

## Toolbar

- **1** Paint Tool
- **2** Erase Tool
- **3** Projection Tool
- **4** Polypaint Tool
- **5** Smudge Tool
- **6** Clone Tool
- **P** Pick Material

## Paint/Tool

- **LMB** Paint/Tool
- **Shift LMB** Straight Lines
- **^ Shift LMB** Straight Snap
- **^ RMB Drag Up/Dwn** Tool Size
- **^ RMB Drag Rt/Lft** Tool Hardness
- **^ LMB Drag Up/Dwn** Tool Flow
- **^ LMB Drag Rt/Lft** Tool Rotation
- **[** Decrease Tool Size
- **]** Increase Tool Size
- **L** Symmetry
- **D** Lazy Mouse
- **X** Invert Grayscale
- **T** Quick Mask Toggle
- **Y** Clear Quick Mask
- **I** Invert Quick Mask

# Online Resources

## ***Substance3D - Academy***

- ***Painter (all the playlists)***
  - <https://academy.substance3d.com/search?software=substance%20painter>
- ***Painter - Getting Started (playlist)***
  - <https://academy.substance3d.com/courses/getting-started-with-substance-painter-2018/youtube-IGGQI9kVB1M>
- ***The PBR Guide***
  - <https://academy.substance3d.com/courses/the-pbr-guide-part-1>

## ***Painting Height & Baking Maps***

- Scifi Crate Project 02: Painting Height
  - [https://www.youtube.com/watch?v=n5\\_bwLc3oYU&list=PLB0wXHrWAmCx994Cb7iRFSmupYHFW5DTx&index=25](https://www.youtube.com/watch?v=n5_bwLc3oYU&list=PLB0wXHrWAmCx994Cb7iRFSmupYHFW5DTx&index=25)
- Scifi Crate Project 03: Baking Maps
  - <https://www.youtube.com/watch?v=0M6PDzxJtWY&list=PLB0wXHrWAmCx994Cb7iRFSmupYHFW5DTx&index=26>
- Substance Painter Shortcuts
  - <https://support.allegorithmic.com/documentation/display/SPDOC/Shortcuts>

# Online Resources

## *Optional: More Online Training*

- Scifi Crate Project 04: Painted metal base material
  - <https://www.youtube.com/watch?v=rsW-0rqc0y0&list=PLB0wXHrWAmCx994Cb7iRFSmupYHFw5DTx&index=27>
- Scifi Crate Project 05: Metal base material
  - <https://www.youtube.com/watch?v=PV9OhCH2HW8&list=PLB0wXHrWAmCx994Cb7iRFSmupYHFw5DTx&index=28>
- Scifi Crate Project 06: Completing the crate bottom textures
  - <https://www.youtube.com/watch?v=4T-lak1BSN4&list=PLB0wXHrWAmCx994Cb7iRFSmupYHFw5DTx&index=29>
- Scifi Crate Project 07: Completing the crate top textures
  - <https://www.youtube.com/watch?v=-4lupCezQak&list=PLB0wXHrWAmCx994Cb7iRFSmupYHFw5DTx&index=30>
- Scifi Crate Project 08: Adding decals
  - <https://www.youtube.com/watch?v=D6VfbveCfOU&list=PLB0wXHrWAmCx994Cb7iRFSmupYHFw5DTx&index=31>

# Physically Based Materials (PBM)

# Physically Based Materials

- Engine approximates what light *actually* does as opposed to approximating what we intuitively think it should do
- Work equally well in all lighting environments
- Material values can be less complex and interdependent; more intuitive interface
- **PBR** = Physically Based Rendering
- **PBS** = Physically Based Surfaces

# How do we see things around us?

Most everything we see is because rays of light hit and bounce (reflect) off the surface of an object and then go into our eyes.



**Diffuse Reflection** (rough surface) = scatters light

**Specular Reflection** (smooth surface) = light stays focused

# Metals and Insulators

**Insulators** = have a pronounced diffuse scattering and weakly expressed specular (plastic, fabric, wood, concrete, paint and so on); scattering allows us to see the red plastic is red. Reflections appear as a glare on the surface

**Metals** (steel, iron, gold, copper, brass, silver, etc.) = have no diffuse scattering (diffusion is always black), but clearly marked colored reflection. Copper has a black diffusion and strong reflection of red color. Gold has a black diffusion and a bright yellow reflection. Silver has a black diffusion and bright white reflection.

DIELECTRICS



METALS



# What is Albedo?

This is the amount of energy of the reflected and scattered light. Roughly speaking, it is the BASE color -- the color of the surface material that we see, whether it is insulator or metallic



# Energy Conservation

Simply put, the higher the intensity of the reflection, the lower the intensity of the diffuse scattering. That's because the sum of both diffuse and reflection scattering intensity can not exceed the intensity of the ray of light that fell on the surface

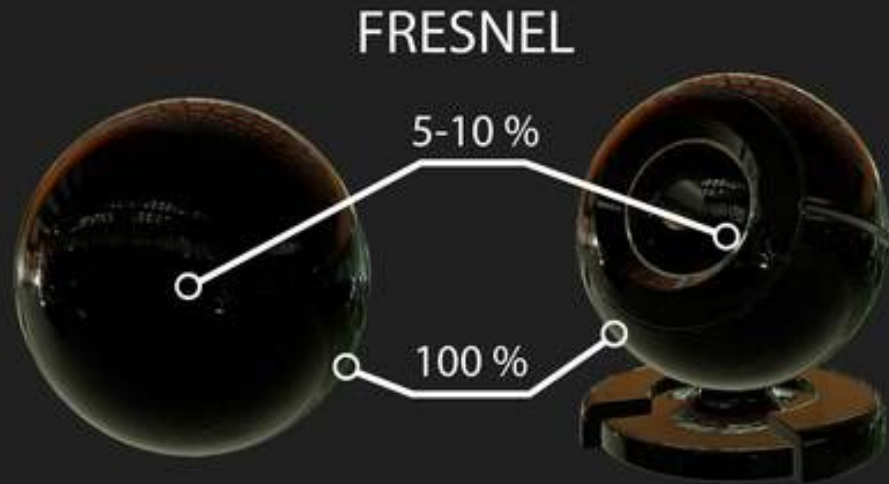
## ENERGY CONSERVATION



# What is Fresnel effect?

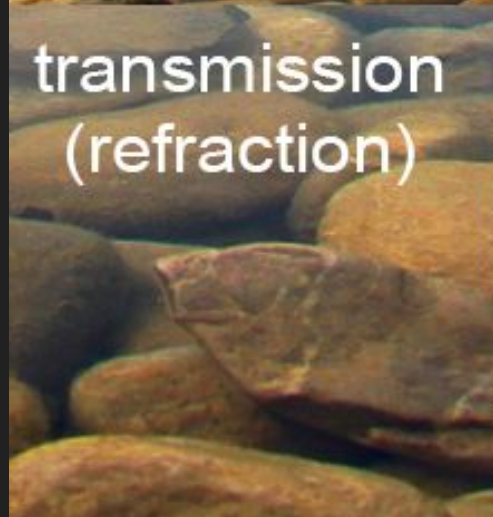
The smaller the angle of incidence of light on the surface, the stronger the reflection

All materials in the nature have this effect. Interestingly, at 0 degrees all materials reflect 100 percent of light, but reflection appearance suffers because of the complex surface structure.

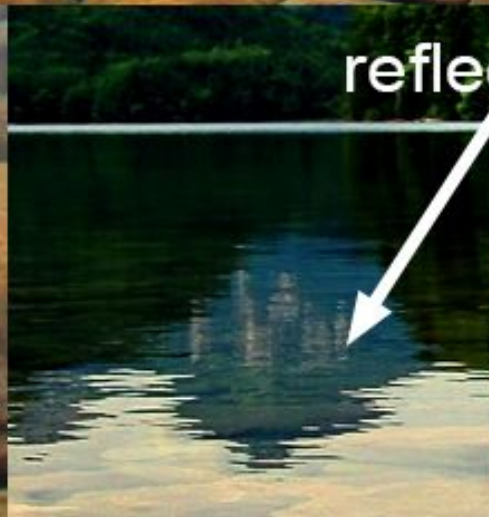


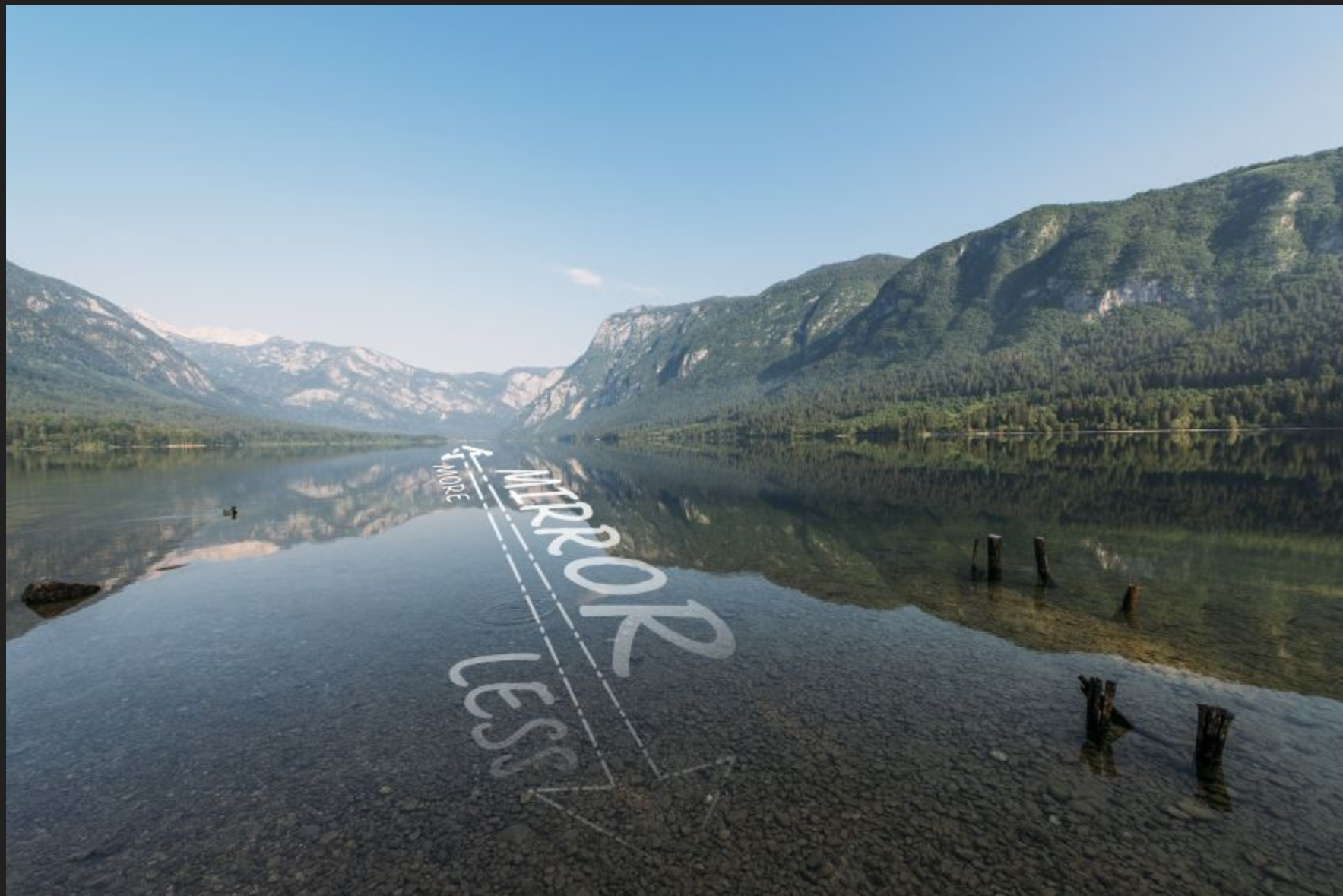


transmission  
(refraction)



reflection









Surface on the LEFT, roughness = 0 (has a specular reflection)  
Surface on the RIGHT, roughness = 1 (has a diffuse reflection)

# Roughness

Micro-relief, tiny pores, depressions or tiny scratches only visible under a microscope cause the effect of surface **ROUGHNESS** & the reflection looks blurred. If perfectly smooth, the reflection is perfectly clear.



# What do Artists do with all this Physics?

**Albedo:** RGB texture defining surface color

**Metalness:** Grayscale texture... black pixels = insulator surface; white pixels = metallic surface (gray = in between)

**Roughness:** Grayscale texture where the lighter the pixel the more *blurred (diffused)* the reflection will be

## TEXTURES FOR METALNESS WORKFLOW

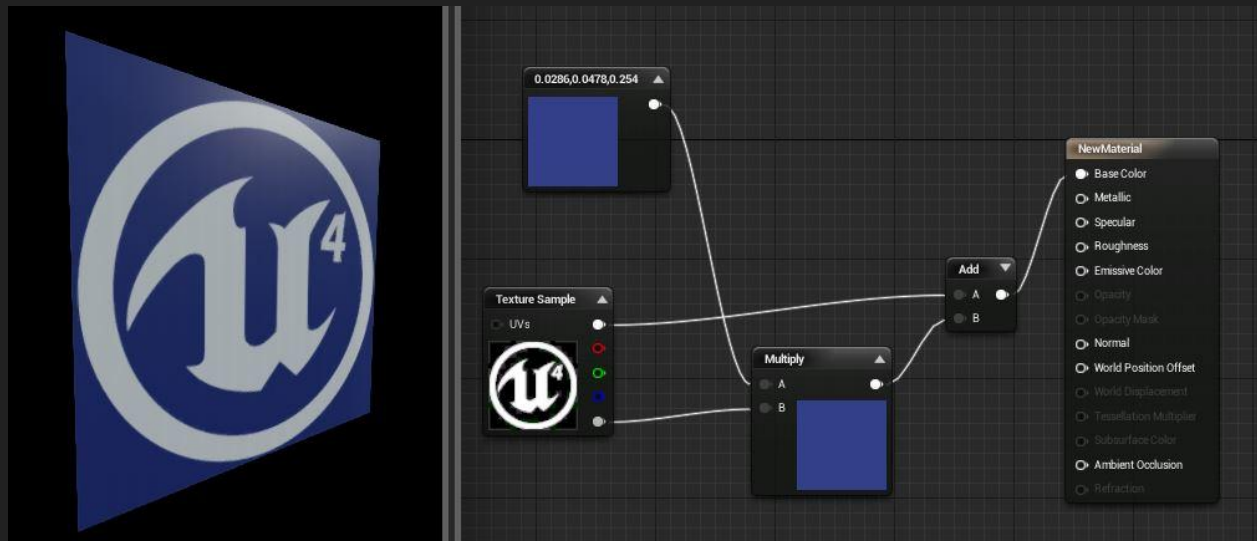


# Unity Material Parameters

- **Base Color** = overall color (aka Albedo)
- **Opacity** = how much env you can see
- **Metallic** = controls how metallic (or non-metallic)
- **Smoothness** = controls how smooth (or rough)
- **Normal** = controls illusion of surface “height”
- **Emissive** = controls how much your surface emits light or “glows”

# Base Color

- Controls overall color of the Material
- Uses ConstantVector3 (RGB) value
- Clamped btwn 0-1



# Roughness

- Controls how ROUGH the surface is
- Determines the reflection's fuzzy or sharpness
- Uses a value range (0-1)
  - Roughness of 0 (smooth) is a mirror reflection
  - Roughness of 1 (rough) is completely matte or diffuse.
  - Can be a CONSTANT (0-1) value expression
  - Frequently used with a GRAYSCALE image

Non-Metal



Metal



# Metallic

- Controls how "metal-like" your surface will be
  - Non-metals have Metallic values of 0
  - Metals have Metallic values of 1
  - Pure surfaces (pure metal, stone, plastic, etc.) value will be 0 or 1, not anything in between
- When creating hybrid surfaces like corroded, dusty, or rusty metals, you may find that you need some value between 0 and 1.



Substance Painter



# Toolbar

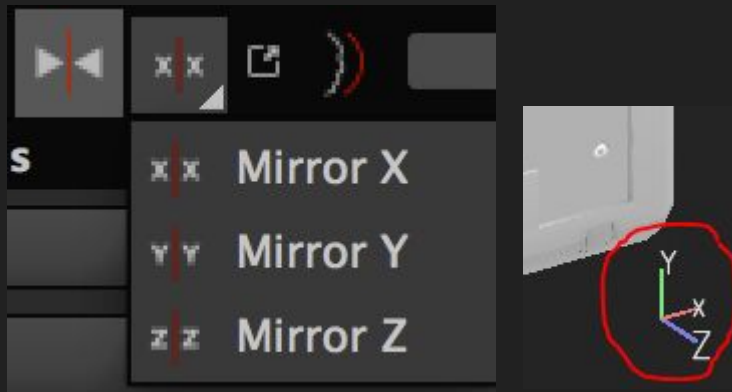


<https://support.allegorithmic.com/documentation/display/SPDOC/Toolbar?src=contextnavpagetreemode>

- Substance Source Website & Substance Share Website
- **1** Paint
- **2** Eraser
- **3** Projection
- **4** Polyfill
- **5** Smudge
- **6** Clone
- **P** Pick Material
- **L** Symmetry
- Viewport Layout [ **F1** (3D/2D); **F2** (3D only); **F3** (2D only) ]
- Camera Tools [**F5** Perspective View; **F6** (Ortho View)]
- **F10** iRAY (rendering)
- **D** Lazy Mouse

# “L” Symmetry

Choose on which axis you want to use a symmetry when performing brush strokes



**NOTE:** In Substance Painter, **Y = UP**

- X = Left/Right
- Y = Up/Down
- Z = Front/Back

The Axis Stick (Arrow-Head) points towards POSITIVE

# “D” Lazy Mouse



- Adds a distance behind your current brush.
- Creates a delay that allows more precise brush strokes
- The distance can be changed with the slide next to the button
- The distance is computed in screen-space



# Substance Painter Workflow

## ***3DS MAX***

- Build the asset (low poly)
- Unwrap the asset (low poly)
- Smoothing Groups
- Build the high poly (for Normal & AO maps)
- Export the asset & the high poly

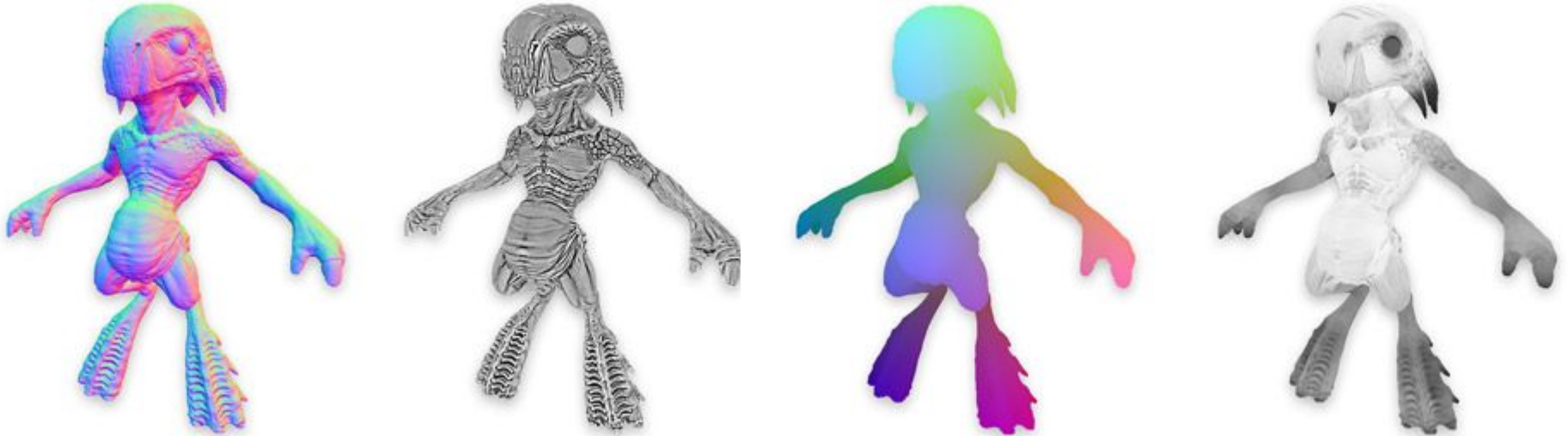
## ***SUBSTANCE PAINTER***

- Import the asset & the high
- **BAKE** the NORMAL
- Add **HEIGHT** & new NORMAL data
- **BAKE *other*** maps (Worlds Space, AO, Curvature, Thickness, Position, etc)
- Add **MATERIALS** (using Masking) & Decals
- **EXPORT** maps for the game engine (UE4 or Unity)

# Baking (Texture Maps)

- **Normal** = create a normal map from HP
- **Ambient Occlusion** = uses HP to compute the occlusion into a map
- **ID** = reads the material color from the HP (only works for FBX files)
- **World Space (Normal)** = If a normal has been baked, it will be used in addition to the low-poly mesh to compute the world space normals.
- **Curvature** = stores concave and convex data from HP
- **Position** = stores relative poly positions within model
- **Thickness** = stores relative thickness within model

# Baked Maps



# Painting HEIGHT vs NORMAL

**Normals (color)** -- can't just paint B/W & Grayscale; must use some pre-baked images or brushes from existing libraries of baked normal data = less flexibility

**Height (grayscale)** -- you have more blending options; ultimately converted to normal, so you *can loose* a *LITTLE* quality (main reason they added implemented the normal channel)

# Masking

Non-destructive texture creation is the concept that...

*At no point in your workflow do you make a permanent, non-reversible change to any information upstream*

Using MASKED layers allows you to...

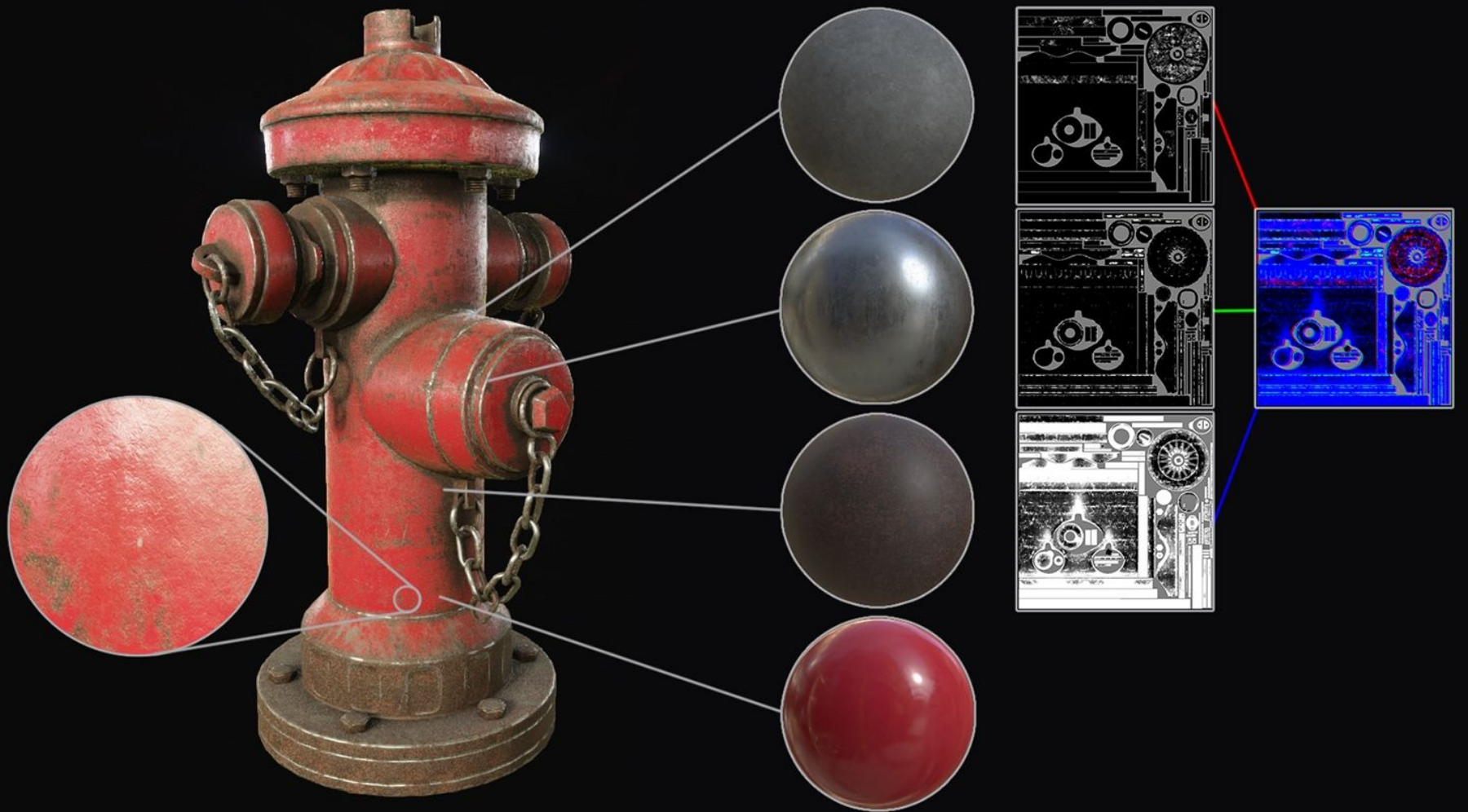
- keep the layer content intact
  - Erasing destroys the layer content. MASKS keep layer content intact
- selectively place the texture on the model
  - Once you have **painted** an area, you can't select that area in programs like Substance Painter.
  - MASKS can be selected and modified, keep layer content intact

# Quick Masking

Allows you to mask parts of your mesh you don't want to paint on. (Works like masking in ZBrush)

- **T** = switch to quick mask edit mode, this will allow you to paint a temporary mask.
- **T again** = switch back to your previous tool and paint across that mask.
- **Y** = reset/disable the mask.
- **I** = invert the mask while in quick mask edit mode.

# Smart Materials



# Export

Substance Painter exports the result of a project as *bitmap textures*.

- <https://support.allegorithmic.com/documentation/display/SPDOC/Exporting+textures>

Use an export *preset* to “pack” the output textures in a specific configuration

- **PBR MetalRough** : Name and export textures needed for a regular Metallic/Roughness PBR workflow
- **Unreal Engine 4 (Packed)** : Name and pack textures to be used in the Unreal Engine 4 with the less memory footprint possible.

# OpenGL vs DirectX Normal Maps

- OpenGL
  - Used in **Unity** game engine
  - Green Channel = White on top
  - White to Black for “V” offset
- DirectX
  - Used in **Unreal** game engine & **Substance Painter**
  - Green Channel = Black on top
  - Black to White for “V” offset

