PHOTOREALISTIC TEXTURING

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Physically-based shading is a technique that, if thoroughly defined, is the closest approach of the reality in real-time rendering nowadays. The term is bandied around the primary fundamentals of the behavior of light and matters and can be referred to as physically based rendering (PBR) or physically based shading (PBS). The ultimate goal of the textures is to describe the individual parameters of how the surface of a 3D object is reacted with the connection of the light within the environments.

Light is a produced transverse electromagnetic wave. The retina of the human eye is sensitive only to a limited radiation at wavelengths that range between 380 to 740 NM. The surface reflects the specific wavelengths and absorbing all the rest, it appears as a value that is revealed.

Color map conveys the subtle details and leans toward the flat image of the surface, where it excludes the directional lights and ambient occlusion. An ambient occlusion map (AO) is used to create exposed soft shadows. It is a grayscale texture that keeps the shadowing information of finely accessible places such as slits, corners, and cracks.
IN REAL-TIME RENDERING, ALL THE OBJECTS ARE EVIDENT BECAUSE OF THE REFLECTED LIGHT FROM DIFFERENT ILLUMINATES. THE REFLECTED RAY OF A RADIANT FROM THE SURFACE IS ALWAYS HEADED IN A CONSTANT DIRECTION ON THE OPPOSING SIDE OF THE SURFACE.

WHEN CREATING MATERIALS FOR PBR, IT IS ALSO ESSENTIAL TO CONSIDER THE STRUCTURE OF THE SURFACE. THERE ARE TWO TYPES OF THE PROPERTIES HOW THE LIGHT REFLECTS FROM AN ELEMENT: INSULATORS OR DIELECTRICS AND ELECTRICAL CONDUCTORS, WHICH ARE ALSO KNOWN AS METALS. IN COMPARISON TO ELECTRICAL CONDUCTORS, DIELECTRICS ABSORB RATHER THAN SCATTER LIGHTING RAYS PENETRATING THE SURFACE, WITHOUT ANY DIFFUSE LIGHT. REFLECTION MAPS EXIST TO CONTROL THESE BEHAVIOURS.

GLOSSINESS

HIGH

SPECULARITY

LOW

ROUGHNESS

METALS

NOMETALS

METALNESS
NORMAL MAPPING is used to fake the lighting of bumps and dents. The texture makes a model appear like high polygon model with various details. It defines a relief of the simple mesh for the lighting and looks more realistic and appealing.

NORMAL MAPS are constructed from 3 channels: red, green, and blue, where each color corresponds to the three-dimensional coordinates. The red channel in the image indicates the direction of light along the X axis (right and left), while the green channel is responsible for the Y axis (up and down) and the blue channel keeps the Z axis which directs the position of normals outwards and inwards of the surface in normal map.

HEIGHT MAP

HEIGHT MAP, also called displacement map, has a similar idea of normal mapping. The process uses a height map to define displacement of the vertices and more evident bumps. With tessellation method applied, the bumpness is smoothed up by dividing polygons into many pieces for even better results but requires more computer resources.
OPACITY, EMISSIVE & DETAIL

WHEN CREATING A SEE-THROUGH MATERIAL, A TRANSPARENCY MAP IS THERE TO CONTROL THE RENDERING OF A PASSAGE OF LIGHT. IT IS ALSO REFERRED TO OPACITY MAP OR ALPHA MAP AND IS USUALLY SET IN AN EXTRA ALPHA CHANNEL OF BASE COLOR IN RGB FORMAT.


EMISSIVE MAP IS USED TO SIMULATE A SELF-ILLUMINATION OF THE SURFACE BY INCREASING THE INTENSITY OF THE SPECIFIC PIXELS. THE MAP BUILDS THE APPEARANCE OF BEING LIT UP BUT DOES NOT ILLUMINATE THE BOUNCING LIGHT RAY.

WHEN TEXTURING AN OBJECT, SOME DETAILS AT THE CLOSER LOOK MAY BECOME BROKEN AND PIXELATED, RESULTING IN A LOW QUALITY OF THE TEXTURES. DETAIL MAP HIDES THE SQUARISH VISUALS AND ADDS MORE QUALITY TO THE SURFACE. IT BUILDS AN ILLUSION OF THE HIGHER RESOLUTION OF THE IMAGE.
MATERIAL EXAMPLES
SCULPTING IN BOTH GAME AND MOVIE PRODUCTIONS BECAME IMPORTANT OVER MANY YEARS. THE METHOD IS USED TO PRODUCE A HIGH POLY MODEL THAT IS DIFFICULT TO PROVIDE VIA TRADITIONAL 3D MODELLING AND IS USED BY THE PROFESSIONALS TO ACHIEVE BOTH MORE REALISTIC AND ORGANIC RESULTS.

SCULPTING

PIXOLOGIC ZBRUSH ALLOWS USING CUSTOMIZABLE BRUSHES TO SHAPE A VIRTUAL CLAY IN A MODERN WAY. ADDING TILEABLE DETAILS INSIDE OF THE BORDER CAN BE QUICKLY SET UP BY INCREASING THE NUMBER OF WARP MODE BY 2.

THE ORGANIC WORKFLOW IS A RELATIVELY SIMPLE AND A STRAIGHTFORWARD PROCESS. IT IS BASED ON BUILDING THE LOW POLYGONAL OBJECTS AND THEN FURTHER REINFORCING IT AND TWEAKING THEM INSIDE ZBRUSH. WITH THE SATISFIED POSITION, TO MAKE IT TILE REQUIRES FILLING THE SIDES, WHICH CAN BE ACHIEVED BY USING DEFORMATION - OFFSET TOOL, USING A POSITIVE OR NEGATIVE VALUE OF 100 IN A REQUIRED AXIS OF THE OFFSET.
IMAGE-BASED TEXTURING

Since the textures are bitmaps, they can be easily created by any image editing software. The most prominent advantage of making a texture via Photoshop is it allows to produce a material straight from the source. The reference images can be manipulated for building a unique look.

Photoshop and extended plugins like Quixel Tools can give a wide variety of 3D texture editing. The combination of the results of 3D sculpting and Photoshop texturing allows to build the materials in no time, but due to the rasterization of the images, the process is limited to its size resolution.
PROCEDURAL TEXTURING

PROCEDURAL TEXTURING IS ANOTHER WAY TO APPROACH THE BUILDING OF A TEXTURE WHICH HAS NO RESOLUTION RESTRICTIONS. SUBSTANCE TOOLS IS A SET OF APPLICATIONS CONSISTING OF SUBSTANCE DESIGNER AND SUBSTANCE PAINTER THAT ALLOW BUILDING PROCEDURALLY GENERATED TEXTURES WITH THE REQUIRED SET OF DEFINED BITMAPS.

SUBSTANCE DESIGNER WORKFLOW HAS MANY POSSIBILITIES OF TEXTURE PRODUCTION WITHOUT THE LOSS OF DATA. THE PIPELINE CONSISTS OF A PRIMARY SETUP WITH BLOCKING OUT THE BASIC SHAPES, WITH FURTHER INCORPORATION OF THE DETAILS. SINCE THE PROCESS IS ENTIRELY PROCEDURAL, THE VARIETY OF THE VISUAL PROPERTIES CAN BE ADJUSTED IN MANY WAYS, ALLOWING TO CREATE ANYTHING FROM SIMPLE PATTERNS TO FULLY TEXTURED SURFACES.

THE POSSIBILITIES OF MATERIAL ADJUSTMENTS CAN BE QUITE FLEXIBLE. WITH THE EXTENDED NODE FUNCTIONS, SUBSTANCE DESIGNER CAN ALLOW TO TWEAK THE PARAMETERS, INCLUDING ATTACHING A BITMAP AS A MASK, WHICH DYNAMICALLY CAN FIT INTO A MATERIAL OR CHANGING THE TEXTURE PROPERTIES AFTERWARDS. WITH THE USE OF SUBSTANCE PAINTER IT ALLOWS TO ADJUST MASKS EVEN FURTHER.

SUBSTANCE PAINTER IS A HANDY SOFTWARE THAT ALLOWS TO PAINT OR GENERATE DETAILS IN CERTAIN PLACES WITH MULTIPLE OPTIONS. TAKING THE MATERIAL FROM SUBSTANCE DESIGNER MAKES THE PROCEDURE EVEN FASTER. THE PROCESS CAN BE DIVIDED INTO THREE STEPS - BAKING, MASKING, AND TWEAKING.

TO ACHIEVE EVEN FASTER RESULT THE PIPELINE MAY INCLUDE USING THE SAME MATERIAL WITH THE DIFFERENT PARAMETERS OF THE EXPOSED FUNCTIONS FROM SUBSTANCE DESIGNER.
PHOTOGRAMMETRY IS A METHOD OF CAPTURING MULTIPLE OVERLAPPING PHOTOGRAPHS AND TAKING MEASUREMENTS FROM THEM TO CREATE 3D MODELS OF OBJECTS OR SCENES. THE TECHNIQUE BRINGS A POSSIBILITY TO BUILD A HIGHLY ACCURATE AND REALISTICALLY PHOTO-TEXTURED MODELS OF STRUCTURES, LANDSCAPES, AND OBJECTS.

THE PROCESS IS CONSIDERED IN PICTURING MULTIPLE PHOTOGRAPHS LIKE A PANORAMA AND COMBINING THEM IN A THREE-DIMENSIONAL SPACE. THE SOFTWARE ESTIMATES THE POSITION OF A CAMERA TOBUILD A HIGH POLY MESH IN X, Y, AND Z COORDINATES.

THOUGH PHOTOGRAMMETRY ALLOWS BUILDING A HIGH POLY MESH WITH A COLOR TEXTURE INFORMATION, NEXT STAGES ARE REQUIRED TO TRANSFER AND FIX THE DETAIL OF THE TEXTURES. THIS COULD BE REALIZED IN MULTIPLE WAYS, INCLUDING SCULPTING FOR THE TOPOLOGY CORRECTIONS, BAKING THE COLOR AND NORMAL MAPS AND FIXING THE RESULTS EITHER IN PHOTOSHOP OR SUBSTANCE TOOLS.