Computer Graphics

COMP 321 - March 2024
Module 5 - Texturing and Mapping

Introduction to Texturing:

- Texturing in computer graphics involves a**pplying 2D images**, called textures, o**nto 3D surfaces** to **enhance their appearance and realism.**

- Textures can represent **surface details such as color, roughness, glossiness, bumpiness, and patterns**, adding visual complexity to objects in a scene.
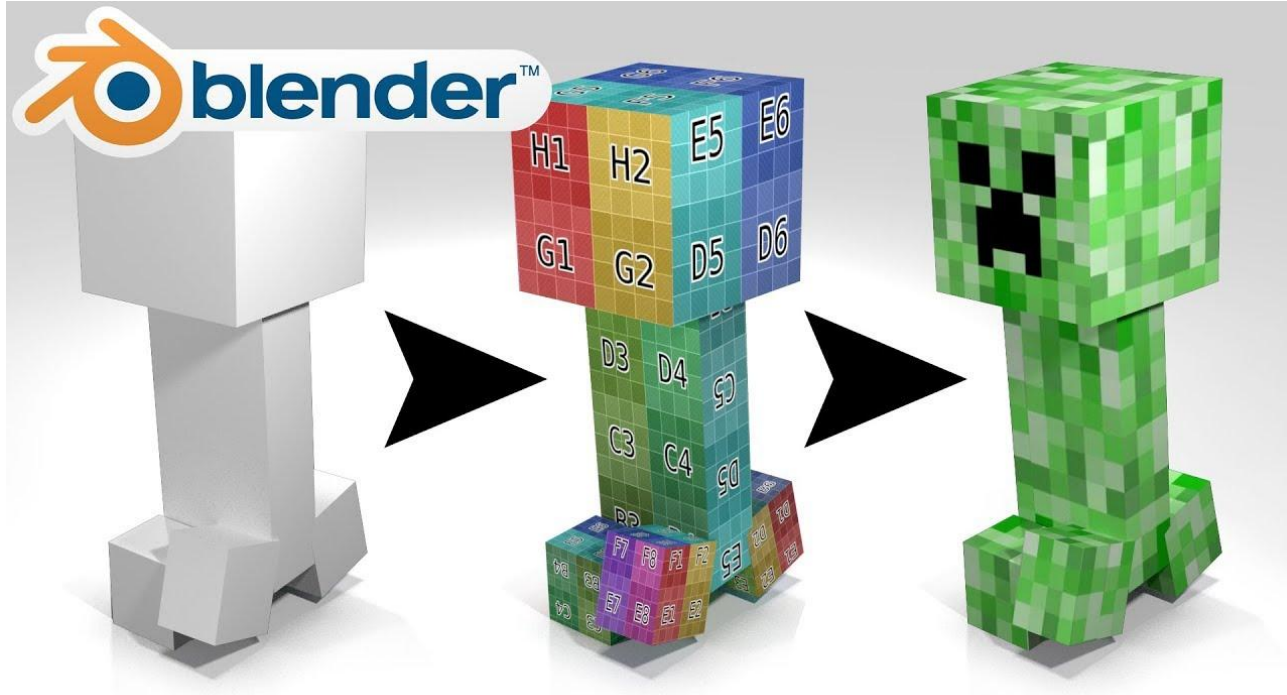
Texture Mapping Techniques:

- Texture mapping techniques determine how textures are applied to 3D objects based on their UV coordinates or surface parameters.

- Common texture mapping techniques include planar mapping, cylindrical mapping, spherical mapping, and cubic mapping, each suited for different types of geometry.
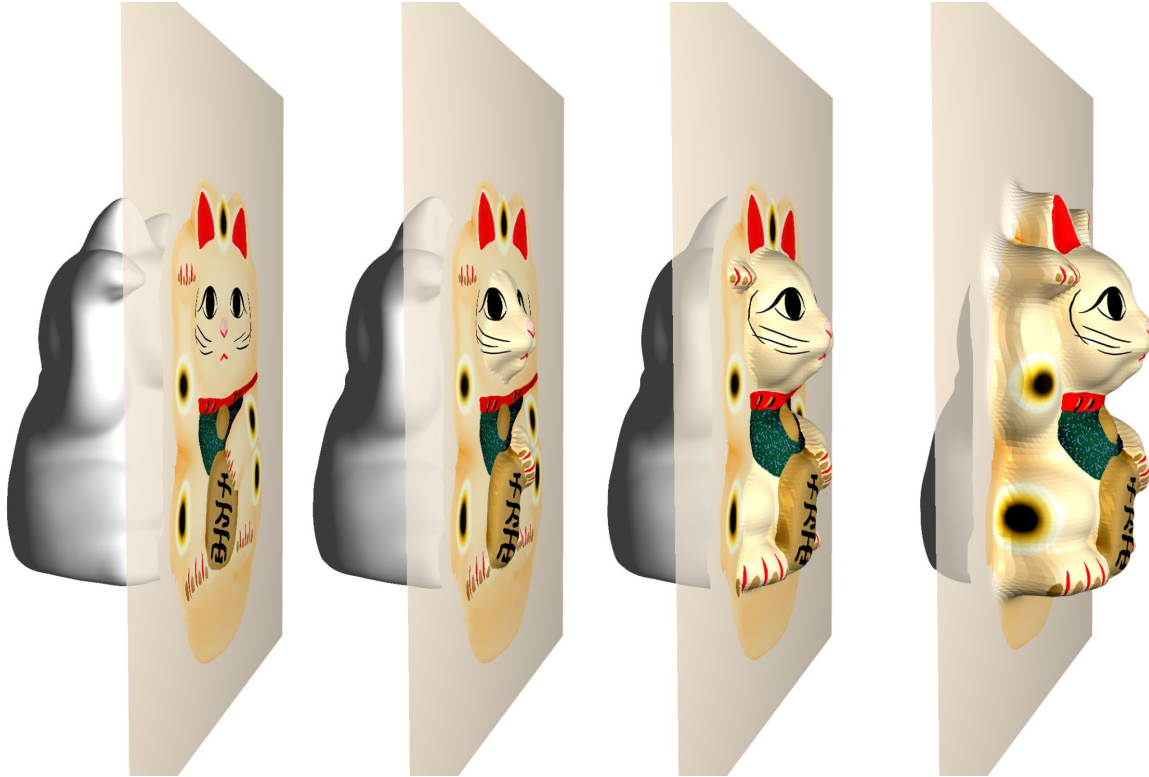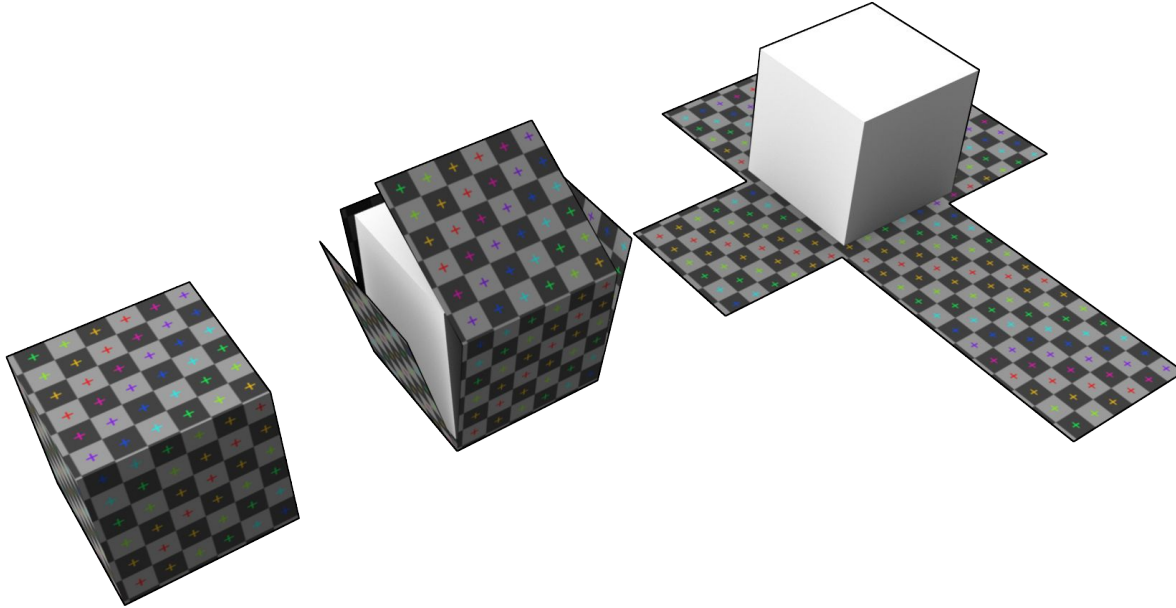
Texture Mapping
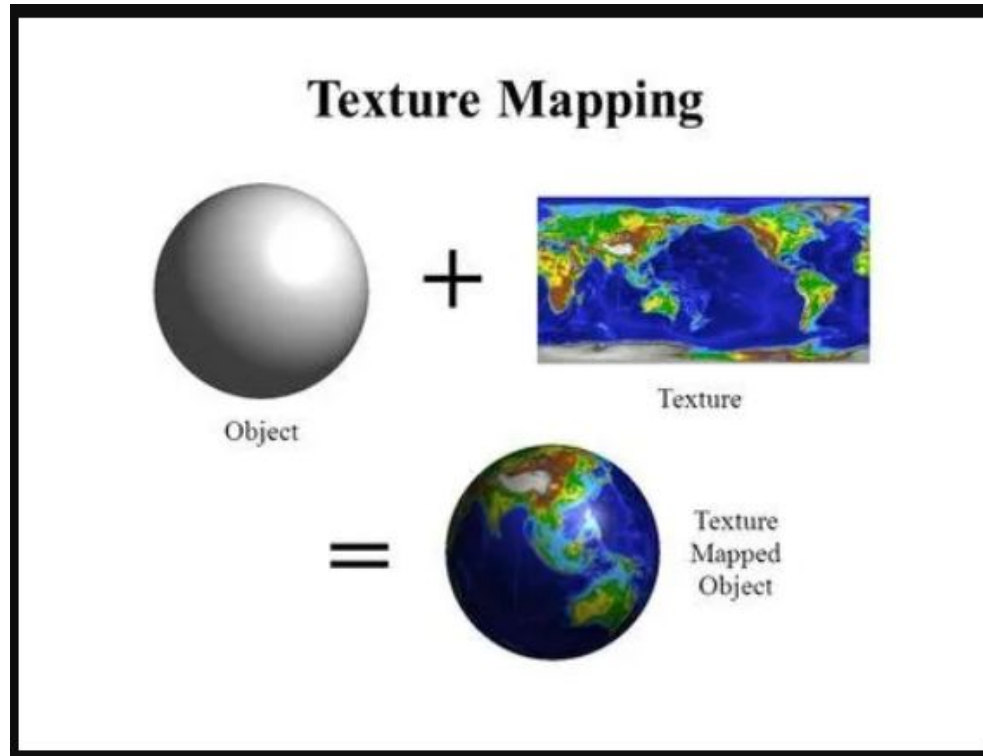
Texture Mapping

Texture Mapping

UV Mapping

- - UV mapping is a **coordinate mapping technique** used to map textures onto 3D surfaces by defining a 2D coordinate system (UV coordinates) on the surface.

- UV coordinates represent the **horizontal (U)** and **vertical (V)** positions of vertices on the surface, which correspond to the texture coordinates in the texture image.

- Refer to this tutorial series to learn more - link

UV Mapping
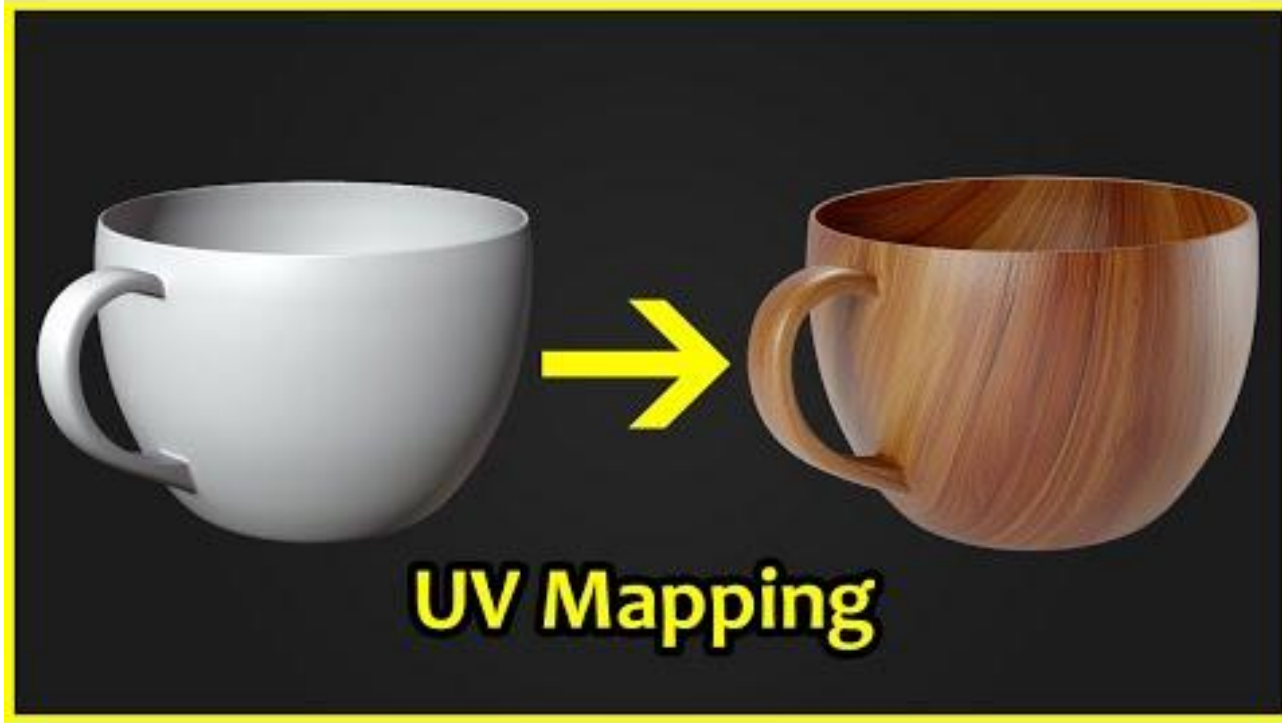
UV Mapping

UV Mapping

UV Mapping Intro

UV Mapping

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TEXTURE MAPS GUIDE

BASE COLOR **AMBIENT OCCLUSION** **NORMAL** **ROUGHNESS**

METALNESS **HEIGHT** **SPECULAR** **OPACITY**

REFRACTION **SELF-ILLUMINATION** **BUMP** **REFLECTION**

Procedural Textures:

- Procedural textures are generated a**lgorithmically** rather than being based on image data.

- They allow for infinite variation and detail without the need for large texture files and are often used for generating natural or organic textures such as clouds, marble, wood, and terrain.

Procedural Textures

Procedural Bricks

Procedural Dirt

Procedural Moss
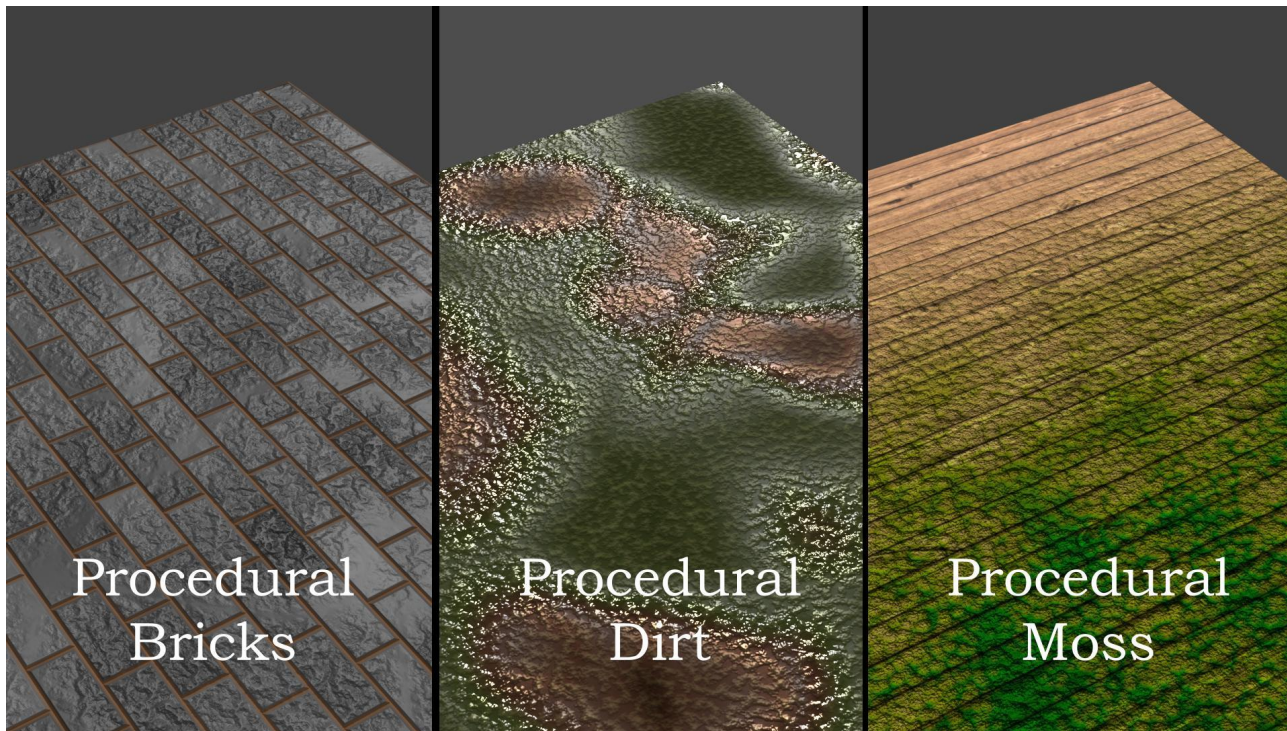
Bump Mapping

- Bump mapping is a shading technique used to simulate surface

  irregularities or bumps without modifying the geometry of the object.

- It perturbs the surface normals of the object based on a height map

  texture, creating the illusion of depth and detail on the surface.

Displacement Mapping:

- Displacement mapping is a technique that modifies the geometry of the object based on a height map texture.

- Unlike bump mapping, displacement mapping physically displaces the vertices of the object along their surface normals, resulting in actual geometric detail.

Bump vs Displacement Mapping

Base
Model

Bump
Mapping

Displacement
Mapping

Image courtesy of www.chromesphere.com

Environment Mapping:

- Environment mapping is a rendering technique used to simulate

  reflections on shiny or reflective surfaces.

- It uses a cube map or spherical map representing the environment to

  create the illusion of reflections on the surface of the object.

Environmental Mapping

Conclusion

- Texturing and mapping techniques play a crucial role in enhancing the visual realism of 3D graphics by adding surface details, patterns, and reflections to objects in a scene.

- By understanding how textures are applied, mapped, and filtered onto 3D surfaces, designers and developers can create immersive and visually compelling virtual environments that captivate audiences and enhance user experiences.