U3M 1.1 Introduction

More info on `https://github.com/vizoogmbh/u3m`

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1 Introduction

Right now, different vendors output their digital materials either in a proprietary format or embedded directly in their styles. And while various integrations already exist, there is a steady conversion that must take place, different file types to manage and still a lot of incompatibility.

Therefore, the Unified 3D Material is being developed as a bridge between software vendors in the Apparel industry with the goal to replace proprietary material formats with a single open–source format.

1.1 Aligned Visualization

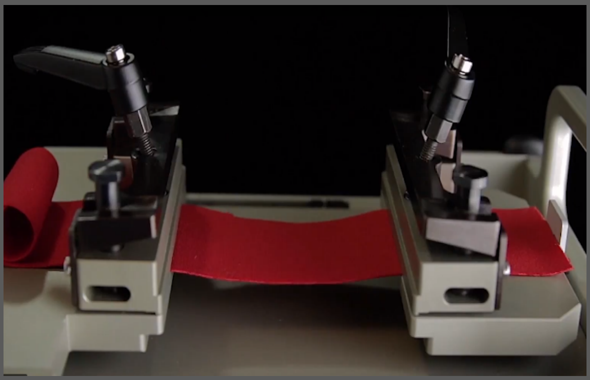
Loading texture maps into different 3d applications does not automatically result in identical visual representations, even if we assume that the environment and lighting situations are the same.
The reason for this is shaders. They are responsible for interpreting the textures, light, environment, geometry, and calculating the image that is being projected onto your screen. And every application uses its own slightly different shading models.

To overcome this, the U3M is now based on a fixed shading model, the Principled BRDF[1]. This means that all texture maps of the U3M are based on the Principled shader, and will have the same, or very similar, appearance in applications supporting that shading model.

Even applications not supporting the Principled at this point in time now have a basis they can use to convert and translate the material into their proprietary shader engine.

[1] https://disney-animation.s3.amazonaws.com/library/s2012_pbs_disney_brdf_notes_v2.pdf

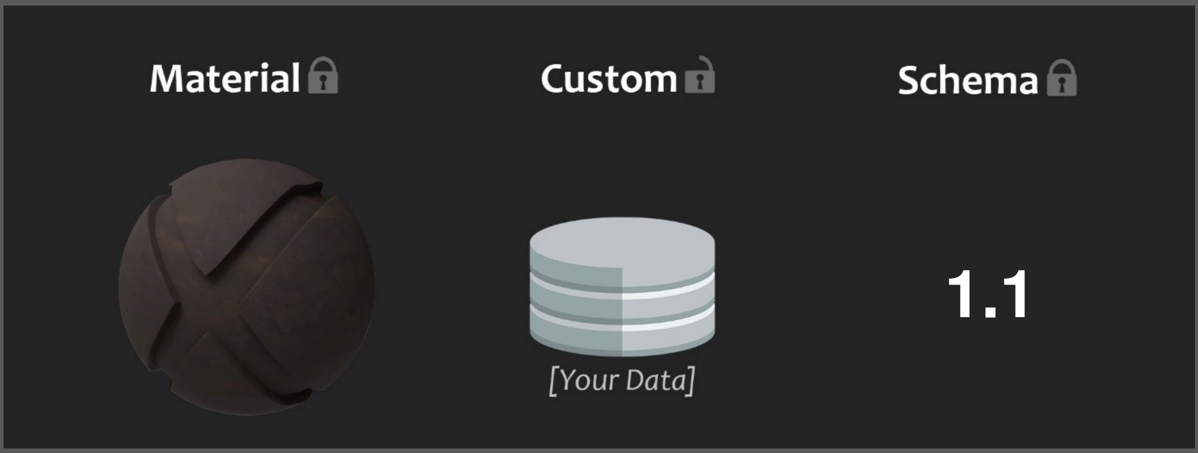
1.2 Combined Visual and Physical Information



Unfortunately, there is no equivalent to the visual alignment solution for the physical measurement information (yet).
However, the U3M makes it possible to store physical information inside your 3D material. This allows vendors and users to add their physical measurements directly to the format.

With visual and physical data combined, this makes the usage in your 3D application easier and simplifies the management of the data in general.

2 Overview



For a real example of the u3m or the specs, please visit: `https://github.com/vizoogmbh/u3m`
Split into three parts, the U3M format manages to be flexible enough to embrace new input as well as manage your personal company data, yet structured enough to provide a reliable visualization.

2.1 Schema/Version

This part simply holds the version number of the U3M file. Please make sure your version number is the same matched by the corresponding json schema.
This will help to provide downward- compatibility.

2.2 Material

The material section is the core of the U3M. It contains both meta data, visual data and physical data. Most importantly, this section is strictly structured through the corresponding JSON schema and must not be changed.

2.3 Material meta data

Unique ID: Every U3M is unique through its id.
Timestamps: Both the creation and last modification dates are stored.
Name: A human readable name.
Description: Optional, can be used to add fabric information.

2.4 Material front, back & side

Front, back and side of the material can both be stored inside U3M and are structurally identical. The references to the texture maps and the values of the Principled Shader are stored here.
Each parameter of the shader can be filled with a custom value and an optional texture map.
The texture maps are placed relatively to the material file, either in the same folder or within a subfolder.

2.5 Physics

Added since U3M 1.1, there is now a physics section inside each U3M file. This can be filled with information like material type, composition, thickness, and weight. In addition, measured physical properties grouped by measurement device can be referenced here.

2.6 Custom

The Custom section is the framework that makes interoperability possible. It enables the vendors to add the data they require for reading & writing of the files, this provides brands and suppliers the option to add meta and production information to it.
This part is not controlled by the JSON schema, it must be read and written as it is, without changing the data. The exception is your own proprietary Custom section.

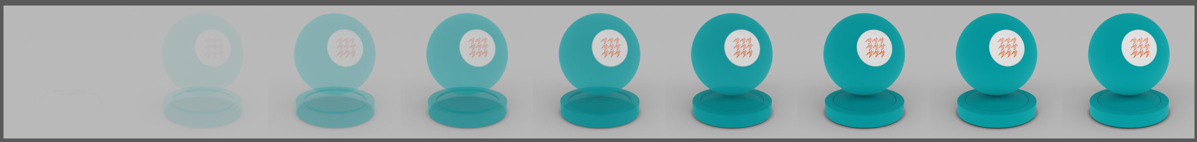
2.7 U3MA

U3MA is a packed version of a U3M file, to allow for easier transfer between applications. For example, if the material is directly sent from a central management database to a 3D tool.
For details on how to read and properly write a U3MA file, please refer to `https://github.com/vizoogmbh/u3m`.

3 Shader Parameters

3.1 Alpha

Defines the opacity of a material. The smaller the alpha value, the bigger the transparency.
The constant or factor can be used for a global transparency, an alpha texture can be used to create holes in the material.



3.2 Anisotropy Value

Describes the intensity of the anisotropy.

3.3 Anisotropy Rotation

Describes the rotation of the anisotropy in percent ($0 = 0°$, $1 = 360°$).

3.4 Clearcoat Value

Describes the intensity, or visibility, of the clearcoat.

3.5 Clearcoat Normal

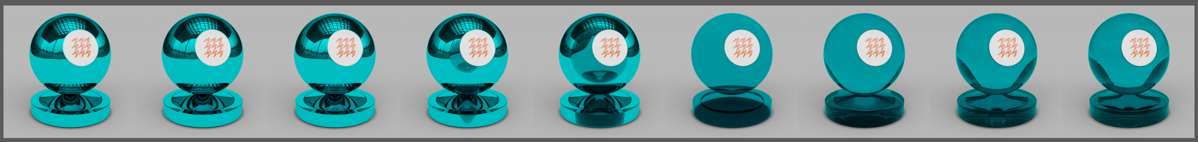
Describes the normals or structure of the clearcoat. The regular Normals only apply to the material, not the clearcoat.

3.6 Clearcoat Roughness

Describes the roughness of the clearcoat reflection.

3.7 IoR (Index of Refraction)

Index of Refraction defines how much the path of the light is bent when it hits the material surface, in other words enters the material.
In the case of the Principled shader, it affects the reflection intensity.



3.8 Metalness

At the center of the shader is the metallic value. It defines how metallic, or dielectric, a material is. Non-metals have a maximum reflection intensity at a zero-degree observing angle of 4%. Limiting this creates much more realistic and reliable visual results.
By default, materials are considered non-metallic.

3.9 Normal

Describes the material surface normals, or structure of the material. This influences how the light is being reflected when hitting the surface.
Normal maps do not influence the geometry's silhouette.

3.10 Displacement

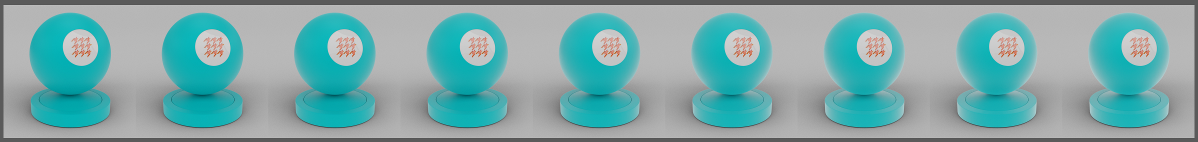
Describes structure of the material. This influences how the light is being reflected when hitting the surface.
Displacement maps do influence the geometry's silhouette and are therefore *heavier* computational-wise.

3.11 Roughness

Roughness describes how much light scatters when it hits the surface, causing a highlight to either be small and bright or big and dull.

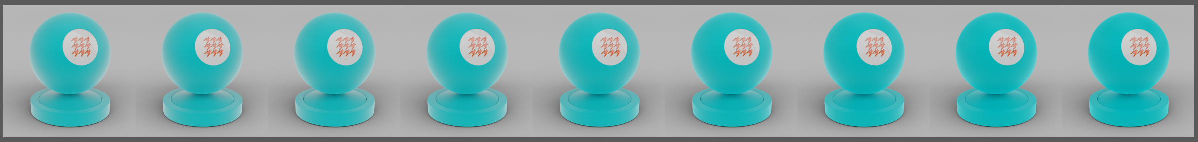
3.12 Sheen Value

Sheen increases the reflection at a grazing angle, simulation how most fabrics behave. Reacts more or less the same as *Fresnel*.



3.13 Sheen Tint

Colors the sheen with the basecolor of the material. Can be used to create a velvet-like effect.



3.14 Specular Value

Slightly increases or decreases the reflection intensity of non-metallic materials, between 0 – 8% at an observer angle of zero-degrees.

3.15 Specular Tint

Applies the basecolor to the specular reflection, creating a metallic-looking effect.

3.16 Subsurface Color

Subsurface, or Subsurface Scattering (SSS) describes the reflection of the light inside the material, after penetrating the surface. This usually causes a sort of *glow*, as in jade, wax, rubber or skin.
This value sets the color of the SSS effect.

3.17 Subsurface Radius

Subsurface, or Subsurface Scattering (SSS) describes the reflection of the light inside the material, after penetrating the surface. This usually causes a sort of *glow*, as in jade, wax, rubber or skin.
This value defines how much the lights *spreads* inside the material.

3.18 Subsurface Value

Subsurface, or Subsurface Scattering (SSS) describes the reflection of the light inside the material, after penetrating the surface. This usually causes a sort of *glow*, as in jade, wax, rubber or skin.
This value increases or decreases the intensity of the effect.

3.19 Transmission

Describes how transparent a material is. In contrast to ”alpha”, this attribute does not affect reflection. Can be used to visualize transparent plastics or glass.

3.20 Basecolor

For non-metallic materials, basecolor describes the color, diffuse, or albedo of the material, either as a constant color value or texture.
For metallic materials, basecolor describes the specular or reflection color of the material, and the diffuse reflection is automatically black.

4 Be a part

Vendors, brands, suppliers – the more people participate, the more successful the format will be. In the end, everybody profits from the interoperability U3M offers.

If you want to integrate, bring in your own ideas or test the format, please reach out via:

Github: `https://github.com/vizoogmbh/u3m`

Mail: `info@vizoo3d.com`