

Materials in pCon.planner

Introduction into physically based rendering (PBR)

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Content

1	Introduction	3
2	Advantages of PBR	3
3	Physically Based Rendering: The Basics	4
3.1	Material Properties and the Interaction of Light and Material	4
3.2	Light Properties and the Interaction of Light and Material	4
4	Parameter in pCon.planner	5
4.1	Material Settings in pCon.planner	5
5	Creating Materials: General Information	6
6	Conversion of older materials to PBR	7
7	Links and Sources	7

1 Introduction

Since autumn 2018, EasternGraphics uses a new model for material creation. The new material model will be used in all new pCon applications¹. The following pages will introduce you to the so called physically based rendering (**PBR**).

You will get to know the essential basics of PBR and will be introduced to its parameters. You will furthermore get tips and examples on creating materials according to PBR and learn how to deal with old materials.

Your older materials will automatically be converted to fit PBR. This means that you will not have to rework most of them. Read [chapter 6](#) to learn in which cases adaptations will be necessary.

2 Advantages of PBR

PBR will bring many benefits for professional creators of materials and pCon users:

- Realistic presentation of materials and objects in real-time mode
- Rendering with OSPRay supports the new materials
- Works in all lighting scenarios
- Materials behave physically plausible
- Improved usability in pCon.planner through use of fewer parameters
- Less interdependence of settings
- All new pCon applications use the new material model - materials only have to be optimized once

¹ pCon.planner 5 and pCon.configurator 5 will continue using the conventional material model.

3 Physically Based Rendering: The Basics

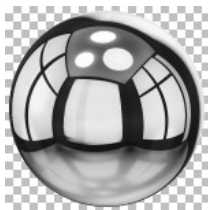
PBR simulates what happens when light meets a materials' surface: A physically correct material has different ways to interact with light: Light is reflected, refracted or absorbed. A material becomes visible to us because it reflects incident light. Furthermore we are able to see materials that shed light by themselves.

In natural conditions, light is not absorbed, reflected or refracted to 100%: All materials lie in a spectrum between these extreme points.

3.1 Material Properties and the Interaction of Light and Material

Reflection, refraction and absorption are also controlled by the material properties.

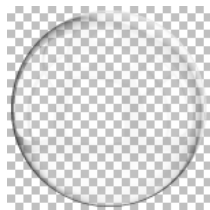
- The specular portion of the light is reflected directly at the surface.
- Diffuse reflection is caused by the scattering of rays of light within the material: rays of light enter into the material and are deflected into different directions.
- Metal materials only have specular reflection, non-metals reflect predominantly diffuse.
- Depending on the properties of a material, the light rays enter deeper into the material. They are either passed through the material (transparency), thrown back within the material (translucency) or swallowed by the material (absorption).



Specular Reflection



Diffuse Reflection



Transparency



Translucency



Absorption

3.2 Light Properties and the Interaction of Light and Material

In addition to the material properties, the physical properties of light rays are also integrated in PBR.

- According to the principles of energy conservation, only as much light as is incident can be reflected.
- The amount of reflected light rays depends on the angle of view. This so-called Fresnel effect leads to stronger reflections for a small grazing angle in comparison to a grazing angle of 90° in relation to the surface.
- The values of the various parameters of the material model are linear.

4 Parameter in pCon.planner

The new material model in pCon.planner is based on the principles stated above.

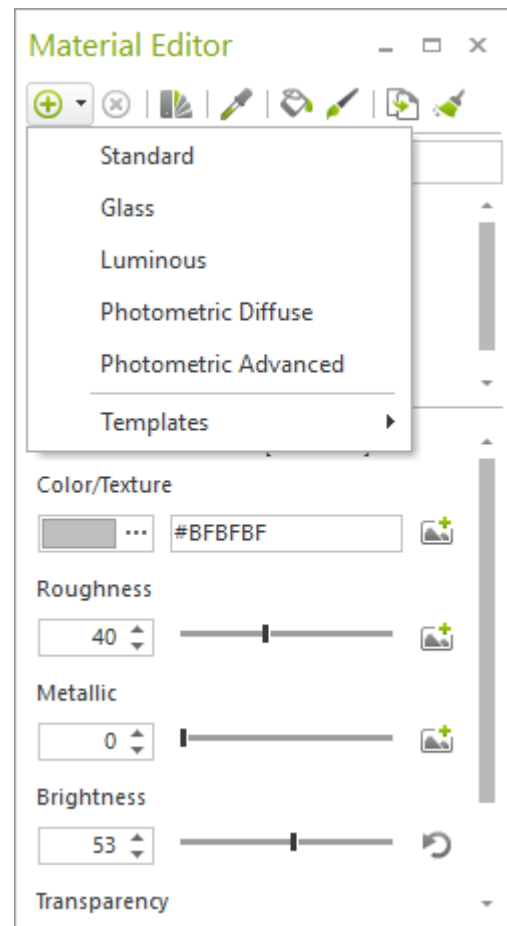
The properties of light (see [chapter 3.2](#)) are simulated by the shader of the render engine and cannot be influenced directly by the user.

The properties of materials ([chapter 3.1](#)), however, are the base for the creation of physically correct materials. Not all of the above properties are directly converted into modifiable parameters in pCon.planner: Some factors are determined by the selected material type.

The following material types are existing in pCon.planner. When you create a new material in the *Material Editor*, you choose the type immediately.

- *Standard* – Metal or Non-Metal
- *Glass*
- *Luminous*

In addition, there are two other types of material: photometric diffuse and photometric advanced. These are not relevant when planning common rooms and objects.



4.1 Material Settings in pCon.planner

The settings for the different types of materials (standard- and glass as well as luminous materials) are listed and explained in the pCon.planner Online Help. Parameters, values and backgrounds are described here:

<http://help.pcon-planner.com/en/help/materials.htm> (topic *Create a Material*)

The help does also contain material examples and their specific settings:

<http://help.pcon-planner.com/en/help/materials.htm> (topic *Examples and Values*)

5 Creating Materials: General Information

You use the *Material Editor* in pCon.planner to create different materials. Some important hints:

Create materials directly in pCon.planner 8 to get physically correct results.

When working with PBR materials, please use a current version of pCon.planner or your other pCon applications. Older program versions can have a negative effect on the appearance of the new materials.

We recommend that you choose one of the templates from the *Material Editor*: Whether glass, metal, non-metal or self-luminous material - you will find the perfect base for your own creations.

Please note the difference between material type (glass, standard and self-luminous) and template: A **template** is always based on the **type** of material: frosted glass is based on glass, wood, fabric or plastic is created using the standard material...



6 Conversion of older materials to PBR

Materials that were created before pCon.planner 8.0 are automatically converted to the new model.

In some cases, however, changes may be necessary:

- Sometimes, the surfaces do appear more glossy than in former versions of pCon.planner. In these cases, use the *Roughness* slider to adjust the appearance.
- It is possible that metal materials are not interpreted as metal (this can for example occur in chrome surfaces). For these materials, please adjust the *Metallic* slider to 100%.

If you want to convert your materials using an external software (this could be the case when it comes to OFML data creation), we recommend exporting them as MAT files:

1. Open the filter line in your *Material Editor*. Check *Read only* to get access to materials used on OFML articles.
2. Select the material in the *Material Editor*.
3. Right click with your mouse to open the context menu.
4. Click on *Export*.
5. Set the file type to *.mat.

Use your external program to edit the material.

7 Links and Sources

- Creating *Normal Maps* from textures: <http://www.smart-page.net/smartnormal/>
- CC0 licensed images for creation of textures: <https://pixabay.com/> (CC0 is stated at image page)
- Textures and Maps (CC0 licensed): <https://cc0textures.com/home>
- Color values, Hexadecimal or RGB: <http://www.color-hex.com/>
- Reflective properties of different metals: <https://refractiveindex.info/>

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