

Constructing 3D Scenes with



WODEN
Engine

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Loading Woden Engine in Pharo 7 and 8

Go to <https://github.com/woden-engine/woden> and do the following script:

Metacello **new**

baseline: 'WodenEngine';

repository: 'github://woden-engine/woden/tonel';

load.

Innovation award demo:

Voyage in the Wodanic Alpha

<https://www.youtube.com/watch?v=p7blxmlhHQQ>

About this talk

- This is not a talk about the internals or the low-level details in Woden Engine.
- This is a talk about:
 - 3D graphics and Art.
 - Prototyping simulations in Pharo.

Talk outline

- Brief description of WODEN Engine.
- Example using Woden Roassal.
- Example using the new Entity System.

Abstraction layers in Woden Engine

- Very low level graphics API: AbstractGPU (standalone C library).
- Lower level: Woden Core (WDC Prefix), *resource caching and management*.
- Low level: Woden Scene Graph (WDS Prefix).
- **High level 1:** Woden Roassal for data visualization (RW Prefix).
- **High level 2:** Woden Entity System for video game development (WDES Prefix).

New features

- Full adoption of the PBR Metallic-Roughness lighting and material model.
- glTF 2.0 model importer (Animations not yet supported).
- Procedural textures in Pharo translated to GPU shaders.
- Particle systems programmed in Pharo.
- HDR, auto exposure and filmic curve tone mapping.

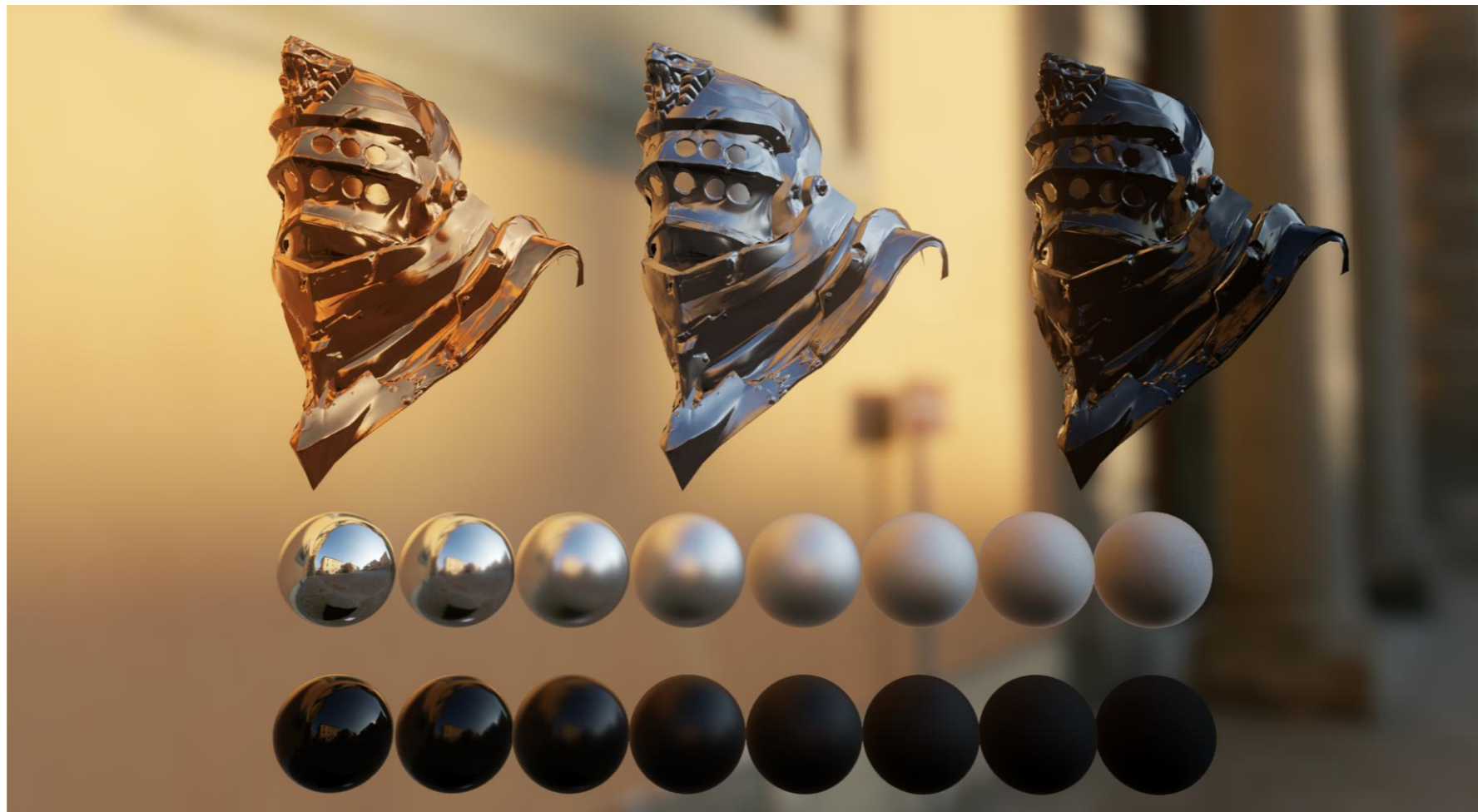
PBR Metallic-Roughness Workflow

- Material and lighting model developed by Disney and Pixar.
- Realtime algorithms and implementation developed by Epic Games for Unreal Engine 4.
- Materials are independent of lighting.
- Mandated by the glTF 2.0 model format spec.

PBR Material Parameters

- Albedo or Base Color.
- Normal map.
- **Metallic** (Binary value, 0 for non-metal, 1 for metal. **Blue channel**).
- **Roughness** (Value between 0 and 1. **Green channel**).
- **Ambient-Occlusion or Cavity**. (**Red channel**)

Image Based Lighting (IBL)



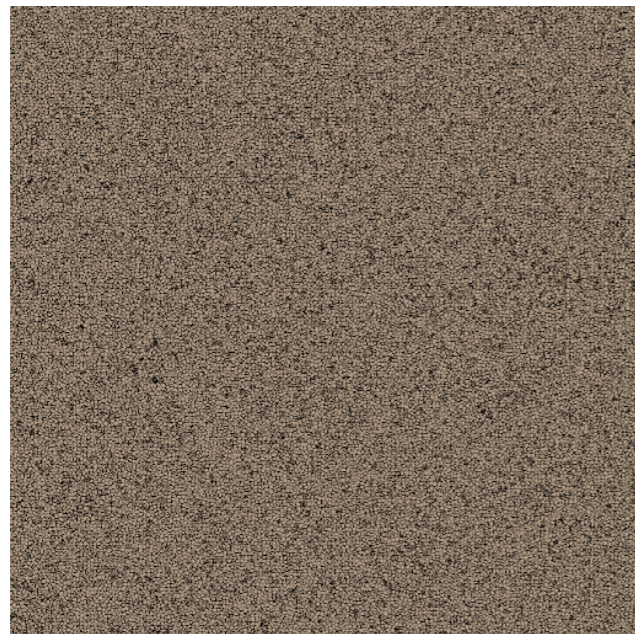
Environment lighting approximation from *Real Shading in Unreal Engine 4* by Brian Karis

IBL in Woden Engine

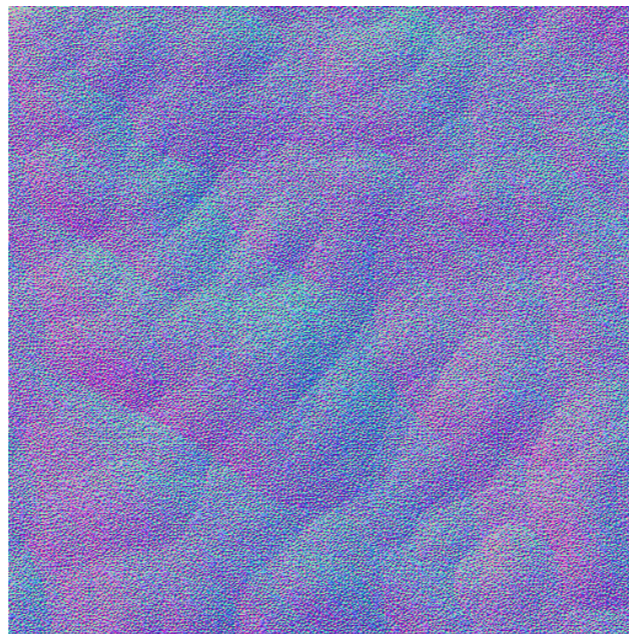


glTF Sample Model *Damaged Helmet* from:
<https://github.com/KhronosGroup/glTF-Sample-Models>

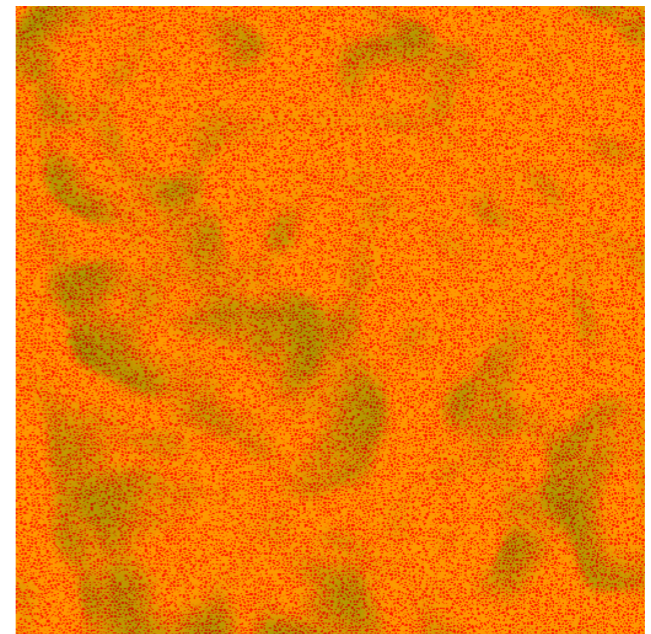
PBR Material Sample: Sand



Albedo

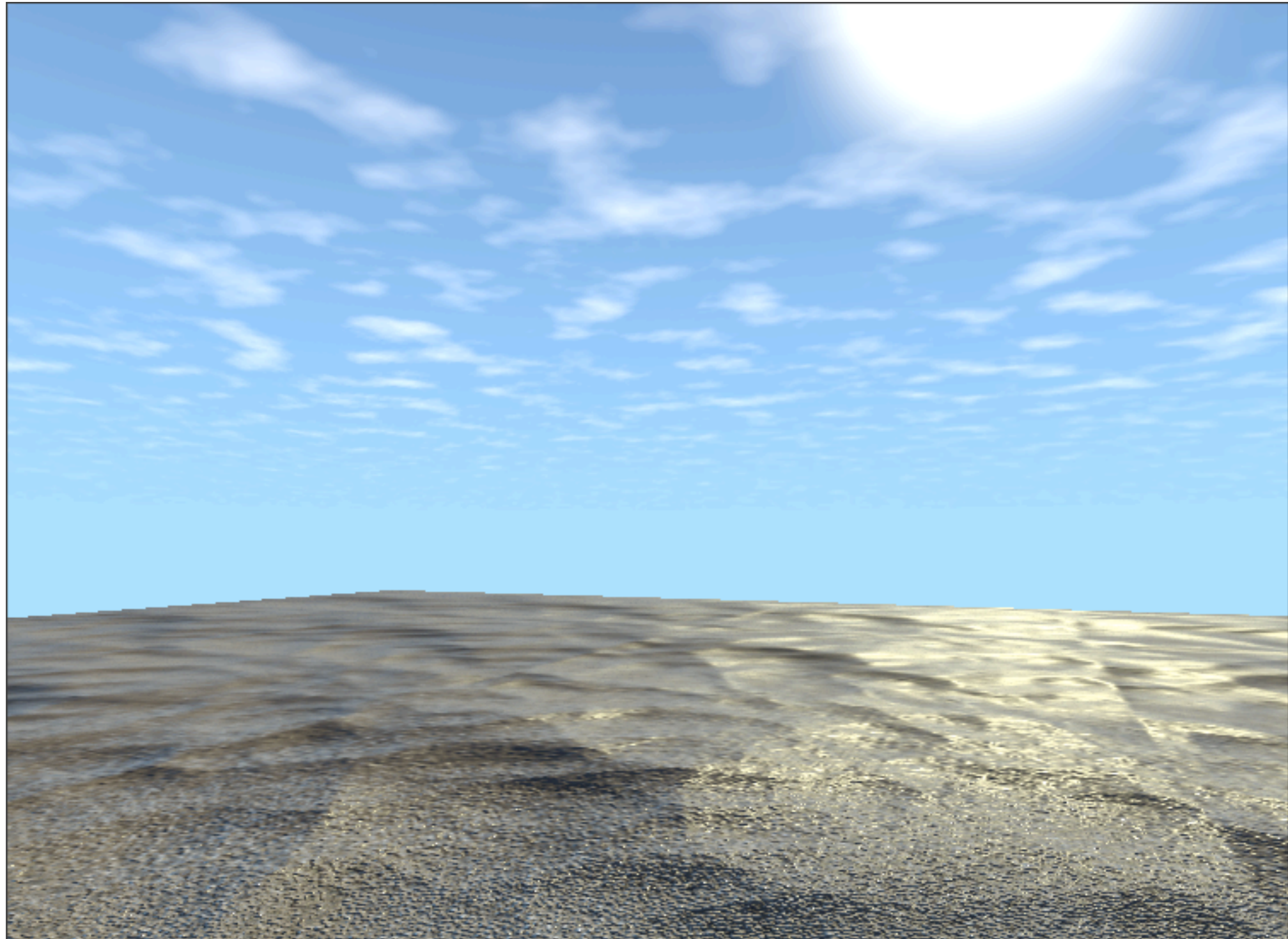


Normal



RMA

PBR Material Sample: Sand



Importing glTF 2.0 models

The easiest way to construct a 3D scene with Woden Engine



WDASceneExamples exampleModelSponza

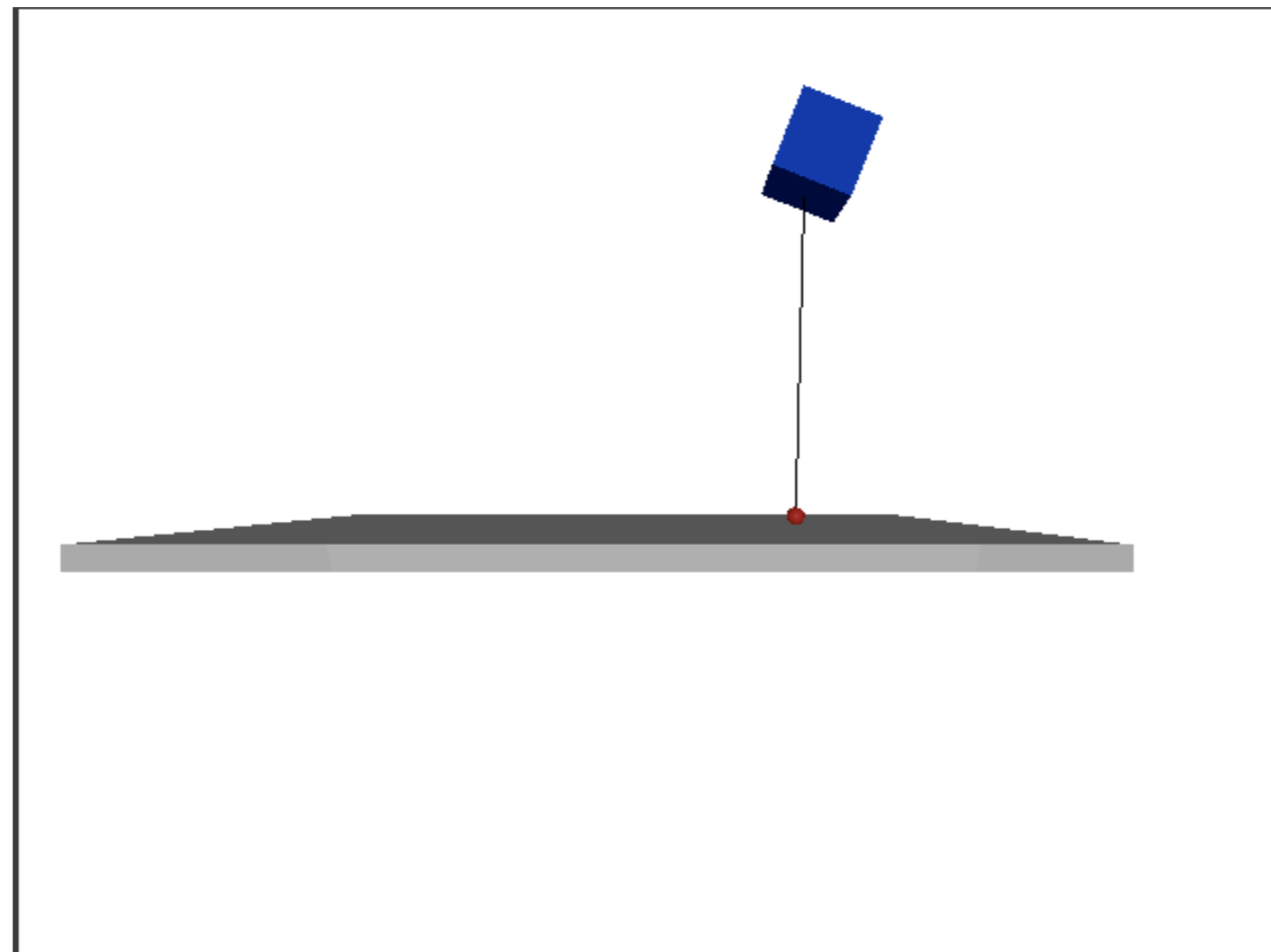
glTF Sample Model *Sponza* from:
<https://github.com/KhronosGroup/glTF-Sample-Models>

Woden Roassal

- Data visualization scripting DSL written above of Woden Engine.
- Not all features are exposed in Woden Roassal.
- Woden Roassal is easy to use:
 - In a Playground.
 - For scripting.
 - And for prototyping.

Woden Roassal Example

Balloon attached to a string



Woden Roassal Example

Physics

Newton second law: $F = ma \rightarrow a = F/m$

Gravity: $(0, -9.8, 0)$

Buoyancy: $(0, 12, 0)$

Hooke's Law (Springs): $F = -\Delta l k$

Damping: $F = -cv$

$T = r \times F$

$T = lw$

Woden Entity System

- Entity-Component system implemented on top of Woden Engine.
- Designed for video game development.
- Supports:
 - 3D Graphics through the Woden Scene graph.
 - Physics through Bullet bindings.
 - Spatial sound through OpenAL.

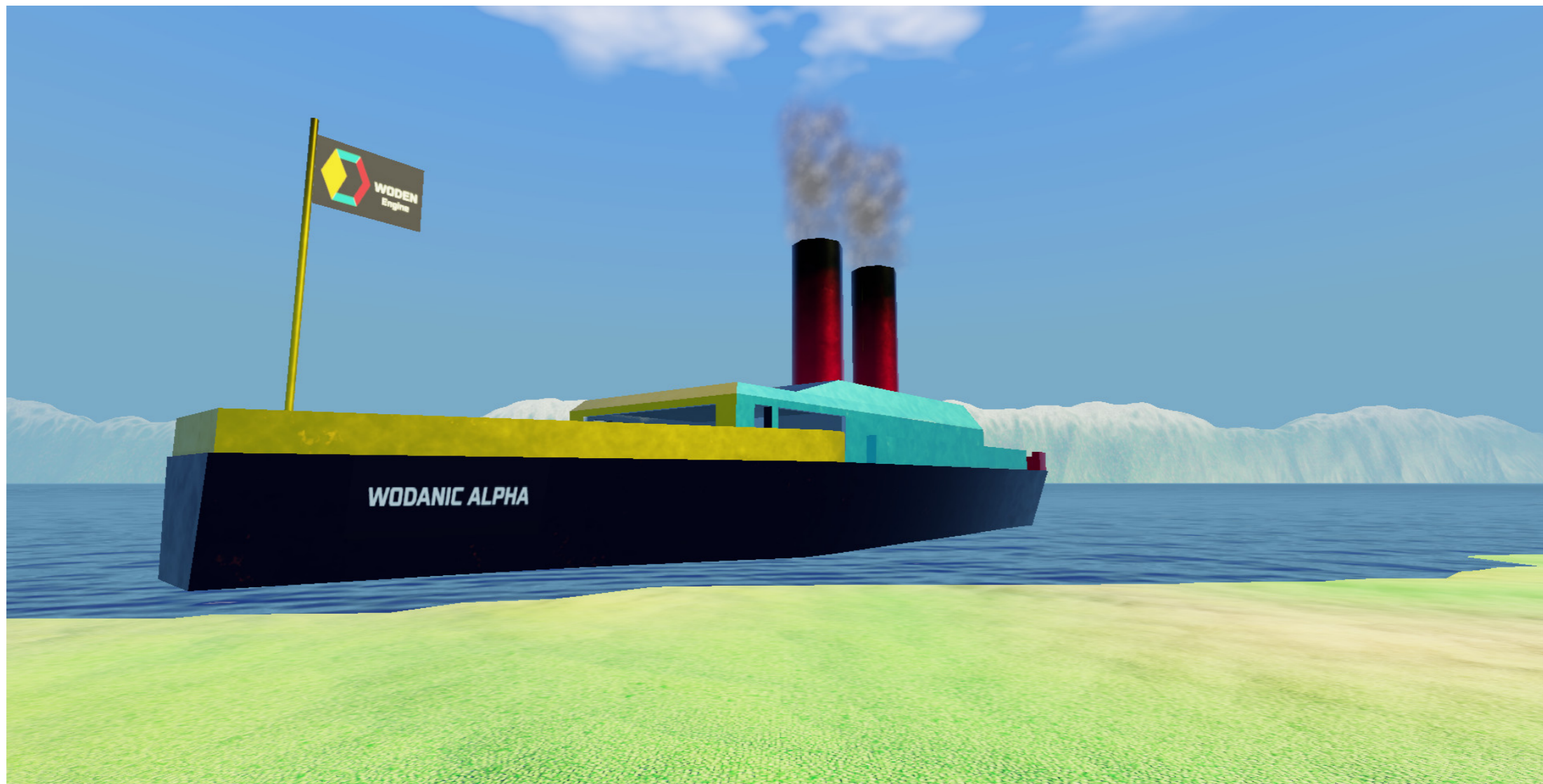
Woden Entity System Example

Hot air balloon vehicle



WDAESProceduralSamples example04BalloonVehicle

Voyage of the WODANIC ALPHA



<https://www.youtube.com/watch?v=p7blxmlhHQQ>

Features of the Demo

- Demo of the Entity System combining procedural with hand made content.
- Terrain and textures are generated with Pharo code.
- Particles are simulated with Pharo.
- The boat dashboard is another Woden application.

Questions

