General Manual for 3D Models

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Introduction

Key Points:

- 3D models optimized for maximum performance on mobile devices and VR.
- Texture atlas system that significantly reduces resource consumption.
- Designed to maintain high visual quality with minimal performance impact.
- Ideal for games requiring 90+ FPS.

Our products offer a specialized solution for developers seeking to balance visual quality and performance. Each model is meticulously optimized to function efficiently on mobile devices, VR systems, and low-resource hardware without compromising the visual quality of your project.

Texture Atlas System

Our texture atlas system provides multiple advantages:

- **Improved Performance:** Significant reduction in draw calls.
- **Memory Efficiency:** Optimized VRAM usage.
- **Flexibility:** Individual manipulation of meshes while maintaining efficiency.
- **Simplicity:** A single shared material reduces project complexity.

Ideal Use Cases

- **VR/AR:** Applications requiring 90+ FPS for a smooth experience.
- **Mobile Games:** Projects needing broad compatibility with devices.
- **E-Sports:** Titles demanding high performance (100+ FPS).
- **WebGL:** Browser-based 3D applications.

Important Note:

Each product includes a specific manual with detailed implementation and optimization instructions for its particular use case. This general manual provides an overview of our modeling system and best practices for its use.

Technical Specifications

Formats and Compatibility

Main Format

- **.blend:** Editable and compatible with major engines.

Additional Formats

- **.obj/.gltf:** Optimized for web.
- **.fbx:** Compatible with major engines.

Technical Limitations

- Maximum 5,000 vertices per mesh.
- Limit of 64 meshes per product.
- Maximum texture resolution: 4096×4096 pixels.
- Metric units (meters).

Texture System

Base Textures (Mandatory)	**Additional Textures (Optional)**
Albedo: Base color and opacity.	**AO:** Ambient occlusion.
Normal: Relief information.	**Specular:** Reflections (grayscale).
Roughness: Surface roughness.	**Translucency:** Translucency (grayscale).
	Self-Illumination: Self-illumination.

Texture Optimization

- **Format:** PNG with alpha support.
- **Dimensions:** 1024², 2048², 4096².
- **Combined Channels:** r-rough-b-ao format for optimization.
- **Recommended Compression:** ASTC (primary), ETC2 (alternative).

Engine Compatibility

- **Unity 2018+**
- **Unreal Engine 4+**
- **Godot 4+**
- **API Requirement:** OpenGL 3+ or Vulkan.

Model Installation

Model Installation Guide

Most game engines are compatible with files exported from Blender. However, some engines interpret axis orientation differently. By default, all models are configured with the **Z-axis pointing up**, but in certain engines, such as Unity, the **Y-axis points up**. To address this discrepancy, you can:

- Rotate the models **90° on the Y-axis** in Blender before exporting.
- Use formats such as **.glb** or **.fbx**, which generally adjust this mismatch automatically.

Material Setup

Although engines are compatible with Blender, the fidelity of materials is often affected during import. Most engines assign a default **PBR (Physically Based Rendering)** material and approximately map the textures. To optimize materials:

- The texture **r-rough-b-ao.png** combines roughness information in the red channel (**Roughness**) and ambient occlusion in the blue channel (**Ambient Occlusion**).
- You may need to configure a **custom shader** to correctly interpret these data.
- The additional files package includes a **GLSL shader** compatible with Blender, which can serve as a base for designing a custom shader in your preferred engine.

Texture Atlas Setup

Some engines, such as Unreal Engine, allow combining multiple textures into a **large Texture Atlas** of up to **8192x8192 pixels**. If your engine supports this feature, you can use it to manage textures more efficiently. However:

- Most engines do not support this feature automatically, which may require manual adjustments.
- The models are already designed with an optimized Texture Atlas, so additional configuration is generally unnecessary.

Model Structure

Model Hierarchy

Each product is delivered as a single file in a specific format (**.blend, .fbx, .obj, .glb**, etc.), containing multiple optimized meshes. These meshes share a single texture to ensure efficiency and compatibility. Key features include:

- **Uniform Scale:** All meshes have a scale of **1.0** on each axis.
- **Standard Rotation:** Rotations are set to **0.0** to prevent inconsistencies during import.
- **Metric Units:** Models are configured in **meters** to align with the International System of Units (SI).

If the model is designed to include animations, movable parts are separated from static parts to simplify manipulation. Most products do not include preconfigured bones or animations unless explicitly specified. For further details, consult the model-specific manual.

Texture Atlas Usage

Meshes utilize an **optimized Texture Atlas** to maximize texture area usage and minimize graphical load. The UV maps are configured with the following features:

- **Efficient Distribution:** UV islands are proportioned to match the model size, ensuring uniform resolution across all meshes.
- **Minimal Stretching:** UV cuts are designed to capture maximum detail without noticeable distortions.

This approach, however, has a limitation: separating meshes to apply individual textures can be challenging. In such cases, you may need to **bake textures into a new UV map**.

Model Handling and Usage

Object Positioning

Meshes are designed with the pivot located at the **base of the model** to facilitate placement on flat surfaces. For irregular objects that may be thrown or physically manipulated, the pivot is positioned at their **center of mass** to ensure more intuitive handling within the game engine.

Additionally, meshes are configured with **standardized dimensions** proportional to real-world objects, reducing the need for scaling adjustments in most cases. This modularity simplifies integration into various scenarios.

Animation Application

By default, most models do not include predefined animations. If animations are available, detailed instructions are provided in the **product-specific manual** included with the package.

Interaction with Engine Scripts and Physics

Most models are designed as **static objects** with no complex hierarchies, simplifying interaction with physics systems and game scripts. However, some models may feature additional functionalities, such as data stored in **vertex colors**. In such cases, additional files will be included to support these features:

- **Examples of use** through specific scripts.
- **Shaders** leveraging features like wind-based movement using vertex colors.
- **Links to web demonstrations** illustrating their functionality.

3D Model Material Configuration

This model pack includes a data texture named `**r-rough-b-ao.png**`, which combines roughness, ambient occlusion, and other properties into separate channels. The purpose of this texture is to save GPU VRAM, but it requires additional configuration. Specifically, you need to create a shader that separates the channels and applies the values to the corresponding material properties. Inside the ZIP file, you'll find a file named `**PBR-shader-for-data-texture.GLSL**`, which serves as an example implementation of the data texture applied to the material. This file is designed for Godot 4, but you can modify it to work with Unity 3D or use it as pseudo-code for Unreal Engine.

Shader Explanation

1. Textures:

- **albedo_texture**: Base color texture (Albedo).
- **normal_texture**: Normal map for surface detail.
- **data_texture**: Combines Roughness (Red), Displace (Green), AO (Blue), and Translucency (Alpha).

2. Separated Channels:

- **data.r**: Roughness.
- **data.g**: Displace (not directly used in this fragment shader).
- **data.b**: Ambient Occlusion.
- **data.a**: Translucency.

3. Adjustable Parameters:

- **roughness_scale**, **displace_scale**, **ao_scale**, **translucency_scale**: Allow you to adjust the intensity of each channel.

4. Shader Outputs:

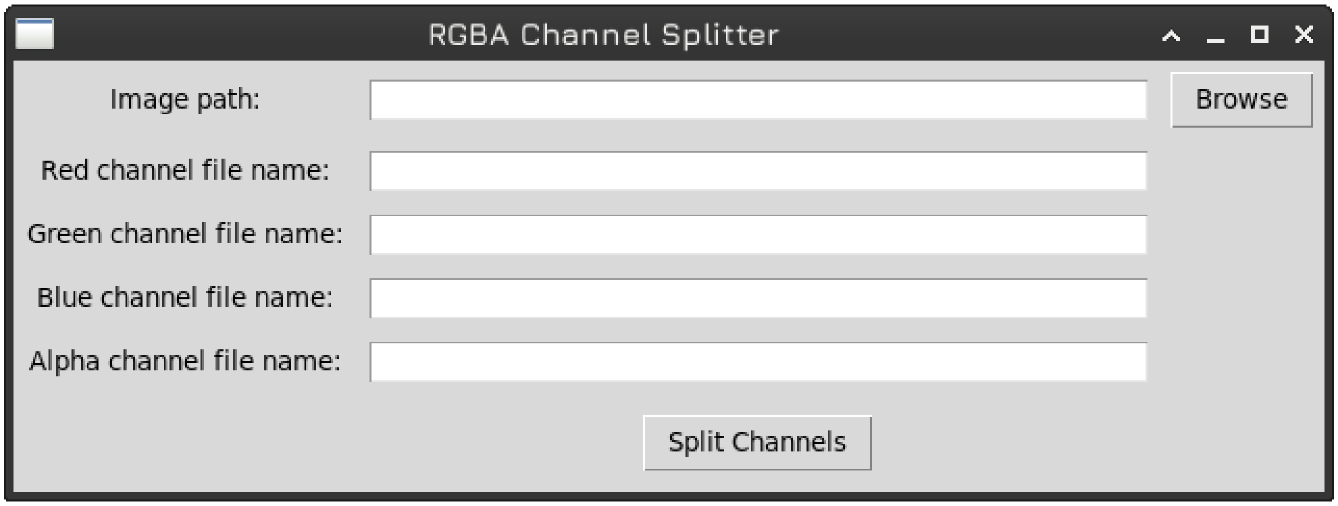
- **ALBEDO**: Base color of the material.
- **NORMAL_MAP**: Normals for surface detail.
- **ROUGHNESS**: Controls material roughness.
- **METALLIC**: Controls metallicity (disabled in this case).
- **AO**: Ambient occlusion for more realistic shadows.
- **TRANSLUCENCY**: Controls material translucency.

Additional Notes:

- If you need to use displacement (displace), you can apply it in the vertex shader to modify vertex positions based on the green channel value.
- Ensure that the textures are correctly configured in Godot's material settings (e.g., sRGB for Albedo and non-sRGB for Roughness, Normal, etc.).
- You can adjust the values of `**roughness_scale**`, `**ao_scale**`, etc., directly in Godot's inspector to customize the effect.

Texture Separations

What if I Don’t Know How to Program Shaders?



Another option is to manually separate the channels of the `**r-rough-b-ao.png**` texture into individual textures. If you're not familiar with programming, you can use image editing software like GIMP or Photoshop to do this.

If you're comfortable with programming, you can run a script included in the ZIP file named **`channel_splitter.py`** to automatically separate the channels into individual textures.

How to Use `channel_splitter.py`

Requirements:

You need to install the **`Pillow`** library, which is used for image processing, by running the following command:

```bash
pip install pillow
```

GUI Execution:

After installing the dependency, simply run the script with the following command:

```bash
python3 channel_splitter.py
```

On Linux, you can execute it with:

```bash
./channel_splitter.py
```

This will launch the graphical interface.

Command-Line Execution:

Using arguments can facilitate automation if you plan to separate channels from multiple data textures. The command structure is as follows:

```bash
```

python script.py -i input_image.png -r red.png -g green.png -b blue.png -a alpha.png
~~~

Here’s a practical example:

```bash
python script.py -i texture.png -r roughness.png -g displace.png -b ao.png -a translucency.png
~~~

**Note:** The **`-i`** parameter is mandatory to load the data texture, while the **`-rgba`** parameters are optional, but at least one must be used.

## Lost the Script?

If you lose the script, you can find a copy in the following GitHub repository: [https://github.com/Darkcom-Dev/automation-scripts-collection](https://github.com/Darkcom-Dev/automation-scripts-collection) under the `texture-ops` folder. This folder contains various scripts related to texture operations for 3D models.
```
```

# Troubleshooting

## Misaligned Uvs

If UVs are not properly assigned, open Blender and check the number of UV maps in the mesh section. It is possible that more than one UV map was mistakenly included. Simply delete the one that doesn't work. Note that stores typically review the content to ensure functionality before publication.

## Textures Not Displaying Correctly

Default textures are located in the same directory as the main file. If the file was accidentally moved to a different location, reassign the textures to their new location within the material settings.

## Compression Quality Loss

The product textures are provided in uncompressed **PNG format** so users can apply compression based on their needs. If compression issues occur, use a format that supports lossless compression and ensure reasonable compression values to maintain quality.

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# Frequently Asked Questions (FAQ)

### Why do the models use a texture atlas instead of individual textures?

The texture atlas significantly reduces draw calls and optimizes GPU memory usage. This improves performance on mobile and VR devices, allowing for high FPS without sacrificing visual quality.

### What should I do if the model appears rotated when importing it?

This is a common issue due to different axis configurations in engines. You can fix it by rotating the model 90 degrees on the Y-axis or using .glb/.fbx formats, which typically handle this situation better.

### How do I handle textures that combine multiple data in their RGB channels?

Use a custom shader to separate the channels. For example, for a texture like r-rough-b-ao.png, extract roughness from the red channel and ambient occlusion from the blue channel. Example GLSL shaders can be found in the additional files.

### Can I modify the UVs to use individual textures?

It is possible but not recommended. It would require redoing the UV mapping and baking new textures, which could result in quality loss and eliminate the optimization benefits of the texture atlas.

### What texture compression format should I use?

ASTC is recommended for most modern mobile devices. If you encounter compatibility issues, use ETC2 as an alternative.

### Why are textures limited to 4096x4096?

This limit ensures compatibility with most mobile devices and engines while maintaining a good balance between visual quality and performance. Larger textures could cause issues on modest hardware.

### Can I use these models in high-resolution games (4K/8K)?

They are not recommended for close-up views in 4K/8K. However, they work well in 1080p or for distant views, such as in RTS games, even at higher resolutions.

### Is it possible to further reduce the polygon count of the models?

The models are already optimized with a limit of 5000 vertices. Further reduction would likely visibly degrade the quality of the mesh.

# Contact

If you have any questions or suggestions, feel free to reach out to us through our support channels.

If you want the latest version of this manual, you can visit:

[https://darkcom-dev.github.io/game-dev-resources-hub/user-manual.html](https://darkcom-dev.github.io/game-dev-resources-hub/user-manual.html)

# System Requirements

## Minimum Hardware

| | Development | Final Device |
|---|---|---|
| **CPU** | 4 cores (6+ recommended) | 2 cores |
| **RAM** | 8GB minimum | 2GB minimum |
| **GPU** | 2GB VRAM minimum | 1GB VRAM |
| **Others** | 1GB available | **OpenGL 3.0+ or Vulkan** |

## Compatible Software

| Modeling | Engines |
|---|---|
| **Blender 2.8+** | **Unity 2018+** |
| **Maya 2018+** | **Unreal Engine 4+** |
| **3ds Max 2018+** | **Godot 4+** |

## Platform-Specific Requirements

| Android | iOS | VR |
|---|---|---|
| **Android 7.0+** | **iOS 11+** | **Oculus Quest:** Android API 29+ |
| **OpenGL ES 3.0+** | **Metal 2.0+** | **Meta Quest:** OpenXR 1.0+ |
| **Vulkan 1.0+ (recommended)** | | **PSVR:** PS4/PS5 dev kit |

**Recommended Performance**

- **Mobile:** Stable 30-60 FPS
- **VR:** Minimum 90+ FPS
- **E-Sports:** 100+ FPS
- **Web:** 30+ FPS in modern browsers

# Environment Setup

## Required Software Installation

The product does not require additional installations as long as the minimum software requirements specified in the documentation are met. Ensure compatible versions are used to avoid compatibility issues.

## Engine Configuration

While the engine can render models without special configurations, mobile game developers should consider the following recommendations to optimize performance.

## Resolution Limitations

This product is optimized for resolutions of **1080p or lower**. It is not recommended for use on **4K or 8K displays** due to the performance impact unless the game camera is distant, such as in real-time strategy (RTS) games.

## Graphic Optimizations

The following optional graphical optimizations are suggested to maximize efficiency without sacrificing visual quality:

- **Custom Shaders:** Design shaders to combine grayscale textures such as Roughness, Ambient Occlusion (AO), or Translucency. This reduces the number of individual textures and optimizes memory usage.
- **Texture Merging:** For performance-critical projects, consider merging AO with Albedo via color multiplication or storing Roughness in the Alpha channel. This may require baking textures or making irreversible adjustments.
- **Post-Processing:** Use effects like SSAO (Screen Space Ambient Occlusion) to enhance lighting without relying on AO textures. Adding a Bloom effect can also improve realism.
- **Compact Shaders:** If skilled in shader programming, combine multiple effects into a single pass to reduce graphical load.

## Compression Formats

For textures, the recommended compression format is **ASTC**, as it provides high quality and compatibility with modern devices. If the target device encounters issues or glitches, switch to **ETC2** as an alternative.

# Mobile Game Optimization

## Tips to Reduce Performance Impact

To optimize performance on mobile devices, compress textures using the **ASTC** format whenever the target device supports it. If incompatible, use **ETC2** as an alternative. All products are designed with a maximum of **5,000 vertices per model** to ensure efficient graphical load. While reducing polygon count further is possible, doing so may compromise the mesh's visual quality.

## Level of Detail (LOD) Configuration

Most models are not pre-configured with Levels of Detail (**LOD**). If you decide to implement them, performance improvements may be marginal depending on the project. A more efficient alternative is using a **tessellation-based shader** to smooth edges dynamically, optimizing both visual quality and performance.

## Lighting and Shadows

For projects with dynamic lighting, such as day-night cycles, implement shaders that calculate lighting at the **vertex level** and manage shadows with minimal or no bias. This reduces GPU computational load.

For static lighting projects, take advantage of **baked shadows and normals** on static objects. This significantly improves performance by eliminating real-time lighting calculations.