

Voxel World

0.0.3

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# Chapter 1

## Class Index

### 1.1 Class List

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## Chapter 2

# File Index

### 2.1 File List

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## Chapter 3

# Class Documentation

### 3.1 Camera Class Reference

```
#include <Camera.hpp>
```

#### Public Member Functions

- [Camera](#) (mat3 frame, vec3 pos, float w, float h)
- [Camera](#) ()
- [~Camera](#) ()
- mat4 [getViewMatrix](#) ()
- mat4 [getPerspectiveMatrix](#) ()
- void [setLookDirection](#) (vec3 v)
- void [move](#) (vec3 v)
- void [setPosition](#) (vec3 p)
- void [turnH](#) (float angle)
- void [turnV](#) (float angle)
- void [incline](#) (float angle)
- void [resetView](#) ()
- void [resetCamera](#) ()
- vec3 [getPosition](#) ()
- vec3 [getForward](#) ()
- vec3 [getUp](#) ()
- vec3 [getSide](#) ()
- float [getFov](#) ()

#### Private Attributes

- vec3 [forward](#)  
*vector indicating forward direction of the camera*
- vec3 [up](#)  
*vector indicating up direction of the camera*
- vec3 [side](#)  
*vector indicating side direction of the camera*
- vec3 [position](#)

- *vector indicating the position of the camera*
- `vec3 orig_forward`  
*vector indicating forward direction of the camera*
- `vec3 orig_up`  
*vector indicating up direction of the camera*
- `vec3 orig_side`  
*vector indicating side direction of the camera*
- `vec3 orig_position`  
*vector indicating the position of the camera*
- `float fov`  
*field of view, dimensions, near clipping angle, far clipping angle*
- `float width`
- `float height`
- `float zNear`
- `float zFar`

### 3.1.1 Constructor & Destructor Documentation

#### 3.1.1.1 `Camera()` [1/2]

```
Camera::Camera (
    mat3 frame,
    vec3 pos,
    float w,
    float h )
```

Parameter constructor

#### 3.1.1.2 `Camera()` [2/2]

```
Camera::Camera ( )
```

Default constructor

#### 3.1.1.3 `~Camera()`

```
Camera::~~Camera ( )
```

Destructor

### 3.1.2 Member Function Documentation

#### 3.1.2.1 getForward()

```
vec3 Camera::getForward ( )
```

Return the direction in which the camera is looking

#### 3.1.2.2 getFov()

```
float Camera::getFov ( )
```

Return the field of view of the camera

#### 3.1.2.3 getPerspectiveMatrix()

```
mat4 Camera::getPerspectiveMatrix ( )
```

Get the perspective matrix of the camera

#### 3.1.2.4 getPosition()

```
vec3 Camera::getPosition ( )
```

Return the global camera position

#### 3.1.2.5 getSide()

```
vec3 Camera::getSide ( )
```

Return the side direction of the camera

#### 3.1.2.6 getUp()

```
vec3 Camera::getUp ( )
```

Return the up direction of the camera

#### 3.1.2.7 getViewMatrix()

```
mat4 Camera::getViewMatrix ( )
```

Get the view matrix of the camera

#### 3.1.2.8 incline()

```
void Camera::incline (
    float angle )
```

Rotate the camera around its forward direction

### 3.1.2.9 move()

```
void Camera::move (
    vec3 v )
```

Move the camera by an offset  $v$

### 3.1.2.10 resetCamera()

```
void Camera::resetCamera ( )
```

Hard reset all camera values to defaults

### 3.1.2.11 resetView()

```
void Camera::resetView ( )
```

Orient the camera to it's default looking direction and orientation

### 3.1.2.12 setLookDirection()

```
void Camera::setLookDirection (
    vec3 v )
```

Orient the camera so that it looks in the direction of  $v$

### 3.1.2.13 setPosition()

```
void Camera::setPosition (
    vec3 p )
```

Place the camera at specified position  $p$

### 3.1.2.14 turnH()

```
void Camera::turnH (
    float angle )
```

Rotate the camera around it's *up direction*

### 3.1.2.15 turnV()

```
void Camera::turnV (
    float angle )
```

Rotate the camera around it's *side direction*

### 3.1.3 Member Data Documentation

#### 3.1.3.1 forward

```
vec3 Camera::forward [private]
```

vector indicating forward direction of the camera

#### 3.1.3.2 fov

```
float Camera::fov [private]
```

field of view, dimensions, near clipping angle, far clipping angle

#### 3.1.3.3 height

```
float Camera::height [private]
```

#### 3.1.3.4 orig\_forward

```
vec3 Camera::orig_forward [private]
```

vector indicating forward direction of the camera

#### 3.1.3.5 orig\_position

```
vec3 Camera::orig_position [private]
```

vector indicating the position of the camera

#### 3.1.3.6 orig\_side

```
vec3 Camera::orig_side [private]
```

vector indicating side direction of the camera

#### 3.1.3.7 orig\_up

```
vec3 Camera::orig_up [private]
```

vector indicating up direction of the camera

#### 3.1.3.8 position

```
vec3 Camera::position [private]
```

vector indicating the position of the camera

#### 3.1.3.9 side

```
vec3 Camera::side [private]
```

vector indicating side direction of the camera

#### 3.1.3.10 up

```
vec3 Camera::up [private]
```

vector indicating up direction of the camera

#### 3.1.3.11 width

```
float Camera::width [private]
```

#### 3.1.3.12 zFar

```
float Camera::zFar [private]
```



## 3.1.3.13 zNear

```
float Camera::zNear [private]
```

The documentation for this class was generated from the following files:

- Rendering/Camera/[Camera.hpp](#)
- Rendering/Camera/[Camera.cpp](#)

## 3.2 Chunk Class Reference

```
#include <World.hpp>
```

### Public Member Functions

- [Cube](#) \* [operator\(\)](#) (int, int, int)
- [Chunk](#) ()
- [Chunk](#) (vec3)
- [Chunk](#) (vec3, [World](#) \*)
- [~Chunk](#) ()
- void [create\\_cubes](#) (vec3)
- void [update](#) ()
- void [send\\_render\\_data](#) ([Renderer](#) \*)

### Public Attributes

- vec3 [position](#)

### Private Member Functions

- void [update\\_visible\\_cubes](#) ()
- bool [check\\_neighbour](#) ([Cube](#) \*c, [Cube](#) \*n)

### Private Attributes

- [World](#) \* [world](#)
- [Cube](#) \* [chunk\\_cubes](#) [[CHUNK\\_DIMS](#) \*[CHUNK\\_DIMS](#) \*[CHUNK\\_DIMS](#)] = {}
- [Object\\_3D](#) \* [render\\_data](#)
- vector< vec4 > [cubes\\_info](#)

### 3.2.1 Constructor & Destructor Documentation

### 3.2.1.1 `Chunk()` [1/3]

```
Chunk::Chunk ( )
```

Default constructor for a chunk

### 3.2.1.2 `Chunk()` [2/3]

```
Chunk::Chunk (
    vec3 offset )
```

Constructor for a chunk (should not be used, for testing only)

### 3.2.1.3 `Chunk()` [3/3]

```
Chunk::Chunk (
    vec3 offset,
    World * w )
```

Creates a chunk in the world *w* at global position *p*

### 3.2.1.4 `~Chunk()`

```
Chunk::~~Chunk ( )
```

Class destructor

## 3.2.2 Member Function Documentation

### 3.2.2.1 `check_neighbour()`

```
bool Chunk::check_neighbour (
    Cube * c,
    Cube * n ) [inline], [private]
```

Check neighbour information

### 3.2.2.2 `create_cubes()`

```
void Chunk::create_cubes (
    vec3 offset )
```

Creates cubes based on the current position of the chunk. This basically overwrites all previous data with new values associated with the current chunk location.

### 3.2.2.3 operator()

```
Cube * Chunk::operator() (
    int x,
    int y,
    int z )
```

() operator overloading, used to fetch cube values in the chunk and the world

### 3.2.2.4 send\_render\_data()

```
void Chunk::send_render_data (
    Renderer * handler ) [inline]
```

Send rendering information to the rendering handler

### 3.2.2.5 update()

```
void Chunk::update ( )
```

Update the current chunk

### 3.2.2.6 update\_visible\_cubes()

```
void Chunk::update_visible_cubes ( ) [private]
```

Set the cubes\_info array with the data of the currently visible cubes

## 3.2.3 Member Data Documentation

### 3.2.3.1 chunk\_cubes

```
Cube* Chunk::chunk_cubes [CHUNK_DIMS *CHUNK_DIMS *CHUNK_DIMS] = {} [private]
```

### 3.2.3.2 cubes\_info

```
vector<vec4> Chunk::cubes_info [private]
```

### 3.2.3.3 position

```
vec3 Chunk::position
```

### 3.2.3.4 render\_data

```
Object_3D* Chunk::render_data [private]
```

### 3.2.3.5 world

```
World* Chunk::world [private]
```

The documentation for this class was generated from the following files:

- [World.hpp](#)
- [World.cpp](#)

## 3.3 Chunk\_Holder Class Reference

```
#include <World.hpp>
```

### Public Member Functions

- [Chunk\\_Holder](#) ()
- [Chunk\\_Holder](#) (int, int, int, [World](#) \*)
- [~Chunk\\_Holder](#) ()
- [Chunk](#) \* [operator\(\)](#) (int, int, int)
- void [shift](#) (ivec3)

### Private Attributes

- [cirArray](#)< [cirArray](#)< [cirArray](#)< [Chunk](#) \* > > > [chunkBox](#)
- [World](#) \* [world](#)

### 3.3.1 Constructor & Destructor Documentation

### 3.3.1.1 Chunk\_Holder() [1/2]

```
Chunk_Holder::Chunk_Holder ( )
```

Default constructor

### 3.3.1.2 Chunk\_Holder() [2/2]

```
Chunk_Holder::Chunk_Holder (
    int x_dim,
    int y_dim,
    int z_dim,
    World * w )
```

Create a chunk holder of *x\_dim* , *y\_dim* , *z\_dim* dimensions in the world *w*

### 3.3.1.3 ~Chunk\_Holder()

```
Chunk_Holder::~~Chunk_Holder ( )
```

Class destructor

## 3.3.2 Member Function Documentation

### 3.3.2.1 operator()()

```
Chunk * Chunk_Holder::operator() (
    int x,
    int y,
    int z )
```

Overloaded () operator, used to fetch the chunk at local indices *x*, *y*, *z*

### 3.3.2.2 shift()

```
void Chunk_Holder::shift (
    ivec3 offset )
```

Shift the entire loaded box in the direction specified by *offset* This effectively moves the world into that direction  
Re-initialize *y* values as needed

## 3.3.3 Member Data Documentation

### 3.3.3.1 chunkBox

```
cirArray<cirArray<cirArray<Chunk*> > > Chunk_Holder::chunkBox [private]
```

### 3.3.3.2 world

```
World* Chunk_Holder::world [private]
```

The documentation for this class was generated from the following files:

- [World.hpp](#)
- [World.cpp](#)

## 3.4 cirArray< T > Class Template Reference

```
#include <tools.hpp>
```

### Public Member Functions

- [cirArray](#) ()
- [cirArray](#) (uint [size](#))
- void [shift](#) (int)
- T & [operator\[\]](#) (int)
- void [operator=](#) (T)
- uint [size](#) ()

### Private Attributes

- vector< T > [array](#)
- int [start](#)

### 3.4.1 Detailed Description

```
template<typename T>
class cirArray< T >
```

A generic circular array class, can be considered a ciircular vector

### 3.4.2 Constructor & Destructor Documentation

#### 3.4.2.1 cirArray() [1/2]

```
template<typename T >
cirArray< T >::cirArray ( )
```

Default constructor of the class

#### 3.4.2.2 cirArray() [2/2]

```
template<typename T >
cirArray< T >::cirArray (
    uint size )
```

Parametrized constructor of the class, creates a circular array of *size elements*

### 3.4.3 Member Function Documentation

#### 3.4.3.1 operator=()

```
template<typename T>
void cirArray< T >::operator= (
    T )
```

#### 3.4.3.2 operator[]()

```
template<typename T >
T & cirArray< T >::operator[] (
    int i )
```

[] operator, returns the element at index *i*

#### 3.4.3.3 shift()

```
template<typename T >
void cirArray< T >::shift (
    int i )
```

shift the circular array by *i units*

#### 3.4.3.4 size()

```
template<typename T >
uint cirArray< T >::size ( )
```

Returns the current size (number of elements) of the circular array

### 3.4.4 Member Data Documentation

#### 3.4.4.1 array

```
template<typename T>
vector<T> cirArray< T >::array [private]
```

#### 3.4.4.2 start

```
template<typename T>
int cirArray< T >::start [private]
```

The documentation for this class was generated from the following file:

- [Helpers/tools.hpp](#)

## 3.5 Cube Class Reference

```
#include <Cube.hpp>
```

### Public Member Functions

- void [update](#) (vec3 offset)
- [Cube](#) (vec3 p, [CubeID](#) type)
- [Cube](#) (vec3 p)
- [Cube](#) ()
- [~Cube](#) ()
- [Mesh](#) [getMesh](#) ()

### Static Public Member Functions

- static void [initialize](#) ()
- static void [cleanup](#) ()

### Public Attributes

- vec3 [position](#)  
*global position of the cube*
- [CubeID](#) [cube\\_type](#) = [DEFAULT](#)  
*unique ID representing the cube*
- bool [transparent](#) = false  
*is the block transparent?*



## Static Public Attributes

- static vector< [Mesh](#) \* > [meshes](#)  
*meshes of all cube subclasses*
- static vector< [Texture](#) \* > [textures](#)  
*textures of all cube subclasses*

### 3.5.1 Detailed Description

[Cube](#) class definition

### 3.5.2 Constructor & Destructor Documentation

#### 3.5.2.1 [Cube\(\)](#) [1/3]

```
Cube::Cube (
    vec3 p,
    CubeID type )
```

Parametrized constructor of the cube class *Type* refers to a cube ID

#### 3.5.2.2 [Cube\(\)](#) [2/3]

```
Cube::Cube (
    vec3 p )
```

Constructor for a cube, creates a default cube at position *p*

#### 3.5.2.3 [Cube\(\)](#) [3/3]

```
Cube::Cube ( )
```

Default constructor for a cube

#### 3.5.2.4 [~Cube\(\)](#)

```
Cube::~Cube ( )
```

Destructor for a cube

### 3.5.3 Member Function Documentation

#### 3.5.3.1 cleanup()

```
void Cube::cleanup ( ) [static]
```

Free memory used by the cube class

#### 3.5.3.2 getMesh()

```
Mesh Cube::getMesh ( )
```

Get the value of the mesh of this cube

#### 3.5.3.3 initialize()

```
void Cube::initialize ( ) [static]
```

Initialize the static memebrs of the [Cube](#) class

#### 3.5.3.4 update()

```
void Cube::update (
    vec3 offset )
```

Update the position of the current cube and reset its values

### 3.5.4 Member Data Documentation

#### 3.5.4.1 cube\_type

```
CubeID Cube::cube_type = DEFAULT
```

unique ID representing the cube

#### 3.5.4.2 meshes

```
vector< Mesh * > Cube::meshes [static]
```

meshes of all cube subclasses

#### 3.5.4.3 position

```
vec3 Cube::position
```

global position of the cube

#### 3.5.4.4 textures

```
vector< Texture * > Cube::textures [static]
```

textures of all cube subclasses

#### 3.5.4.5 transparent

```
bool Cube::transparent = false
```

is the block transparent?

The documentation for this class was generated from the following files:

- [Cube.hpp](#)
- [Cube.cpp](#)

## 3.6 Light Struct Reference

```
#include <World.hpp>
```

### Public Attributes

- vec3 [position](#)
- vec4 [color](#)
- double [intensity](#)

### 3.6.1 Member Data Documentation

#### 3.6.1.1 color

```
vec4 Light::color
```

### 3.6.1.2 intensity

```
double Light::intensity
```

### 3.6.1.3 position

```
vec3 Light::position
```

The documentation for this struct was generated from the following file:

- [World.hpp](#)

## 3.7 Mesh Struct Reference

```
#include <OpenGL-Wrappers.hpp>
```

### Public Member Functions

- [~Mesh\(\)](#)

### Public Attributes

- vector< vec3 > [vertices](#)  
*Vertex data.*
- vector< vec3 > [normals](#)  
*Normal data.*
- vector< uint > [indices](#)  
*Element data (sequence in which data will be read)*
- vector< vec2 > [uvs](#)

### 3.7.1 Constructor & Destructor Documentation

#### 3.7.1.1 ~Mesh()

```
Mesh::~~Mesh ( )
```

Class destructor

### 3.7.2 Member Data Documentation

### 3.7.2.1 indices

```
vector<uint> Mesh::indices
```

Element data (sequence in which data will be read)

### 3.7.2.2 normals

```
vector<vec3> Mesh::normals
```

Normal data.

### 3.7.2.3 uvs

```
vector<vec2> Mesh::uvs
```

[Texture](#) data for this geometry (the associated coordinates of the mesh)

### 3.7.2.4 vertices

```
vector<vec3> Mesh::vertices
```

Vertex data.

The documentation for this struct was generated from the following files:

- [Rendering/OpenGL-Wrappers.hpp](#)
- [Rendering/OpenGL-Wrappers.cpp](#)

## 3.8 Object\_3D Class Reference

```
#include <OpenGL-Wrappers.hpp>
```

### Public Member Functions

- [Object\\_3D](#) ([Mesh](#) \*)
- [template<class T >](#)  
void [set\\_instance\\_data](#) ([Renderer](#) \*, [vector< T >](#))

## Public Attributes

- GLuint [VAO](#)  
*Vertex Array Object.*
- vector< GLuint > [VBOs](#)  
*array of VBO Ids*
- vector< GLuint > [types](#)  
*Array of VBO types.*
- uint [layouts](#)  
*The number of layouts to activate.*
- uint [render\\_instances](#)  
*Number of instances to render current object.*
- uint [mesh\\_indices](#)  
*Indices for index rendering, if any.*

## 3.8.1 Constructor & Destructor Documentation

### 3.8.1.1 Object\_3D()

```
Object_3D::Object_3D (
    Mesh * mesh )
```

Create a 3D rendereable object from a mesh

## 3.8.2 Member Function Documentation

### 3.8.2.1 set\_instance\_data()

```
template<class T >
void Object_3D::set_instance_data (
    Renderer * handler,
    vector< T > info )
```

Set the visual data for the current 3D object (SSBO data)

## 3.8.3 Member Data Documentation

### 3.8.3.1 layouts

```
uint Object_3D::layouts
```

The number of layouts to activate.

### 3.8.3.2 mesh\_indices

```
uint Object_3D::mesh_indices
```

Indices for index rendering, if any.

### 3.8.3.3 render\_instances

```
uint Object_3D::render_instances
```

Number of instances to render current object.

### 3.8.3.4 types

```
vector<GLuint> Object_3D::types
```

Array of VBO types.

### 3.8.3.5 VAO

```
GLuint Object_3D::VAO
```

Vertex Array Object.

### 3.8.3.6 VBOs

```
vector<GLuint> Object_3D::VBOs
```

array of VBO ids

The documentation for this class was generated from the following files:

- [Rendering/OpenGL-Wrappers.hpp](#)
- [Rendering/OpenGL-Wrappers.cpp](#)

## 3.9 Renderer Class Reference

```
#include <OpenGL-Wrappers.hpp>
```

### Public Member Functions

- [Renderer](#) ()
- [Renderer](#) (int width, int height)
- [~Renderer](#) ()
- [Shader](#) \* [find\\_shader](#) (string shader\_name)
- void [update](#) (GLFWwindow \*window)
- void [add\\_Shader](#) (string shader, GLuint type)
- void [make\\_program](#) (vector< uint > \*shaders)
- void [set\\_camera](#) ([Camera](#) \*new\_cam)
- void [multi\\_render](#) (GLuint VAO, vector< GLuint > \*VBOs, vector< GLuint > \*buffer\_types, GLuint layout↵\_num, GLuint index\_num, GLuint instances)
- void [change\\_active\\_program](#) (GLuint newProgram)
- void [add\\_data](#) ([Object\\_3D](#) \*)
- void [render](#) ()
- void [clear](#) ()

### Public Attributes

- mutex [busy\\_queue](#)  
*Lock to synchronize queue W/R.*
- [Camera](#) \* [cam](#)  
*Main (player) camera object.*
- GLuint [current\\_program](#)  
*Current shading program (program used to render)*

### Private Attributes

- vector< GLuint > [shading\\_programs](#)  
*Shading programs IDs.*
- vector< [Shader](#) > [vertex\\_shaders](#)  
*Vertex shader IDs.*
- vector< [Shader](#) > [fragment\\_shaders](#)  
*Fragment shader IDs.*
- vector< [Shader](#) > [tessellation\\_shaders](#)  
*Tessellation shader IDs.*
- vector< [Object\\_3D](#) \* > [render\\_queue](#)

#### 3.9.1 Constructor & Destructor Documentation



### 3.9.1.1 `Renderer()` [1/2]

```
Renderer::Renderer ( )
```

Default constructor for the [Renderer](#) Class

### 3.9.1.2 `Renderer()` [2/2]

```
Renderer::Renderer (
    int width,
    int height )
```

Contructor for the [Renderer](#) class. Creates a renderer object that handles all render calls. It's intended to be unique but has not been implemented as a singleton be weary!

### 3.9.1.3 `~Renderer()`

```
Renderer::~~Renderer ( )
```

Class destructor

## 3.9.2 Member Function Documentation

### 3.9.2.1 `add_data()`

```
void Renderer::add_data (
    Object\_3D * data )
```

Add a rendereable 3D object to the current render queue

### 3.9.2.2 `add_Shader()`

```
void Renderer::add_Shader (
    string shader,
    GLuint type )
```

Add a new shader to the set of all shaders

### 3.9.2.3 `change_active_program()`

```
void Renderer::change_active_program (
    GLuint newProgram )
```

#### 3.9.2.4 clear()

```
void Renderer::clear ( )
```

Clear all objects in the render queue

#### 3.9.2.5 find\_shader()

```
Shader * Renderer::find_shader (
    string shader_name )
```

Find a shader through a string

#### 3.9.2.6 make\_program()

```
void Renderer::make_program (
    vector< uint > * shaders )
```

#### 3.9.2.7 multi\_render()

```
void Renderer::multi_render (
    GLuint VAO,
    vector< GLuint > * VBOs,
    vector< GLuint > * buffer_types,
    GLuint layout_num,
    GLuint index_num,
    GLuint instances )
```

Function to render multiple instances of the same mesh index\_num is the number of indices in the mesh (for drawing elements) layout\_num is the number of layouts to enable (always 0 to layout\_num-1)

#### 3.9.2.8 render()

```
void Renderer::render ( )
```

Render all elements in the current render queue

#### 3.9.2.9 set\_camera()

```
void Renderer::set_camera (
    Camera * new_cam )
```

Initialize the main rendering camera

#### 3.9.2.10 update()

```
void Renderer::update (
    GLFWwindow * window )
```

Update general rendering values

### 3.9.3 Member Data Documentation

#### 3.9.3.1 busy\_queue

```
mutex Renderer::busy_queue
```

Lock to synchronize queue W/R.

#### 3.9.3.2 cam

```
Camera* Renderer::cam
```

Main (player) camera object.

#### 3.9.3.3 current\_program

```
GLuint Renderer::current_program
```

Current shading program (program used to render)

#### 3.9.3.4 fragment\_shaders

```
vector<Shader> Renderer::fragment_shaders [private]
```

Fragment shader IDs.

#### 3.9.3.5 render\_queue

```
vector<Object_3D*> Renderer::render_queue [private]
```

Queue of objects to render in the current frame

### 3.9.3.6 shading\_programs

```
vector<GLuint> Renderer::shading_programs [private]
```

Shading programs IDs.

### 3.9.3.7 tessellation\_shaders

```
vector<Shader> Renderer::tessellation_shaders [private]
```

Tessellation shader IDs.

### 3.9.3.8 vertex\_shaders

```
vector<Shader> Renderer::vertex_shaders [private]
```

Vertex shader IDs.

The documentation for this class was generated from the following files:

- Rendering/[OpenGL-Wrappers.hpp](#)
- Rendering/[OpenGL-Wrappers.cpp](#)

## 3.10 Shader Class Reference

```
#include <OpenGL-Wrappers.hpp>
```

### Public Member Functions

- [Shader](#) ()
- [Shader](#) (string file, GLenum [type](#))
- [~Shader](#) ()
- string [load\\_from\\_file](#) (string &)
- void [clear](#) ()

### Public Attributes

- string [fileName](#)  
*source file*
- GLuint [shaderID](#)  
*generated OpenGL shader ID*
- GLuint [type](#)  
*shader type*

### 3.10.1 Constructor & Destructor Documentation

#### 3.10.1.1 Shader() [1/2]

```
Shader::Shader ( )
```

Default Constructor

#### 3.10.1.2 Shader() [2/2]

```
Shader::Shader (
    string file,
    GLenum type )
```

Initialize the fields of a shader object using a glsl shader file

Parameters

<i>file</i>	the file path (relative or absolute) where the shader program is defined
<i>type</i>	the type of shader (e.g vertex,fragment, tessellation...)

#### 3.10.1.3 ~Shader()

```
Shader::~Shader ( )
```

Destructor of a shader struct

### 3.10.2 Member Function Documentation

#### 3.10.2.1 clear()

```
void Shader::clear ( )
```

Cleanup the shader OpenGL information

#### 3.10.2.2 load\_from\_file()

```
string Shader::load_from_file (
    string & filepath )
```

Copy a file into a a string

**Parameters**

<i>filepath</i>	path to the file
-----------------	------------------

**Returns**

A string that is the copy of the source file

### 3.10.3 Member Data Documentation

#### 3.10.3.1 fileName

```
string Shader::fileName
```

source file

#### 3.10.3.2 shaderID

```
GLuint Shader::shaderID
```

generated OpenGL shader ID

#### 3.10.3.3 type

```
GLuint Shader::type
```

shader type

The documentation for this class was generated from the following files:

- Rendering/[OpenGL-Wrappers.hpp](#)
- Rendering/[OpenGL-Wrappers.cpp](#)

## 3.11 Texture Class Reference

```
#include <OpenGL-Wrappers.hpp>
```

## Public Member Functions

- [Texture](#) (const char \*filename, GLuint [target](#)=GL\_TEXTURE\_2D)
- [~Texture](#) ()
- void [load\\_to\\_GPU](#) (GLuint)
- void [clear](#) ()

## Public Attributes

- GLuint [textureID](#)  
*OpenGL generated ID for the texture.*
- GLuint [target](#)  
*OpenGL target (Usually 2D texture or rectangle) check OpenGL doc.*
- string [texture](#)  
*Texture data.*
- int [width](#)  
*width of the texture*
- int [height](#)  
*height of the texture*

### 3.11.1 Constructor & Destructor Documentation

#### 3.11.1.1 Texture()

```
Texture::Texture (
    const char * filename,
    GLuint targ = GL_TEXTURE_2D )
```

Initialize the fields of a texture object using arrays

#### Parameters

<i>filename</i>	the filepath to the texture file
<i>targ</i>	the OpenGL texture target (e.g 2D, rectangle...)

#### Returns

Boolean value indicating whether an error occurred (true means no error)

#### 3.11.1.2 ~Texture()

```
Texture::~Texture ( )
```

Destructor of a texture struct

### 3.11.2 Member Function Documentation

#### 3.11.2.1 clear()

```
void Texture::clear ( )
```

Clear all OpenGL information of the texture object

#### 3.11.2.2 load\_to\_GPU()

```
void Texture::load_to_GPU (
    GLuint program )
```

### 3.11.3 Member Data Documentation

#### 3.11.3.1 height

```
int Texture::height
```

height of the texture

#### 3.11.3.2 target

```
GLuint Texture::target
```

OpenGL target (Usually 2D texture or rectangle) check OpenGL doc.

#### 3.11.3.3 texture

```
string Texture::texture
```

[Texture](#) data.



#### 3.11.3.4 textureID

```
GLuint Texture::textureID
```

OpenGL generated ID for the texture.

#### 3.11.3.5 width

```
int Texture::width
```

width of the texture

The documentation for this class was generated from the following files:

- Rendering/[OpenGL-Wrappers.hpp](#)
- Rendering/[OpenGL-Wrappers.cpp](#)

## 3.12 World Class Reference

```
#include <World.hpp>
```

### Public Member Functions

- [World](#) ()
- [~World](#) ()
- [Cube \\* operator\(\)](#) (int x, int y, int z)
- void [center\\_frame](#) (ivec3 offset)
- void [send\\_render\\_data](#) ([Renderer](#) \*)

### Public Attributes

- int [h\\_radius](#) = 7
- int [v\\_radius](#) = 4
- ivec3 [origin](#) = ivec3(0)

### Private Attributes

- [Chunk\\_Holder](#) \* [loaded\\_chunks](#)

### 3.12.1 Constructor & Destructor Documentation

#### 3.12.1.1 World()

```
World::World ( )
```

[World](#) default constructor

#### 3.12.1.2 ~World()

```
World::~~World ( )
```

[World](#) class destructor

### 3.12.2 Member Function Documentation

#### 3.12.2.1 center\_frame()

```
void World::center_frame (
    ivec3 position )
```

Center the frame around *position*

#### 3.12.2.2 operator>()()

```
Cube * World::operator() (
    int x,
    int y,
    int z )
```

Overloaded () operator, used to get chunk pointers in the loaded chunks of the world through their global position

#### 3.12.2.3 send\_render\_data()

```
void World::send_render_data (
    Renderer * handler )
```

Send all world render data to the handler

### 3.12.3 Member Data Documentation

### 3.12.3.1 h\_radius

```
int World::h_radius = 7
```

### 3.12.3.2 loaded\_chunks

```
Chunk_Holder* World::loaded_chunks [private]
```

### 3.12.3.3 origin

```
ivec3 World::origin = ivec3(0)
```

### 3.12.3.4 v\_radius

```
int World::v_radius = 4
```

The documentation for this class was generated from the following files:

- [World.hpp](#)
- [World.cpp](#)



## Chapter 4

# File Documentation

### 4.1 Cube.cpp File Reference

Definition of a generic cube object.

```
#include "system-libraries.hpp"
#include "Cube.hpp"
#include "cout-definitions.hpp"
```

#### Variables

- `vector< string > texture_source_files = {"Assets/Textures/white_cube.png"}`
- `vector< string > obj_source_files = {"Assets/Objs/cube.obj"}`

#### 4.1.1 Detailed Description

Definition of a generic cube object.

#### Author

Camilo Talero

Version: 0.0.3

#### 4.1.2 Variable Documentation

##### 4.1.2.1 obj\_source\_files

```
vector<string> obj_source_files = {"Assets/Objs/cube.obj"}
```

#### 4.1.2.2 texture\_source\_files

```
vector<string> texture_source_files = {"Assets/Textures/white_cube.png"}
```

Global texture and mesh source file strings

## 4.2 Cube.hpp File Reference

Header for the definition of a generic cube object.

```
#include <string>
#include "OpenGL-Wrappers.hpp"
#include "wavefront-loader.hpp"
```

### Classes

- class [Cube](#)

### Enumerations

- enum [CubeID](#) { [DEFAULT](#) =0 }

### Variables

- const uint [cube\\_types](#) = 1

#### 4.2.1 Detailed Description

Header for the definition of a generic cube object.

#### Author

Camilo Talero

Version: 0.0.3

#### 4.2.2 Enumeration Type Documentation

##### 4.2.2.1 CubeID

```
enum CubeID
```

## Enumerator

DEFAULT	
---------	--

### 4.2.3 Variable Documentation

#### 4.2.3.1 cube\_types

```
const uint cube_types = 1
```

## 4.3 Helpers/cout-definitions.cpp File Reference

Implementation of the output functions for I/O debugging.

```
#include "cout-definitions.hpp"
```

### Functions

- ostream & [operator<<](#) (ostream &os, vec2 &v)
- ostream & [operator<<](#) (ostream &os, vec3 &v)
- ostream & [operator<<](#) (ostream &os, vec4 &v)
- ostream & [operator<<](#) (ostream &os, vector< float > &v)

#### 4.3.1 Detailed Description

Implementation of the output functions for I/O debugging.

## Author

Camilo Talero

Version: 0.0.3

#### 4.3.2 Function Documentation

#### 4.3.2.1 `operator<<()` [1/4]

```
ostream& operator<< (
    ostream & os,
    vec2 & v )
```

Print a vec2

#### 4.3.2.2 `operator<<()` [2/4]

```
ostream& operator<< (
    ostream & os,
    vec3 & v )
```

Print a vec3

#### 4.3.2.3 `operator<<()` [3/4]

```
ostream& operator<< (
    ostream & os,
    vec4 & v )
```

Print a vec4

#### 4.3.2.4 `operator<<()` [4/4]

```
ostream& operator<< (
    ostream & os,
    vector< float > & v )
```

Print a vector of floats

## 4.4 Helpers/cout-definitions.hpp File Reference

Header defining some output methods to print structures to the terminal.

```
#include "system-libraries.hpp"
```

### Functions

- ostream & [operator<<](#) (ostream &os, vec2 &v)
- ostream & [operator<<](#) (ostream &os, vec3 &v)
- ostream & [operator<<](#) (ostream &os, vec4 &v)
- ostream & [operator<<](#) (ostream &os, vector< float > &v)



### 4.4.1 Detailed Description

Header defining some output methods to print structures to the terminal.

#### Author

Camilo Talero

Version: 0.0.3

### 4.4.2 Function Documentation

#### 4.4.2.1 `operator<<()` [1/4]

```
ostream& operator<< (
    ostream & os,
    vec2 & v )
```

Print a vec2

#### 4.4.2.2 `operator<<()` [2/4]

```
ostream& operator<< (
    ostream & os,
    vec3 & v )
```

Print a vec3

#### 4.4.2.3 `operator<<()` [3/4]

```
ostream& operator<< (
    ostream & os,
    vec4 & v )
```

Print a vec4

#### 4.4.2.4 `operator<<()` [4/4]

```
ostream& operator<< (
    ostream & os,
    vector< float > & v )
```

Print a vector of floats

## 4.5 Helpers/system-libraries.hpp File Reference

General header for system libraries.

```
#include <GL/glew.h>
#include <GLFW/glfw3.h>
#include <string>
#include <sstream>
#include <iostream>
#include <vector>
#include <fstream>
#include <cstdlib>
#include <unistd.h>
#include <time.h>
#include <thread>
#include <mutex>
#include <math.h>
#include <chrono>
#include <ctime>
#include <glm/glm.hpp>
#include <glm/gtc/matrix_transform.hpp>
#include <glm/gtx/transform.hpp>
#include <glm/gtc/type_ptr.hpp>
#include <ft2build.h>
```

### Macros

- `#define GLEW_DYNAMIC`

#### 4.5.1 Detailed Description

General header for system libraries.

##### Author

Camilo Talero

Version: 0.0.3

#### 4.5.2 Macro Definition Documentation

##### 4.5.2.1 GLEW\_DYNAMIC

```
#define GLEW_DYNAMIC
```

## 4.6 Helpers/tools.cpp File Reference

Implementation of miscellaneous helping functions and structures.

```
#include "tools.hpp"
```

### Functions

- void `vec_field_init` ()
- double `fade` (double d)
- double `length` (double x, double y)
- double `surflet` (double x, double y, double grad\_x, double grad\_y)
- double `perlin_noise` (double x, double y)
- double `noise_2D` (double x, double y)

### Variables

- int const `size` = 256
- int const `mask` = `size`-1
- int `perm` [`size`]
- float `vec_field_x` [`size`]
- float `vec_field_y` [`size`]

#### 4.6.1 Detailed Description

Implementation of miscellaneous helping functions and structures.

##### Author

Camilo Talero

Version: 0.0.3

Perlin noise implementation was done following the information at: <http://eastfarthing.com/blog/2015-04-21-noise>

#### 4.6.2 Function Documentation

##### 4.6.2.1 `fade()`

```
double fade (
    double d ) [inline]
```

Function to smooth out the transition from each grid cell to another  $f(x)=1-6*|x|^5-15|x|^4+10|x|^3$

#### 4.6.2.2 length()

```
double length (
    double x,
    double y ) [inline]
```

Return the length of the vector (x,y) for radial fading.

#### 4.6.2.3 noise\_2D()

```
double noise_2D (
    double x,
    double y )
```

Composite 2D noise function. Combines multiple iterations of Perlin noise at different sampling rates and amplitudes and merges them using octaves to create more complex noise functions

#### 4.6.2.4 perlin\_noise()

```
double perlin_noise (
    double x,
    double y )
```

2D Perlin Noise function

#### 4.6.2.5 surflet()

```
double surflet (
    double x,
    double y,
    double grad_x,
    double grad_y ) [inline]
```

2D convolution surflet function, returns a scalar based on the gradient at (x,y)

#### 4.6.2.6 vec\_field\_init()

```
void vec_field_init ( )
```

Initialize the perlin noise grid. We basically rotate a 2D vector 2PI units in the counter clockwise direction and assign a random location to it in a lookup table

### 4.6.3 Variable Documentation

#### 4.6.3.1 mask

```
int const mask = size-1
```

#### 4.6.3.2 perm

```
int perm[size]
```

#### 4.6.3.3 size

```
int const size = 256
```

#### 4.6.3.4 vec\_field\_x

```
float vec_field_x[size]
```

#### 4.6.3.5 vec\_field\_y

```
float vec_field_y[size]
```

## 4.7 Helpers/tools.hpp File Reference

Header for the definition of a generic chunk object.

```
#include "system-libraries.hpp"
```

### Classes

- class [cirArray< T >](#)

### Functions

- double [noise\\_2D](#) (double x, double y)
- void [vec\\_field\\_init](#) ()

### 4.7.1 Detailed Description

Header for the definition of a generic chunk object.

#### Author

Camilo Talero

Version: 0.0.3

### 4.7.2 Function Documentation

#### 4.7.2.1 noise\_2D()

```
double noise_2D (
    double x,
    double y )
```

Composite 2D noise function. Combines multiple iterations of Perlin noise at different sampling rates and amplitudes and merges them using octaves to create more complex noise functions

#### 4.7.2.2 vec\_field\_init()

```
void vec_field_init ( )
```

Initialize the perlin noise grid. We basically rotate a 2D vector 2PI units in the counter clockwise direction and assign a random location to it in a lookup table

## 4.8 Helpers/wavefront-loader.cpp File Reference

Defines methods needed to load wavefront (.obj) meshes.

```
#include "wavefront-loader.hpp"
#include <algorithm>
```

### Functions

- void [load\\_obj](#) (string filename, vector< float > \*vertices, vector< float > \*normals, vector< float > \*texture\_coords)

### 4.8.1 Detailed Description

Defines methods needed to load wavefront (.obj) meshes.

Author

Camilo Talero

Version: 0.0.3

### 4.8.2 Function Documentation

#### 4.8.2.1 load\_obj()

```
void load_obj (
    string filename,
    vector< float > * vertices,
    vector< float > * normals,
    vector< float > * texture_coords )
```

Function to load the mesh information from a .obj file, it assumes triangular meshes only. All return arrays must be cleared before using the function, else information will be returned at the end of the arrays.

Params: filename: the path to the file to be loaded. vertices: a pointer to a vector of floats where the vertex information will be loaded normals: a pointer to a vector of floats where the normal information will be loaded texture\_coords: a pointer to a vector of floats where the texture mapping information will be loaded

## 4.9 Helpers/wavefront-loader.hpp File Reference

Header declaration of methods needed to load wavefront (.obj) meshes.

```
#include "system-libraries.hpp"
```

### Functions

- void [load\\_obj](#) (std::string filename, std::vector< float > \*vertices, std::vector< float > \*normals, std::vector< float > \*texture\_coords)

#### 4.9.1 Detailed Description

Header declaration of methods needed to load wavefront (.obj) meshes.

Author

: Camilo Talero

Version: 0.0.3

## 4.9.2 Function Documentation

### 4.9.2.1 load\_obj()

```
void load_obj (
    std::string filename,
    std::vector< float > * vertices,
    std::vector< float > * normals,
    std::vector< float > * texture_coords )
```

## 4.10 main.cpp File Reference

main file. Thread and global loop definitoins go here, as well as initialization

```
#include "system-libraries.hpp"
#include "Window-Management.hpp"
#include "Cube.hpp"
#include "World.hpp"
```

### Typedefs

- typedef std::chrono::duration< int, std::ratio< 1, 60 > > [frame\\_duration](#)
- typedef std::chrono::duration< int, std::ratio< 1, 600 > > [world\\_duration](#)

### Functions

- void [render\\_loop](#) (GLFWwindow \*window)
- void [update\\_loop](#) (GLFWwindow \*, GLFWwindow \*)
- int [main](#) (int argc, char \*\*argv)

### 4.10.1 Detailed Description

main file. Thread and global loop definitoins go here, as well as initialization

#### Author

Camilo Talero

Version: 0.0.3

References: <https://open.gl> <http://www.opengl-tutorial.org/beginners-tutorials/tutorial-3-ma>  
<http://www.glfw.org/docs/latest/> <http://eastfarthing.com/blog/2015-04-21-noise/>



## 4.10.2 Typedef Documentation

### 4.10.2.1 frame\_duration

```
typedef std::chrono::duration<int, std::ratio<1, 60> > frame_duration
```

### 4.10.2.2 world\_duration

```
typedef std::chrono::duration<int, std::ratio<1, 600> > world_duration
```

## 4.10.3 Function Documentation

### 4.10.3.1 main()

```
int main (
    int argc,
    char ** argv )
```

### 4.10.3.2 render\_loop()

```
void render_loop (
    GLFWwindow * window )
```

### 4.10.3.3 update\_loop()

```
void update_loop (
    GLFWwindow * window,
    GLFWwindow * o_window )
```

## 4.11 Rendering/Camera/Camera.cpp File Reference

Implementation of the camera header. Defines the behaviour for a generic camera.

```
#include "Camera.hpp"
```

### 4.11.1 Detailed Description

Implementation of the camera header. Defines the behaviour for a generic camera.

#### Author

Camilo Talero

Version: 0.0.3

## 4.12 Rendering/Camera/Camera.hpp File Reference

Header declaration of functions and members for a generic camera class.

```
#include "system-libraries.hpp"
```

### Classes

- class [Camera](#)

### 4.12.1 Detailed Description

Header declaration of functions and members for a generic camera class.

#### Author

Camilo Talero

Version: 0.0.3

## 4.13 Rendering/OpenGL-Wrappers.cpp File Reference

Wrapper structures to abstract OpenGL function calls.

```
#include <stb/stb_image.h>
#include <stb/stb_image_write.h>
#include "system-libraries.hpp"
#include "OpenGL-Wrappers.hpp"
```

### Macros

- #define [STB\\_IMAGE\\_IMPLEMENTATION](#)
- #define [STB\\_IMAGE\\_WRITE\\_IMPLEMENTATION](#)

## Functions

- `template<class T >`  
void `init_buffer` (vector< T > data, GLuint buffer, GLenum buffer\_type, GLuint layout, GLboolean normalize, GLenum elements, GLenum data\_type)
- void `verify_uniform_location` (GLint location, string error\_message)

## Variables

- `Renderer * Rendering_Handler`  
*The global render handler.*

### 4.13.1 Detailed Description

Wrapper structures to abstract OpenGL function calls.

#### Author

Camilo Talero

Version: 0.0.3

### 4.13.2 Macro Definition Documentation

#### 4.13.2.1 STB\_IMAGE\_IMPLEMENTATION

```
#define STB_IMAGE_IMPLEMENTATION
```

#### 4.13.2.2 STB\_IMAGE\_WRITE\_IMPLEMENTATION

```
#define STB_IMAGE_WRITE_IMPLEMENTATION
```

### 4.13.3 Function Documentation

#### 4.13.3.1 `init_buffer()`

```
template<class T >
void init_buffer (
    vector< T > data,
    GLuint buffer,
    GLenum buffer_type,
    GLuint layout,
    GLboolean normalize,
    GLuint elements,
    GLenum data_type ) [inline]
```

Method to initialize a basic [Shader](#) layout from a vector of data. Mainly use to make the code less verbose.

#### 4.13.3.2 `verify_uniform_location()`

```
void verify_uniform_location (
    GLint location,
    string error_message ) [inline]
```

Error checking and message function for uniforms.

### 4.13.4 Variable Documentation

#### 4.13.4.1 `Rendering_Handler`

[Renderer\\*](#) `Rendering_Handler`

The global render handler.

## 4.14 Rendering/OpenGL-Wrappers.hpp File Reference

Header to define variables, structure definitions, include libraries... Shared among all rendering functions.

```
#include "system-libraries.hpp"
#include "Camera.hpp"
#include "cout-definitions.hpp"
```

### Classes

- class [Shader](#)
- class [Texture](#)
- struct [Mesh](#)
- class [Renderer](#)
- class [Object\\_3D](#)

## Enumerations

- enum [PROGRAM](#)

## Functions

- int [openGLError](#) ()

## Variables

- [Renderer](#) \* [Rendering\\_Handler](#)

*The global render handler.*

### 4.14.1 Detailed Description

Header to define variables, structure definitions, include libraries... Shared among all rendering functions.

#### Author

Camilo Talero

Version: 0.0.3

### 4.14.2 Enumeration Type Documentation

#### 4.14.2.1 PROGRAM

enum [PROGRAM](#)

### 4.14.3 Function Documentation

#### 4.14.3.1 [openGLError](#)()

```
int openGLError ( )
```

Check for OpenGL errors and print the appropriate error message if needed.

#### Returns

The number of the generated error.

#### 4.14.4 Variable Documentation

##### 4.14.4.1 Rendering\_Handler

`Renderer*` `Rendering_Handler`

The global render handler.

### 4.15 Rendering/Window-Management.cpp File Reference

File defining all relevant OpenGL and GLFW related functions needed to create an OpenGL context and GLFW window.

```
#include "Window-Management.hpp"
```

#### Macros

- `#define CAM_SPEED 0.3f`

#### Functions

- `GLFWwindow *` `create_context` (`GLFWwindow *``other_window`, `bool` `visible`)
- `int` `openGLError` ()
- `void` `callBackInit` (`GLFWwindow *``window`)
- `GLFWwindow *` `createWindow` (`GLFWwindow *``other_window`, `bool` `visible`)
- `void` `error_callback` (`int` `error`, `const char *``description`)
- `void` `cursor_pos_callback` (`GLFWwindow *``window`, `double` `xpos`, `double` `ypos`)
- `void` `mouse_button_callback` (`GLFWwindow *``window`, `int` `button`, `int` `action`, `int` `mods`)
- `void` `key_callback` (`GLFWwindow *``window`, `int` `key`, `int` `scancode`, `int` `action`, `int` `mods`)

#### 4.15.1 Detailed Description

File defining all relevant OpenGL and GLFW related functions needed to create an OpenGL context and GLFW window.

#### Author

Camilo Talero

Version: 0.0.3

#### 4.15.2 Macro Definition Documentation

#### 4.15.2.1 CAM\_SPEED

```
#define CAM_SPEED 0.3f
```

### 4.15.3 Function Documentation

#### 4.15.3.1 callBackInit()

```
void callBackInit (
    GLFWwindow * window )
```

Initialize GLFW callBack Functions

#### 4.15.3.2 create\_context()

```
GLFWwindow* create_context (
    GLFWwindow * other_window,
    bool visible )
```

Function to create the OpenGL context.

##### Returns

The pointer to the GLFW window containing the current context.

#### 4.15.3.3 createWindow()

```
GLFWwindow* createWindow (
    GLFWwindow * other_window,
    bool visible )
```

Method to create a GLFW window, window will be maximized and decorated.

##### Returns

A pointer to the created window.

#### 4.15.3.4 cursor\_pos\_callback()

```
void cursor_pos_callback (
    GLFWwindow * window,
    double xpos,
    double ypos )
```

GLFW cursor position function

#### 4.15.3.5 error\_callback()

```
void error_callback (
    int error,
    const char * description )
```

Print out GLFW error information

#### 4.15.3.6 key\_callback()

```
void key_callback (
    GLFWwindow * window,
    int key,
    int scancode,
    int action,
    int mods )
```

GLFW keys function

Called when a key is pressed and handles the event for each implemented key

#### 4.15.3.7 mouse\_button\_callback()

```
void mouse_button_callback (
    GLFWwindow * window,
    int button,
    int action,
    int mods )
```

GLFW Mouse button function

#### 4.15.3.8 openGLError()

```
int openGLError ( )
```

Check for OpenGL errors and print the appropriate error message if needed.

##### Returns

The number of the generated error.

## 4.16 Rendering/Window-Management.hpp File Reference

Header for the context creation implementation. Exposes functions and defines needed included files.

```
#include "system-libraries.hpp"
#include "OpenGL-Wrappers.hpp"
```



## Functions

- void [error\\_callback](#) (int error, const char \*description)
- void [key\\_callback](#) (GLFWwindow \*window, int key, int scancode, int action, int mods)
- void [mouse\\_button\\_callback](#) (GLFWwindow \*window, int button, int action, int mods)
- void [cursor\\_pos\\_callback](#) (GLFWwindow \*window, double xpos, double ypos)
- void [callBackInit](#) (GLFWwindow \*window)
- double [calculateFPS](#) (double prevTime, double currentTime)
- GLFWwindow \* [createWindow](#) (GLFWwindow \*other\_window, bool)
- GLFWwindow \* [create\\_context](#) (GLFWwindow \*other\_window, bool)

### 4.16.1 Detailed Description

Header for the context creation implementation. Exposes functions and defines needed included files.

#### Author

Camilo Talero

Version: 0.0.3

### 4.16.2 Function Documentation

#### 4.16.2.1 [calculateFPS\(\)](#)

```
double calculateFPS (
    double prevTime,
    double currentTime )
```

#### 4.16.2.2 [callBackInit\(\)](#)

```
void callBackInit (
    GLFWwindow * window )
```

Initialize GLFW callBack Functions

#### 4.16.2.3 [create\\_context\(\)](#)

```
GLFWwindow* create_context (
    GLFWwindow * other_window,
    bool visible )
```

Function to create the OpenGL context.

#### Returns

The pointer to the GLFW window containing the current context.

#### 4.16.2.4 `createWindow()`

```
GLFWwindow* createWindow (
    GLFWwindow * other_window,
    bool visible )
```

Method to create a GLFW window, window will be maximized and decorated.

##### Returns

A pointer to the created window.

#### 4.16.2.5 `cursor_pos_callback()`

```
void cursor_pos_callback (
    GLFWwindow * window,
    double xpos,
    double ypos )
```

GLFW cursor position function

#### 4.16.2.6 `error_callback()`

```
void error_callback (
    int error,
    const char * description )
```

Print out GLFW error information

#### 4.16.2.7 `key_callback()`

```
void key_callback (
    GLFWwindow * window,
    int key,
    int scancode,
    int action,
    int mods )
```

GLFW keys function

Called when a key is pressed and handles the event for each implemented key

#### 4.16.2.8 `mouse_button_callback()`

```
void mouse_button_callback (
    GLFWwindow * window,
    int button,
    int action,
    int mods )
```

GLFW Mouse button function

## 4.17 World.cpp File Reference

Definitions of all world related classes and methods.

```
#include "World.hpp"
#include "cout-definitions.hpp"
```

### Macros

- #define `MESH Cube::meshes[0]`

### Variables

- `World * the_world`  
*Global world object, should eb treated as a singleton.*

### 4.17.1 Detailed Description

Definitions of all world related classes and methods.

#### Author

Camilo Talero

Version: 0.0.3

### 4.17.2 Macro Definition Documentation

#### 4.17.2.1 MESH

```
#define MESH Cube::meshes[0]
```

### 4.17.3 Variable Documentation

#### 4.17.3.1 the\_world

```
World* the_world
```

Global world object, should eb treated as a singleton.

## 4.18 World.hpp File Reference

Header for the definition of a generic chunk object.

```
#include "Cube.hpp"  
#include "tools.hpp"
```

### Classes

- struct [Light](#)
- class [Chunk](#)
- class [Chunk\\_Holder](#)
- class [World](#)

### Macros

- `#define` [CHUNK\\_DIMS](#) 16

### Variables

- [World](#) \* [the\\_world](#)  
*Global world object, should eb treated as a singleton.*

### 4.18.1 Detailed Description

Header for the definition of a generic chunk object.

#### Author

Camilo Talero

Version: 0.0.3

### 4.18.2 Macro Definition Documentation

#### 4.18.2.1 CHUNK\_DIMS

```
#define CHUNK_DIMS 16
```

### 4.18.3 Variable Documentation

#### 4.18.3.1 the\_world

```
World* the\_world
```

Global world object, should eb treated as a singleton.

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