# pEngine

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# 1 Hierarchical Index

## 1.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

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# 2 Class Index

## 2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

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## 3.1 File List

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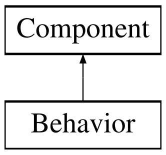
# 4 Class Documentation

## 4.1 Behavior Class Reference

```
#include <behavior.hpp>
```

Inheritance diagram for Behavior:



### Public Member Functions

- Behavior ()

  *Creates an empty Behavior object.*
- Behavior (const Behavior &other)

  *Copy constructor.*
- Behavior (File_Reader &reader)

  *Creates Behavior object using file.*
- Behavior ∗ Clone () const

  *Clones current Behavior object.*
- ∼Behavior ()

  *Deletes all of the lua states.*
- void Update ()

  *Update for Behavior object. Calls Behavior manager giving list of its behaviors.*
- void Read (File_Reader &reader)

  *Reads in the behaviors to be used.*
- void Write (File_Writer &writer)

  *Gives the names of each lua file to the writer.*
- void SetupClassesForLua ()

  *Setups up the interface between the engine and the lua files.*
- std::vector< std::string > & GetScripts ()

  *Returns list of lua filenames.*
- void ClassSetup (sol::state ∗state)

  *Sends engine variables and functions to lua.*
- bool SwitchScript (unsigned scriptNum, std::string newScriptName)

  *Switches one script to another (replace)*
- bool AddScript (std::string newScriptName)

  *Attaching new script to the object.*
- bool CheckIfCopy (std::string newScriptName)

  *Checks if the script is already attached to the object.*
- void Clear ()

  *Clears states and state filenames from object.*

### Static Public Member Functions

- static CType GetCType ()

  *Gets the CType of Behavior (used in Object::GetComponent<>())*

## Private Attributes

- std::vector< std::string > scripts

  *Names of the lua scripts being used.*
- std::vector< sol::state * > states

  *States of each lua script.*

## Additional Inherited Members

### 4.1.1 Detailed Description

Behavior class

Definition at line 30 of file behavior.hpp.

### 4.1.2 Constructor & Destructor Documentation

#### 4.1.2.1 Behavior() [1/3] `Behavior::Behavior ( )`

Creates an empty Behavior object.

Definition at line 29 of file behavior.cpp.

```
: Component(CType::CBehavior) {}
```

Referenced by Clone().

#### 4.1.2.2 Behavior() [2/3] `Behavior::Behavior ( const Behavior & other )`

Copy constructor.

**Parameters**

| | |
|---|---|
| *other* | Behavior object to copy |

Definition at line 36 of file behavior.cpp.

```
                                          : Component(CType::CBehavior) {
    *this = other;
}
```

#### 4.1.2.3 Behavior() [3/3]

```
Behavior::Behavior (
        File_Reader & reader )
```

Creates Behavior object using file.

**Parameters**

| | |
|---|---|
| *reader* | Data from file |

Definition at line 45 of file behavior.cpp.

```
                                        : Component(CType::CBehavior) {
    Read(reader);
}
```

References Read().

#### 4.1.2.4 ∼Behavior()

```
Behavior::∼Behavior ( )
```

Deletes all of the lua states.

Definition at line 62 of file behavior.cpp.

```
                       {
    Clear();
}
```

References Clear().

### 4.1.3 Member Function Documentation

#### 4.1.3.1 AddScript()

```
bool Behavior::AddScript (
        std::string newScriptName )
```

Attaching new script to the object.

**Parameters**

| | |
|---|---|
| *newScriptName* | |

**Returns**

true

false

Definition at line 233 of file behavior.cpp.

```
                                             {
      // Checking if this script is already attached
    if (newScriptName.find(".lua") == std::string::npos) return false;
    if (CheckIfCopy(newScriptName)) return false;
      // Setting up new lua state
    sol::state* state = new sol::state;
    state->open_libraries(sol::lib::base, sol::lib::math, sol::lib::io, sol::lib::string);
    states.emplace_back(state);
      // Adding new script filename to list
    scripts.emplace_back(newScriptName);
    ClassSetup(state);
      // Setting up lua script to run
    states.back()->script_file(scripts.back());
    (*states.back())["Start"]();

    return true;
}
```

References CheckIfCopy(), ClassSetup(), scripts, and states.

Referenced by Editor::Display_Scripts().

#### 4.1.3.2 CheckIfCopy() `bool Behavior::CheckIfCopy ( std::string newScriptName )`

Checks if the script is already attached to the object.

**Parameters**

| | |
|---|---|
| *newScriptName* | Name of script being checked |

**Returns**

true

false

Definition at line 258 of file behavior.cpp.

```
                                               {
      // Checking if script is the same as an existing one
    for (std::string scriptName : scripts) {
        if (scriptName.compare(newScriptName) == 0) return true;
    }

      // Script is not a copy
    return false;
}
```

References scripts.

Referenced by AddScript(), and SwitchScript().

#### 4.1.3.3 ClassSetup() `void Behavior::ClassSetup ( sol::state * state )`

Sends engine variables and functions to lua.

**Parameters**

|  |  |
|---|---|
| *state* |  |

Definition at line 149 of file behavior.cpp.

```
                                        {
      // Giving lua random functions
    state->set_function("random_vec3", Random::random_vec3);
    state->set_function("random_float", Random::random_float);

      // Giving lua glm::vec3 wrapper class
    sol::usertype<glm::vec3> vec3_type = state->new_usertype<glm::vec3>("vec3",
        sol::constructors<glm::vec3(float, float, float), glm::vec3(float)>());
      // Giving lua glm::vec3 wrapper class variables
    vec3_type.set("x", &glm::vec3::x);
    vec3_type.set("y", &glm::vec3::y);
    vec3_type.set("z", &glm::vec3::z);
      // Giving lua glm::vec3 wrapper class functions
    state->set_function("normalize", Vector3_Func::normalize);
    state->set_function("distance", Vector3_Func::distance);
    state->set_function("get_direction", Vector3_Func::get_direction);
    state->set_function("zero_vec3", Vector3_Func::zero_vec3);
    state->set_function("length", Vector3_Func::length);
    state->set_function("add_float", Vector3_Func::add_float);
    state->set_function("add_vec3", Vector3_Func::add_vec3);

    state->set_function("FindObject", sol::overload(sol::resolve<Object*(int)>(&Object_Manager::FindObject),

        sol::resolve<Object*(std::string)>(&Object_Manager::FindObject)));

      // Giving lua physics class
    sol::usertype<Physics> physics_type = state->new_usertype<Physics>("Physics",
        sol::constructors<Physics(), Physics(const Physics)>());
      // Giving lua physics class variables
    physics_type.set("acceleration", sol::property(Physics::GetAccelerationRef, &Physics::SetAcceleration));
    physics_type.set("forces",       sol::property(Physics::GetForcesRef,       &Physics::SetForces));
    physics_type.set("velocity",     sol::property(Physics::GetVelocityRef,     &Physics::SetVelocity));
      // Giving lua physics class functions
    physics_type.set_function("ApplyForce",    &Physics::ApplyForce);
    physics_type.set_function("UpdateGravity", &Physics::UpdateGravity);

      // Giving lua transform class
    sol::usertype<Transform> transform_type = state->new_usertype<Transform>("Transform",
        sol::constructors<Transform(), Transform(const Transform)>());
      // Giving lua transform class variables
    transform_type.set("position",      sol::property(Transform::GetPositionRef,
   &Transform::SetPosition));
    transform_type.set("rotation",      sol::property(Transform::GetRotationRef,
   &Transform::SetRotation));
    transform_type.set("scale",         sol::property(Transform::GetScaleRef,
   &Transform::SetScale));
    transform_type.set("startPosition", sol::property(Transform::GetStartPositionRef,
   &Transform::SetStartPosition));

      // Giving lua object class
    state->set("object", GetParent());
    sol::usertype<Object> object_type = state->new_usertype<Object>("Object",
        sol::constructors<Object(), Object(const Object)>());
      // Giving lua object class variables
    object_type.set("name", sol::property(Object::GetNameRef, &Object::SetName));
    object_type.set("id",   sol::readonly_property(Object::GetId));
    object_type.set_function("GetPhysics", &Object::GetComponent<Physics>);
    object_type.set_function("GetTransform", &Object::GetComponent<Transform>);
}
```

References Vector3_Func::add_float(), Vector3_Func::add_vec3(), Physics::ApplyForce(), Vector3_Func::distance(), Object_Manager::FindObject(), Vector3_Func::get_direction(), Physics::GetAccelerationRef(), Physics::GetForces↩Ref(), Object::GetId(), Object::GetNameRef(), Component::GetParent(), Transform::GetPositionRef(), Transform::Get↩RotationRef(), Transform::GetScaleRef(), Transform::GetStartPositionRef(), Physics::GetVelocityRef(), Vector3_Func↩::length(), Vector3_Func::normalize(), Random::random_float(), Random::random_vec3(), Physics::SetAcceleration(), Physics::SetForces(), Object::SetName(), Transform::SetPosition(), Transform::SetRotation(), Transform::SetScale(), Transform::SetStartPosition(), Physics::SetVelocity(), Physics::UpdateGravity(), and Vector3_Func::zero_vec3().

Referenced by AddScript(), and SetupClassesForLua().

#### 4.1.3.4 Clear() `void Behavior::Clear ( )`

Clears states and state filenames from object.

Definition at line 272 of file behavior.cpp.

```
                        {
    for (sol::state* state : states) {
        if (!state) continue;
        delete state;
        state = nullptr;
    }

    states.clear();
    scripts.clear();
}
```

References scripts, and states.

Referenced by Object::ReRead(), and ∼Behavior().

#### 4.1.3.5 Clone() `Behavior * Behavior::Clone ( ) const`

Clones current Behavior object.

**Returns**

Behavior∗

Definition at line 54 of file behavior.cpp.

```
                                {
    return new Behavior(*this);
}
```

References Behavior().

#### 4.1.3.6 GetCType() `CType Behavior::GetCType ( ) [static]`

Gets the CType of Behavior (used in Object::GetComponent<>())

**Returns**

CType

Definition at line 118 of file behavior.cpp.

```
                            {
    return CType::CBehavior;
}
```

#### 4.1.3.7 GetScripts() `std::vector< std::string > & Behavior::GetScripts ( )`

Returns list of lua filenames.

**Returns**

std::vector<std::string>&

Definition at line 142 of file behavior.cpp.

```
{ return scripts; }
```

References scripts.

Referenced by Editor::Display_Scripts().

#### 4.1.3.8 Read() `void Behavior::Read ( File_Reader & reader )`

Reads in the behaviors to be used.

**Parameters**

| | |
|---|---|
| *reader* | Data from file |

Definition at line 83 of file behavior.cpp.

```
                                      {
   unsigned behavior_num = 0;

     // Reads the name of the lua files
   while (true) {
         // Getting the name of the next lua file
       std::string behavior_name = reader.Read_Behavior_Name("behavior_" + std::to_string(behavior_num));
       if (behavior_name.compare("") == 0) break;
       if (behavior_name.find(".lua") == std::string::npos) continue;
         // Adding lua filename to list
       scripts.emplace_back(std::string(getenv("USERPROFILE")) + "/Documents/pEngine/scripts/" +
   behavior_name);
       ++behavior_num;
   }
     // Creating lua state for each of the scripts that were read in
   for (unsigned i = 0; i < scripts.size(); ++i) {
       sol::state* state = new sol::state;
       state->open_libraries(sol::lib::base, sol::lib::math, sol::lib::io, sol::lib::string);
        states.emplace_back(state);
    }
}
```

References File_Reader::Read_Behavior_Name(), scripts, and states.

Referenced by Behavior(), and Object::ReRead().

### 4.1.3.9 SetupClassesForLua() `void Behavior::SetupClassesForLua ( )`

Setups up the interface between the engine and the lua files.

Definition at line 126 of file behavior.cpp.

```
                                    {
    for (sol::state* state : states) {
        ClassSetup(state);
    }

    for (unsigned i = 0; i < states.size(); ++i) {
        states[i]->script_file(scripts[i]);
        (*states[i])["Start"]();
    }
}
```

References ClassSetup(), scripts, and states.

Referenced by Object_Manager::ReadList(), and Object::ReRead().

### 4.1.3.10 SwitchScript() `bool Behavior::SwitchScript ( unsigned scriptNum, std::string newScriptName )`

Switches one script to another (replace)

**Parameters**

| | |
|---|---|
| *scriptNum* | |
| *newScriptName* | |

**Returns**

true

false

Definition at line 212 of file behavior.cpp.

```
                                                                                {
      // Checking if this script is already attached
    if (CheckIfCopy(newScriptName)) return false;
    if (newScriptName.compare(".lua") == 0) return false;
    if (newScriptName.find(".lua") == std::string::npos) return false;
    sol::state* state = states[scriptNum];
    scripts[scriptNum] = newScriptName;
      // Setting up new lua script
    state->script_file(scripts[scriptNum]);
    (*state)["Start"]();

    return true;
}
```

References CheckIfCopy(), scripts, and states.

Referenced by Editor::Display_Scripts().

#### 4.1.3.11 Update() `void Behavior::Update ( )`

Update for Behavior object. Calls Behavior manager giving list of its behaviors.

Definition at line 71 of file behavior.cpp.

```
                     {
    for (sol::state* state : states) {
        if (!state) continue;
        (*state)["FixedUpdate"](Engine::GetDt());
    }
}
```

References Engine::GetDt(), and states.

Referenced by Object::Update().

#### 4.1.3.12 Write() `void Behavior::Write ( File_Writer & writer )`

Gives the names of each lua file to the writer.

**Parameters**

| | |
|---|---|
| *writer* | |

Definition at line 109 of file behavior.cpp.

```
                                       {
    writer.Write_Behavior_Name(scripts);
}
```

References scripts, and File_Writer::Write_Behavior_Name().

Referenced by Object::Write().

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

- behavior.hpp
- behavior.cpp

## 4.2 Camera Class Reference

`#include <camera.hpp>`

### Public Member Functions

- Camera (int width, int height)

    *Creates a new camera with default values.*

### Static Public Member Functions

- static bool Initialize (File_Reader &settings)

  *Initializes the camera.*
- static bool Initialize ()

  *Initialize the camera with default values.*
- static void Update ()

  *Moves the camera and checks for some other inputs.*
- static void MouseUpdate (GLFWwindow ∗, double xpos, double ypos)

  *Moves the camera using the mouse.*
- static void Shutdown ()

  *Deletes the camera object if it exists.*
- static glm::vec3 & GetPosition ()

  *Returns the position of the camera.*
- static glm::vec3 & GetFront ()

  *Returns the direction of the camera.*
- static glm::vec3 & GetUp ()

  *Returns the upward direction of the camera.*
- static float GetFov ()

  *Returns the field of view of the camera.*
- static float GetNear ()

  *Returns the near view distance of the camera.*
- static float GetFar ()

  *Returns the far view distance of the camera.*
- static float GetYaw ()

  *Returns the x rotation of the camera.*
- static float GetPitch ()

  *Returns the y rotation of the camera.*
- static float & GetOriginalMoveSpeed ()

  *Returns reference to originalMoveSpeed.*
- static float & GetOriginalSprintSpeed ()

  *Returns reference to originalSprintSpeed.*
- static float & GetOriginalSensitivity ()

  *Returns reference to originalSensitivity.*

### Private Attributes

- glm::vec3 position

  *Position of camera.*
- glm::vec3 front

  *Direction of camera.*
- glm::vec3 up

  *90 degree upwards direction of camera*
- float yaw

  *x rotation*
- float pitch

  *y rotation*

- std::pair< float, float > last

  *Last position of mouse on screen.*
- float fov

  *Field of view.*
- float speed

  *Move speed.*
- float nearV

  *Near view distance.*
- float farV

  *Far view distance.*
- float sensitivity

  *Mouse sensitivity.*
- float originalMoveSpeed

  *Initial move speed (speed gets change by delta time)*
- float originalSprintSpeed

  *Initial sprint speed.*
- float originalSensitivity

  *Original mouse sensitivity.*
- bool canMoveMouse

  *Whether the user can move the camera using the mouse.*

### 4.2.1 Detailed Description

Camera class ?

Definition at line 26 of file camera.hpp.

### 4.2.2 Constructor & Destructor Documentation

#### 4.2.2.1 Camera()

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

Creates a new camera with default values.

**Parameters**

| | |
|---|---|
| *width* | Width of screen |
| *height* | Height of screen |

Definition at line 33 of file camera.cpp.

```
                                      : position(0.f, 0.f, 0.f), front(0.f, 0.f, -1.f),
      up(0.f, 1.f, 0.f), yaw(-90.f), pitch(0.f), last({ width / 2.f, height / 2.f }),
    fov(45.f), speed(1), nearV(0.1f), farV(10000.f), sensitivity(1), canMoveMouse(true) {}
```

Referenced by Initialize().

### 4.2.3 Member Function Documentation

#### 4.2.3.1 GetFar() `float Camera::GetFar ( )  [static]`

Returns the far view distance of the camera.

**Returns**

float

Definition at line 243 of file camera.cpp.

```
243 { return camera->farV; }
```

References camera, and farV.

Referenced by Graphics::Render().

#### 4.2.3.2 GetFov() `float Camera::GetFov ( )  [static]`

Returns the field of view of the camera.

**Returns**

float

Definition at line 229 of file camera.cpp.

```
229 { return camera->fov; }
```

References camera, and fov.

Referenced by Graphics::Render().

#### 4.2.3.3 GetFront() `glm::vec3 & Camera::GetFront ( ) [static]`

Returns the direction of the camera.

**Returns**

vec3&

Definition at line 215 of file camera.cpp.
```
215 { return camera->front; }
```

References camera, and front.

Referenced by Graphics::Render().

#### 4.2.3.4 GetNear() `float Camera::GetNear ( ) [static]`

Returns the near view distance of the camera.

**Returns**

float

Definition at line 236 of file camera.cpp.
```
236 { return camera->nearV; }
```

References camera, and nearV.

Referenced by Graphics::Render().

#### 4.2.3.5 GetOriginalMoveSpeed() `float & Camera::GetOriginalMoveSpeed ( ) [static]`

Returns reference to originalMoveSpeed.

**Returns**

float&

Definition at line 264 of file camera.cpp.
```
264 { return camera->originalMoveSpeed; }
```

References camera, and originalMoveSpeed.

Referenced by Editor::Display_Camera_Settings().

#### 4.2.3.6 GetOriginalSensitivity() `float & Camera::GetOriginalSensitivity ( ) [static]`

Returns reference to originalSensitivity.

**Returns**

float&

Definition at line 278 of file camera.cpp.

```
278 { return camera->originalSensitivity; }
```

References camera, and originalSensitivity.

Referenced by Editor::Display_Camera_Settings().

#### 4.2.3.7 GetOriginalSprintSpeed() `float & Camera::GetOriginalSprintSpeed ( ) [static]`

Returns reference to originalSprintSpeed.

**Returns**

float&

Definition at line 271 of file camera.cpp.

```
271 { return camera->originalSprintSpeed; }
```

References camera, and originalSprintSpeed.

Referenced by Editor::Display_Camera_Settings().

#### 4.2.3.8 GetPitch() `float Camera::GetPitch ( ) [static]`

Returns the y rotation of the camera.

**Returns**

float

Definition at line 257 of file camera.cpp.

```
257 { return camera->pitch; }
```

References camera, and pitch.

#### 4.2.3.9 GetPosition() `glm::vec3 & Camera::GetPosition ( ) [static]`

Returns the position of the camera.

**Returns**

vec3&

Definition at line 208 of file camera.cpp.

```
{ return camera->position; }
```

References camera, and position.

Referenced by Graphics::Render().

#### 4.2.3.10 GetUp() `glm::vec3 & Camera::GetUp ( ) [static]`

Returns the upward direction of the camera.

**Returns**

vec3&

Definition at line 222 of file camera.cpp.

```
{ return camera->up; }
```

References camera, and up.

Referenced by Graphics::Render().

#### 4.2.3.11 GetYaw() `float Camera::GetYaw ( ) [static]`

Returns the x rotation of the camera.

**Returns**

float

Definition at line 250 of file camera.cpp.

```
{ return camera->yaw; }
```

References camera, and yaw.

### 4.2.3.12 Initialize() [1/2] `bool Camera::Initialize ( ) [static]`

Initialize the camera with default values.

**Returns**

true

false

Definition at line 66 of file camera.cpp.

```
                          {
        // Initializing the camera
      camera = new Camera(1920, 1080);
      if (!camera) {
          Trace::Message("Camera was not initialized.");
          return false;
      }

        // Getting data from settings file
      camera->originalMoveSpeed = 10.f;
      camera->originalSprintSpeed = 30.f;
      camera->originalSensitivity = 150.f;

      return true;
  }
```

References camera, Camera(), Trace::Message(), originalMoveSpeed, originalSensitivity, and originalSprintSpeed.

Referenced by Engine::Initialize().

### 4.2.3.13 Initialize() [2/2] `bool Camera::Initialize ( File_Reader & settings ) [static]`

Initializes the camera.

**Parameters**

| | |
|---|---|
| *settings* | File that contains settings for the camera |

**Returns**

true

false

Definition at line 44 of file camera.cpp.

```
                                              {
        // Initializing the camera
      camera = new Camera(settings.Read_Int("windowWidth"), settings.Read_Int("windowHeight"));
      if (!camera) {
          Trace::Message("Camera was not initialized.");
          return false;
      }

        // Getting data from settings file
      camera->originalMoveSpeed = settings.Read_Float("moveSpeed");
      camera->originalSprintSpeed = settings.Read_Float("sprintSpeed");
```

```
    camera->originalSensitivity = settings.Read_Float("sensitivity");

    return true;
}
```

References camera, Camera(), Trace::Message(), originalMoveSpeed, originalSensitivity, originalSprintSpeed, File_↩ Reader::Read_Float(), and File_Reader::Read_Int().

#### 4.2.3.14 MouseUpdate()

```
void Camera::MouseUpdate (
            GLFWwindow * ,
            double xpos,
            double ypos )  [static]
```

Moves the camera using the mouse.

**Parameters**

| | |
|---|---|
| *xpos* | x position of the mouse |
| *ypos* | y position of the mouse |

**Returns**

void

Definition at line 138 of file camera.cpp.

```
                                                              {
    if (!camera->canMoveMouse) {
        camera->last = { xpos, ypos };
        return;
    }
      // Setting up variables
    static bool firstMouse = true;
    std::pair<double, double> mousePos = { xpos, ypos };

      // Setting the camera sens using delta time
    camera->sensitivity = camera->originalSensitivity * Engine::GetDeltaTime();

      // Checking if this is the first time the function was called
    if (firstMouse) {
        camera->last = { mousePos.first, mousePos.second };
        firstMouse = false;
    }

      // Finding how far the mouse is from its last position
    std::pair<float, float> offset = {
        mousePos.first - camera->last.first,
        camera->last.second - mousePos.second
    };
      // Setting new last position
    camera->last = { mousePos.first, mousePos.second };

      // Updating offsets to use the sensitivity of the camera
    offset.first *= camera->sensitivity;
    offset.second *= camera->sensitivity;

      // Applying the offset to the camera's direction
    camera->yaw += offset.first;
    camera->pitch += offset.second;

      // Stops the camera from circling completely in the y direction
    if (camera->pitch > 89.f) camera->pitch = 89.f;
    if (camera->pitch < -89.f) camera->pitch = -89.f;
```

```

      // Finding the direction of the camera
    glm::vec3 tempFront = {
        std::cos(glm::radians(camera->yaw)) * std::cos(glm::radians(camera->pitch)),
        std::sin(glm::radians(camera->pitch)),
        std::sin(glm::radians(camera->yaw)) * std::cos(glm::radians(camera->pitch))
    };
    camera->front = glm::normalize(tempFront);

      // Finding the upward direction of the camera
    glm::vec3 tempUp = { 0.f, 1.f, 0.f };
    glm::vec3 right = glm::normalize(glm::cross(tempUp, camera->front));
    glm::vec3 up = glm::cross(camera->front, right);
    camera->up = up;
}
```

References camera, canMoveMouse, front, Engine::GetDeltaTime(), last, originalSensitivity, pitch, sensitivity, up, and yaw.

Referenced by Graphics::Initialize().

#### 4.2.3.15 Shutdown() `void Camera::Shutdown ( ) [static]`

Deletes the camera object if it exists.

**Returns**

void

Definition at line 196 of file camera.cpp.

```
                       {
    if (camera) {
        delete camera;
        camera = nullptr;
    }
}
```

References camera.

Referenced by Engine::Shutdown().

#### 4.2.3.16 Update() `void Camera::Update ( ) [static]`

Moves the camera and checks for some other inputs.

**Returns**

void

Definition at line 87 of file camera.cpp.

```
                       {
    // Checking if the engine should be closed
  if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_ESCAPE) == GLFW_PRESS) {
      if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_ESCAPE) == GLFW_RELEASE) {
          glfwSetWindowShouldClose(Graphics::GetWindow(), true);
      }
  }

    // Checking if sprint is being used
  if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_LEFT_SHIFT) == GLFW_PRESS &&
  Editor::GetTakeKeyboardInput()) {
      camera->speed = camera->originalSprintSpeed * Engine::GetDeltaTime();
  }
  else {
       camera->speed = camera->originalMoveSpeed * Engine::GetDeltaTime();
   }

     // Checking for movement using W, A, S, D, SPACE, and CTRL
   if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_W) == GLFW_PRESS && Editor::GetTakeKeyboardInput()) {
       camera->position += camera->speed * camera->front;
   }
   if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_S) == GLFW_PRESS && Editor::GetTakeKeyboardInput()) {
       camera->position -= camera->speed * camera->front;
   }
   if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_A) == GLFW_PRESS && Editor::GetTakeKeyboardInput()) {
       camera->position -= glm::normalize(glm::cross(camera->front, camera->up)) * camera->speed;
   }
   if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_D) == GLFW_PRESS && Editor::GetTakeKeyboardInput()) {
       camera->position += glm::normalize(glm::cross(camera->front, camera->up)) * camera->speed;
   }
   if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_SPACE) == GLFW_PRESS && Editor::GetTakeKeyboardInput()) {
       camera->position += camera->speed * camera->up;
   }
   if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_LEFT_CONTROL) == GLFW_PRESS &&
  Editor::GetTakeKeyboardInput()) {
       camera->position -= camera->speed * camera->up;
   }

   if (glfwGetMouseButton(Graphics::GetWindow(), GLFW_MOUSE_BUTTON_RIGHT) == GLFW_PRESS &&
  Editor::GetTakeKeyboardInput()) {
       camera->canMoveMouse = true;
   }
   if (glfwGetMouseButton(Graphics::GetWindow(), GLFW_MOUSE_BUTTON_RIGHT) == GLFW_RELEASE) {
       camera->canMoveMouse = false;
   }
}
```

References camera, canMoveMouse, front, Engine::GetDeltaTime(), Editor::GetTakeKeyboardInput(), Graphics::Get↩ Window(), originalMoveSpeed, originalSprintSpeed, position, speed, and up.

Referenced by Engine::Update().

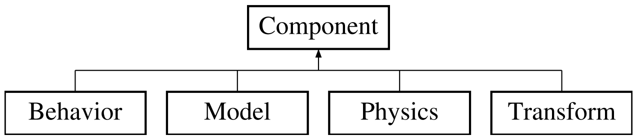
The documentation for this class was generated from the following files:

- camera.hpp
- camera.cpp

## 4.3 Component Class Reference

```
#include <component.hpp>
```

Inheritance diagram for Component:



**Public Types**

- enum CType { **CBehavior**, **CModel**, **CPhysics**, **CTransform** }

**Public Member Functions**

- Component (CType type_)

  *Creates a new component of given type.*
- void SetParent (Object ∗object)

  *Sets the parent of the component.*
- Object ∗ GetParent () const

  *Gets the parent of the component.*
- CType GetCType () const

  *Gets the type of the component.*

**Private Attributes**

- CType type

  *Type of component.*
- Object ∗ parent

  *Object that this component is attached to.*

### 4.3.1 Detailed Description

Component class

Definition at line 20 of file component.hpp.

### 4.3.2 Member Enumeration Documentation

#### 4.3.2.1 CType `enum Component::CType`

Types of components

Definition at line 23 of file component.hpp.

```
23                  {
24            CBehavior,
25            CModel,
26            CPhysics,
27            CTransform,
28        };
```

### 4.3.3 Constructor & Destructor Documentation

#### 4.3.3.1 Component()

```
Component::Component (
        CType type_ )
```

Creates a new component of given type.

**Parameters**

| | |
|---|---|
| *type_* | Type of component |

Definition at line 20 of file component.cpp.

```
20 : type(type_) {}
```

### 4.3.4 Member Function Documentation

#### 4.3.4.1 GetCType()

```
CType Component::GetCType ( ) const
```

Gets the type of the component.

**Returns**

CType Type of the component

Definition at line 41 of file component.cpp.

```
41 { return type; }
```

References type.

Referenced by Object::AddComponent().

#### 4.3.4.2 GetParent()

```
Object * Component::GetParent ( ) const
```

Gets the parent of the component.

**Returns**

Object∗ The parent

Definition at line 34 of file component.cpp.

```
34 { return parent; }
```

References parent.

Referenced by Behavior::ClassSetup(), Editor::Display_Model(), Editor::Display_Physics(), Editor::Display_Scripts(), Model::Draw(), Physics::Update(), and Physics::UpdateGravity().

#### 4.3.4.3 SetParent() `void Component::SetParent ( Object * object )`

Sets the parent of the component.

**Parameters**

| | |
|---|---|
| *object* | The object that is the parent |

Definition at line 27 of file component.cpp.

```
27 { parent = object; }
```

References parent.

Referenced by Object::AddComponent().

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

- component.hpp
- component.cpp

## 4.4 Editor Class Reference

```
#include <editor.hpp>
```

### Static Public Member Functions

- static bool Initialize ()

  *Sets up the config and style of the editor.*
- static void Update ()

  *Updates the editor content and calls display functions.*
- static void Render ()

  *Render the editor.*
- static void Shutdown ()

  *Destroy editor windows and systems.*
- static void Reset ()

  *Sets selected object to invalid value.*
- static bool GetTakeKeyboardInput ()

  *Returns whether the program should ignore keyboard input.*

### Private Member Functions

- void Display_Dockspace ()

  *Setup and display the editor's dockspace.*
- void Display_Scene ()

  *Display the scene window.*
- void Display_Components ()

  *Display all of the components of the current selected_object.*
- void Display_World_Settings ()

  *Shows all of the settings of the engine itself.*
- void Display_Camera_Settings ()

  *Displays the different camera settings, allows user to change them as needed.*
- void Display_Scripts (Behavior ∗behavior)

  *Displays the different lua scripts attached to the selected object.*
- void Display_Model (Model ∗model)

  *Displays the data of the model being used.*
- void Display_Physics (Physics ∗physics)

  *Shows the Physics component.*
- void Display_Transform (Transform ∗transform)

  *Display transform data, users can change any of it.*
- void Display_Menu_Bar ()

  *Displays menu bar that can be used to save the scene.*

### Static Private Member Functions

- static std::string Make_Display_String (std::string inputString)

  *Removes the filepath from a filename.*

### Private Attributes

- bool isOpen

  *Whether the editor window is open or not.*
- int selected_object

  *Current object selected in the scene window.*
- int selected_component

  *Current component selected.*
- bool takeKeyboardInput

  *Whether the program should take keyboard input.*
- int object_to_copy

  *Object that will be copied if paste is used (doesn't need to be the same as selected_object)*

### 4.4.1 Detailed Description

Editor class

Definition at line 25 of file editor.hpp.

### 4.4.2 Member Function Documentation

#### 4.4.2.1 Display_Camera_Settings() `void Editor::Display_Camera_Settings ( ) [private]`

Displays the different camera settings, allows user to change them as needed.

Definition at line 431 of file editor.cpp.

```
                                        {
    ImGui::Begin("Camera Settings");

    ImGui::PushItemWidth(137);

      // Default move speed
    ImGui::Text("Move Speed");
    ImGui::SameLine(100); ImGui::InputFloat("##2", &Camera::GetOriginalMoveSpeed());

      // Move speed when holding shift
    ImGui::Text("Sprint Speed");
    ImGui::SameLine(100); ImGui::InputFloat("##3", &Camera::GetOriginalSprintSpeed());

      // Mouse sensitivity when looking around
    ImGui::Text("Sensitivity");
    ImGui::SameLine(100); ImGui::InputFloat("##4", &Camera::GetOriginalSensitivity());

    ImGui::PopItemWidth();

    ImGui::End();
}
```

References Camera::GetOriginalMoveSpeed(), Camera::GetOriginalSensitivity(), and Camera::GetOriginalSprint↩ Speed().

Referenced by Update().

#### 4.4.2.2 Display_Components() `void Editor::Display_Components ( ) [private]`

Display all of the components of the current selected_object.

Definition at line 271 of file editor.cpp.

```
                                   {
    ImGui::Begin("Components##1");

    if (selected_object == -1) { ImGui::End(); return; }
    Object* object = Object_Manager::FindObject(selected_object);
    std::string objectName = object->GetName();

    ImGui::Text("Id: %d", object->GetId());

      // Display name box (allows changing the name of an object)
    static char nameBuf[128] = "";
    sprintf(nameBuf, objectName.c_str());

    if (ImGui::InputText("Name", nameBuf, 128, ImGuiInputTextFlags_EnterReturnsTrue)) {
        object->SetName(std::string(nameBuf));
    }

    if (ImGui::IsItemDeactivatedAfterEdit()) {
        object->SetName(std::string(nameBuf));
    }

      // Template used by the selected object
    ImGui::Text("Template:");
    ImGui::SameLine(100);
    std::string templateName = object->GetTemplateName();
    if (templateName.empty()) templateName = "No template##1";
    else templateName = Editor::Make_Display_String(templateName);

    if (ImGui::Button(templateName.c_str())) {
        ImGuiFileDialog::Instance()->OpenDialog("ChooseTemplate##1", "Choose File", ".json",
   std::string(getenv("USERPROFILE")) + "/Documents/pEngine/json/objects/");
    }

    ImGui::SameLine();
    if (ImGui::Button("New Template")) {
        ImGuiFileDialog::Instance()->OpenDialog("ChooseFileDlgKey##6", "Choose File", ".json",
   std::string(getenv("USERPROFILE")) + "/Documents/pEngine/json/objects/");
    }


    if (ImGuiFileDialog::Instance()->Display("ChooseFileDlgKey##6")) {
        if (ImGuiFileDialog::Instance()->IsOk()) {
            std::string filePath = ImGuiFileDialog::Instance()->GetCurrentPath();
            object->Write(filePath);
        }

       ImGuiFileDialog::Instance()->Close();
    }

    if (ImGuiFileDialog::Instance()->Display("ChooseTemplate##1")) {
        if (ImGuiFileDialog::Instance()->IsOk()) {
            std::string filePath = ImGuiFileDialog::Instance()->GetCurrentPath();
            filePath += "/" + ImGuiFileDialog::Instance()->GetCurrentFileName();
            object->ReRead(filePath);
        }

        ImGuiFileDialog::Instance()->Close();
    }

      // Getting all of the components
    Behavior* behavior = object->GetComponent<Behavior>();
    Model* model = object->GetComponent<Model>();
    Physics* physics = object->GetComponent<Physics>();
    Transform* transform = object->GetComponent<Transform>();

      // Display all of the components of the selected_object
    Display_Transform(transform);
    Display_Physics(physics);
    Display_Model(model);
    Display_Scripts(behavior);

    ImGui::Separator();

      // Button to add new components to the selected_object
    if (ImGui::Button("Add Component##1")) {
        ImGui::OpenPopup("New Component##1");
    }

      // Add new components to object (only ones that the object doesn't already have)
    if (ImGui::BeginPopup("New Component##1")) {
        if (!physics) {
            if (ImGui::Selectable("Physics##1")) {
                physics = new Physics;
                object->AddComponent(physics);
            }
        }
        if (!model) {
            if (ImGui::Selectable("Model##1")) {
                model = new Model;
                object->AddComponent(model);
            }
        }
        if (!behavior) {
            if (ImGui::Selectable("Scripts##1")) {
                behavior = new Behavior;
                object->AddComponent(behavior);
            }
        }
        ImGui::EndPopup();
    }

    ImGui::End();
}
```

References Display_Model(), Display_Physics(), Display_Scripts(), Display_Transform(), Object_Manager::Find↩ Object(), Object::GetId(), Make_Display_String(), and selected_object.

Referenced by Update().

#### 4.4.2.3 Display_Dockspace() `void Editor::Display_Dockspace ( ) [private]`

Setup and display the editor's dockspace.

Definition at line 155 of file editor.cpp.

```
                                    {
      // Setting up viewport
    ImGuiViewport* viewport = ImGui::GetMainViewport();
    ImGui::SetNextWindowPos(viewport->Pos);
    ImGui::SetNextWindowSize(viewport->Size);
    ImGui::SetNextWindowViewport(viewport->ID);
    ImGui::SetNextWindowBgAlpha(0.0f);

      // Setting up window flags
    ImGuiWindowFlags window_flags = ImGuiWindowFlags_MenuBar | ImGuiWindowFlags_NoDocking;
    window_flags |= ImGuiWindowFlags_NoTitleBar | ImGuiWindowFlags_NoCollapse | ImGuiWindowFlags_NoResize |
   ImGuiWindowFlags_NoMove;
    window_flags |= ImGuiWindowFlags_NoBringToFrontOnFocus | ImGuiWindowFlags_NoNavFocus;

      // Setting up window style
    ImGui::PushStyleVar(ImGuiStyleVar_WindowRounding, 0.0f);
    ImGui::PushStyleVar(ImGuiStyleVar_WindowBorderSize, 0.0f);
    ImGui::PushStyleVar(ImGuiStyleVar_WindowPadding, ImVec2(0.0f, 0.0f));

      // Making the window
    ImGui::SetNextWindowBgAlpha(0.0f);
    ImGui::Begin("Editor Window", &editor->isOpen, window_flags);
    ImGui::PopStyleVar(3);

      // Setting up window settings
    ImGuiID dockspace_id = ImGui::GetID("Editor");
    ImGuiDockNodeFlags dockspace_flags = ImGuiDockNodeFlags_PassthruCentralNode |
   ImGuiDockNodeFlags_NoDockingInCentralNode;
    ImGui::DockSpace(dockspace_id, ImVec2(0.0f, 0.0f), dockspace_flags);
    editor->Display_Menu_Bar();
    ImGui::End();
}
```

References Display_Menu_Bar(), editor, and isOpen.

Referenced by Update().

#### 4.4.2.4 Display_Menu_Bar() `void Editor::Display_Menu_Bar ( ) [private]`

Displays menu bar that can be used to save the scene.

Definition at line 717 of file editor.cpp.

```
                                  {
    if (ImGui::BeginMenuBar()) {
        if (ImGui::BeginMenu("File##1")) {
            if (ImGui::MenuItem("Save##1")) {
                Engine::Write();
            }
            if (ImGui::MenuItem("Save As..##1")) {
                ImGuiFileDialog::Instance()->OpenDialog("ChooseFileDlgKey##7", "Choose File", ".json",
   std::string(getenv("USERPROFILE")) + "/Documents/pEngine/json/preset");
            }
            ImGui::EndMenu();
        }

        if (ImGuiFileDialog::Instance()->Display("ChooseFileDlgKey##7")) {
            if (ImGuiFileDialog::Instance()->IsOk()) {
                std::string filePath = ImGuiFileDialog::Instance()->GetCurrentPath();
                filePath += "/" + ImGuiFileDialog::Instance()->GetCurrentFileName() + ".json";
                Engine::SetPresetName(std::string(filePath));
                Engine::Write();
            }
            ImGuiFileDialog::Instance()->Close();
        }

        ImGui::EndMenuBar();
    }
}
```

References Engine::SetPresetName(), and Engine::Write().

Referenced by Display_Dockspace().

#### 4.4.2.5 Display_Model() `void Editor::Display_Model ( Model * model ) [private]`

Displays the data of the model being used.

**Parameters**

| | |
|---|---|
| *model* | |

Definition at line 537 of file editor.cpp.

```
                                             {
    if (!model) return;

    std::string modelName = Editor::Make_Display_String(model->GetModelName());
    std::string textureName = Editor::Make_Display_String(model->GetTextureName());

    if (modelName.compare("") == 0) modelName = "no model";
    if (textureName.compare("") == 0) textureName = "no texture";

      // Setting up tree flags
    ImGuiTreeNodeFlags node_flags = ImGuiTreeNodeFlags_SpanAvailWidth | ImGuiTreeNodeFlags_OpenOnDoubleClick
   | ImGuiTreeNodeFlags_OpenOnArrow;
    if (selected_component == CType::CModel) node_flags |= ImGuiTreeNodeFlags_Selected;

    const bool model_open = ImGui::TreeNodeEx((void*)(intptr_t)CType::CModel, node_flags, "Model");
    if (ImGui::IsItemClicked()) selected_component = CType::CModel;

      // Right click behavior to delete model component from selected object
    if (ImGui::IsItemClicked(ImGuiMouseButton_Right)) {
        selected_component = CType::CModel;
        ImGui::OpenPopup("DeleteModel##1");
    }

    if (ImGui::BeginPopup("DeleteModel##1")) {
        if (ImGui::Selectable("Delete##3")) {
            model->GetParent()->RemoveComponent<Model>();
            selected_component = -1;
        }
        ImGui::EndPopup();
    }

    if (model_open) {
          // Model that is being used
        ImGui::Text("Model"); ImGui::SameLine(100);
        if (ImGui::Button(modelName.c_str())) {
            ImGuiFileDialog::Instance()->OpenDialog("ChooseFileDlgKey##1", "Choose File", ".obj",
    std::string(getenv("USERPROFILE")) + "/Documents/pEngine/models/");
        }

        if (ImGuiFileDialog::Instance()->Display("ChooseFileDlgKey##1")) {
            if (ImGuiFileDialog::Instance()->IsOk()) {
                std::string filePath = ImGuiFileDialog::Instance()->GetCurrentPath();
                filePath += "/" + ImGuiFileDialog::Instance()->GetCurrentFileName();
                model->SwitchModel(filePath);
            }

            ImGuiFileDialog::Instance()->Close();
        }

          // Texture that is being used
        ImGui::Text("Texture"); ImGui::SameLine(100);
        if (ImGui::Button(textureName.c_str())) {
            ImGuiFileDialog::Instance()->OpenDialog("ChooseFileDlgKey##2", "Choose File", ".dds,.DDS",
    std::string(getenv("USERPROFILE")) + "/Documents/pEngine/textures/");
        }

        if (ImGuiFileDialog::Instance()->Display("ChooseFileDlgKey##2")) {
            if (ImGuiFileDialog::Instance()->IsOk()) {
                std::string filePath = ImGuiFileDialog::Instance()->GetCurrentPath();
                filePath += "/" + ImGuiFileDialog::Instance()->GetCurrentFileName();
                model->SwitchTexture(filePath);
            }

            ImGuiFileDialog::Instance()->Close();
        }

        ImGui::TreePop();
    }
}
```

References Model::GetModelName(), Component::GetParent(), Model::GetTextureName(), Make_Display_String(), Object::RemoveComponent(), selected_component, Model::SwitchModel(), and Model::SwitchTexture().

Referenced by Display_Components().

#### 4.4.2.6 Display_Physics() `void Editor::Display_Physics ( Physics * physics ) [private]`

Shows the Physics component.

**Parameters**

| | |
|---|---|
| *physics* | |

Definition at line 609 of file editor.cpp.

```
                                              {
    if (!physics) return;

    glm::vec3& velocity = physics->GetVelocityRef();
    glm::vec3& rotVel = physics->GetRotationalVelocityRef();

    ImGuiTreeNodeFlags node_flags = ImGuiTreeNodeFlags_SpanAvailWidth | ImGuiTreeNodeFlags_OpenOnDoubleClick
   | ImGuiTreeNodeFlags_OpenOnArrow;
    if (selected_component == CType::CPhysics) node_flags |= ImGuiTreeNodeFlags_Selected;

    const bool physics_open = ImGui::TreeNodeEx((void*)(intptr_t)CType::CPhysics, node_flags, "Physics");
    if (ImGui::IsItemClicked()) selected_component = CType::CPhysics;

    if (ImGui::IsItemClicked(ImGuiMouseButton_Right)) {
        selected_component = CType::CPhysics;
```

```
            ImGui::OpenPopup("DeletePhysics##1");
        }

        if (ImGui::BeginPopup("DeletePhysics##1")) {
            if (ImGui::Selectable("Delete##4")) {
                physics->GetParent()->RemoveComponent<Physics>();
                selected_component = -1;
            }
            ImGui::EndPopup();
        }

        if (physics_open) {
            ImGui::Text("Velocity");

            ImGui::PushItemWidth(65);
            ImGui::SameLine(100); ImGui::InputFloat("x##1", &velocity.x);
            ImGui::SameLine(185); ImGui::InputFloat("y##1", &velocity.y);
            ImGui::SameLine(270); ImGui::InputFloat("z##1", &velocity.z);

            ImGui::Text("RotVel");

            ImGui::PushItemWidth(65);
            ImGui::SameLine(100); ImGui::InputFloat("x##6", &rotVel.x);
            ImGui::SameLine(185); ImGui::InputFloat("y##6", &rotVel.y);
            ImGui::SameLine(270); ImGui::InputFloat("z##6", &rotVel.z);

            ImGui::Text("Mass");
            ImGui::SameLine(100); ImGui::InputFloat("##6", &physics->GetMassRef());
            ImGui::PopItemWidth();

            ImGui::TreePop();
        }
    }
```

References Physics::GetMassRef(), Component::GetParent(), Physics::GetRotationalVelocityRef(), Physics::Get↩ VelocityRef(), Object::RemoveComponent(), and selected_component.

Referenced by Display_Components().

#### 4.4.2.7 Display_Scene() `void Editor::Display_Scene ( ) [private]`

Display the scene window.

Definition at line 190 of file editor.cpp.

```
                                {
        ImGui::Begin("Scene");

        if (!takeKeyboardInput && ImGui::IsWindowFocused()) {
            if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_LEFT_CONTROL) == GLFW_PRESS) {
                // Copy current selected object
                if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_C) == GLFW_PRESS) {
                    if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_C) == GLFW_RELEASE) {
                        editor->object_to_copy = editor->selected_object;
                    }
                }
                // Paste current selected object
                if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_V) == GLFW_PRESS) {
                    if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_V) == GLFW_RELEASE) {
                        if (editor->object_to_copy != -1) {
                            Object* object = new Object(*Object_Manager::FindObject(editor->selected_object));
                            Object_Manager::AddObject(object);
                        }
                    }
                }
            }
        }

        // Display all objects
        for (int i = 0; i < (int)Object_Manager::GetSize(); ++i) {
            if (ImGui::Selectable(Object_Manager::FindObject(i)->GetName().c_str(), selected_object == i,
       ImGuiSelectableFlags_AllowDoubleClick)) {
                if (selected_object != i) editor->selected_component = -1;
                selected_object = i;
                selected_component = -1;
            }

              // Checking for right click behavior
            if (ImGui::IsItemClicked(ImGuiMouseButton_Right)) {
                if (selected_object != i) editor->selected_component = -1;
                selected_object = i;
                selected_component = -1;
                ImGui::OpenPopup("ObjectSettings##1");
            }
        }

        if (ImGui::BeginPopup("ObjectSettings##1")) {
              // Removes selected object from scene
            if (ImGui::Selectable("Delete##1")) {
                Object_Manager::RemoveObject(selected_object);
                selected_object = -1;
                selected_component = -1;
            }
              // Copies selected object
            if (ImGui::Selectable("Copy##1")) {
                editor->object_to_copy = editor->selected_object;
            }
              // Pastes copied object into scene
            if (ImGui::Selectable("Paste##1")) {
                if (editor->object_to_copy != -1) {
                    Object* object = new Object(*Object_Manager::FindObject(editor->selected_object));
                    Object_Manager::AddObject(object);
                }
            }
            ImGui::EndPopup();
        }

        ImGui::Separator();

        // Button to add new object to the scene
        if (ImGui::Button("Add Object")) {
            Object* newObject = new Object;
            Transform* transform = new Transform;
            transform->SetStartPosition(glm::vec3(0.f));
            newObject->SetName("New_Object");
            newObject->AddComponent(transform);

            Object_Manager::AddObject(newObject);
        }

        ImGui::End();
    }
```

References Object::AddComponent(), Object_Manager::AddObject(), editor, Object_Manager::FindObject(), Object_↩ Manager::GetSize(), Graphics::GetWindow(), object_to_copy, Object_Manager::RemoveObject(), selected_component, selected_object, Object::SetName(), Transform::SetStartPosition(), and takeKeyboardInput.

Referenced by Update().

#### 4.4.2.8 Display_Scripts() `void Editor::Display_Scripts ( Behavior * behavior ) [private]`

Displays the different lua scripts attached to the selected object.

**Parameters**

| | |
|---|---|
| *behavior* | Contains the script data |

Definition at line 458 of file editor.cpp.

```
                                              {
    if (!behavior) return;

    // Setting up tree flags
    ImGuiTreeNodeFlags node_flags = ImGuiTreeNodeFlags_SpanAvailWidth | ImGuiTreeNodeFlags_OpenOnDoubleClick
   | ImGuiTreeNodeFlags_OpenOnArrow;
    if (selected_component == CType::CBehavior) node_flags |= ImGuiTreeNodeFlags_Selected;

    const bool scripts_open = ImGui::TreeNodeEx((void*)(intptr_t)CType::CBehavior, node_flags, "Scripts");
    if (ImGui::IsItemClicked()) selected_component = CType::CBehavior;

      // Right click behavior to delete script component from object
    if (ImGui::IsItemClicked(ImGuiMouseButton_Right)) {
        selected_component = CType::CBehavior;
        ImGui::OpenPopup("DeleteScripts##1");
    }

    if (ImGui::BeginPopup("DeleteScripts##1")) {
        if (ImGui::Selectable("Delete##2")) {
            behavior->GetParent()->RemoveComponent<Behavior>();
            selected_component = -1;
        }
        ImGui::EndPopup();
    }

      // Displays the currently attached scripts
    if (scripts_open) {
        std::vector<std::string>& scripts = behavior->GetScripts();
        unsigned scriptNum = 1;
        for (std::string& script : scripts) {
            ImGui::Text(std::string("Script " + std::to_string(scriptNum) + ":").c_str());
            ImGui::SameLine(100);
            if (ImGui::Button(Editor::Make_Display_String(script).c_str())) {
                ImGuiFileDialog::Instance()->OpenDialog("ChooseFileDlgKey##3", "Choose File", ".lua",
   std::string(getenv("USERPROFILE")) + "/Documents/pEngine/scripts/");
            }

            if (ImGuiFileDialog::Instance()->Display("ChooseFileDlgKey##3")) {
                if (ImGuiFileDialog::Instance()->IsOk()) {
                    std::string filePath = ImGuiFileDialog::Instance()->GetCurrentPath();
                    filePath += "/" + ImGuiFileDialog::Instance()->GetCurrentFileName();
                    behavior->SwitchScript(scriptNum - 1, filePath);
                }

                ImGuiFileDialog::Instance()->Close();
            }
            ++scriptNum;
        }

          // Add new script to the object
        ImGui::Indent(71);
        if (ImGui::Button("New Script##1")) {
            ImGuiFileDialog::Instance()->OpenDialog("ChooseFileDlgKey##4", "Choose File", ".lua",
   std::string(getenv("USERPROFILE")) + "/Documents/pEngine/scripts/");
        }

        if (ImGuiFileDialog::Instance()->Display("ChooseFileDlgKey##4")) {
            if (ImGuiFileDialog::Instance()->IsOk()) {
                std::string filePath = ImGuiFileDialog::Instance()->GetCurrentPath();
                filePath += "/" + ImGuiFileDialog::Instance()->GetCurrentFileName();
                behavior->AddScript(filePath);
            }

            ImGuiFileDialog::Instance()->Close();
        }

          // Popup to say that the selected script to add is already attached to the object
        if (ImGui::BeginPopup("ExistingScript##1")) {
            ImGui::Text(std::string("Script already being used or doesn't exist").c_str(),
                ImGui::GetFontSize() * 2);
            ImGui::EndPopup();
        }

        ImGui::TreePop();
    }
}
```

References Behavior::AddScript(), Component::GetParent(), Behavior::GetScripts(), Make_Display_String(), Object::↩ RemoveComponent(), selected_component, and Behavior::SwitchScript().

Referenced by Display_Components().

#### 4.4.2.9 Display_Transform() `void Editor::Display_Transform ( Transform * transform ) [private]`

Display transform data, users can change any of it.

**Parameters**

|   |   |
|---|---|
| *transform* |   |

Definition at line 662 of file editor.cpp.

```
                                                   {
    if (!transform) return;

    glm::vec3& position = transform->GetPositionRef();
    glm::vec3& scale = transform->GetScaleRef();
    glm::vec3& rotation = transform->GetRotationRef();
    glm::vec3& startPos = transform->GetStartPositionRef();

    ImGuiTreeNodeFlags node_flags = ImGuiTreeNodeFlags_SpanAvailWidth | ImGuiTreeNodeFlags_OpenOnDoubleClick
   | ImGuiTreeNodeFlags_OpenOnArrow;
    if (selected_component == CType::CTransform) node_flags |= ImGuiTreeNodeFlags_Selected;

    const bool transform_open = ImGui::TreeNodeEx((void*)(intptr_t)CType::CTransform, node_flags,
   "Transform");
    if (ImGui::IsItemClicked()) selected_component = CType::CTransform;

    if (transform_open) {
        ImGui::Text("Position");

        ImGui::PushItemWidth(65);
        ImGui::SameLine(100); ImGui::InputFloat("x##1", &position.x);
        ImGui::SameLine(185); ImGui::InputFloat("y##1", &position.y);
        ImGui::SameLine(270); ImGui::InputFloat("z##1", &position.z);
        ImGui::PopItemWidth();

        ImGui::Text("Scale");

        ImGui::PushItemWidth(65);
        ImGui::SameLine(100); ImGui::InputFloat("x##2", &scale.x);
        ImGui::SameLine(185); ImGui::InputFloat("y##2", &scale.y);
        ImGui::SameLine(270); ImGui::InputFloat("z##2", &scale.z);
        ImGui::PopItemWidth();

        ImGui::Text("Rotation");

        ImGui::PushItemWidth(65);
        ImGui::SameLine(100); ImGui::InputFloat("x##3", &rotation.x);
        ImGui::SameLine(185); ImGui::InputFloat("y##3", &rotation.y);
        ImGui::SameLine(270); ImGui::InputFloat("z##3", &rotation.z);
        ImGui::PopItemWidth();

        ImGui::Text("Start Pos");

        ImGui::PushItemWidth(65);
        ImGui::SameLine(100); ImGui::InputFloat("x##5", &startPos.x);
        ImGui::SameLine(185); ImGui::InputFloat("y##5", &startPos.y);
        ImGui::SameLine(270); ImGui::InputFloat("z##5", &startPos.z);
        ImGui::PopItemWidth();

        ImGui::TreePop();
    }
}
```

References Transform::GetPositionRef(), Transform::GetRotationRef(), Transform::GetScaleRef(), Transform::Get↩ StartPositionRef(), and selected_component.

Referenced by Display_Components().

#### 4.4.2.10 Display_World_Settings() `void Editor::Display_World_Settings ( ) [private]`

Shows all of the settings of the engine itself.

Definition at line 377 of file editor.cpp.

```
                                        {
    ImGui::Begin("World Settings");
    std::string presetName = Engine::GetPresetName();
    if (presetName.compare("no preset") != 0)
        presetName = Editor::Make_Display_String(presetName);

      // Allows user to change the preset that is loaded
    ImGui::Text("Presets"); ImGui::SameLine(120);
    if (ImGui::Button(presetName.c_str())) {
        ImGuiFileDialog::Instance()->OpenDialog("ChooseFileDlgKey##5", "Choose File", ".json",
   std::string(getenv("USERPROFILE")) + "/Documents/pEngine/json/preset/");
    }

    if (ImGuiFileDialog::Instance()->Display("ChooseFileDlgKey##5")) {
        if (ImGuiFileDialog::Instance()->IsOk()) {
            std::string filePath = ImGuiFileDialog::Instance()->GetCurrentPath();
            filePath += "/" + ImGuiFileDialog::Instance()->GetCurrentFileName();

            if (Engine::Restart(filePath)) {
                selected_object = -1;
                selected_component = -1;
                object_to_copy = -1;
            }
        }

        ImGuiFileDialog::Instance()->Close();
    }

    ImGui::PushItemWidth(141);

      // Strength of the light being used
    ImGui::Text("Light Power");
    ImGui::SameLine(120); ImGui::InputFloat("##1", &Engine::GetLightPower());

      // Position of the light being used
    ImGui::Text("Light Position");
    ImGui::PushItemWidth(65);
    ImGui::SameLine(120); ImGui::InputFloat("x##4", &Engine::GetLightPos().x);
    ImGui::SameLine(205); ImGui::InputFloat("y##4", &Engine::GetLightPos().y);
    ImGui::SameLine(290); ImGui::InputFloat("z##4", &Engine::GetLightPos().z);
    ImGui::PopItemWidth();

      // Grav const of the engine
    ImGui::Text("Grav Const");
    ImGui::SameLine(120); ImGui::InputDouble("##5", &Engine::GetGravConst());

    ImGui::PopItemWidth();

    ImGui::End();
}
```

References Engine::GetGravConst(), Engine::GetLightPos(), Engine::GetLightPower(), Engine::GetPresetName(), Make_Display_String(), object_to_copy, Engine::Restart(), selected_component, and selected_object.

Referenced by Update().

#### 4.4.2.11 GetTakeKeyboardInput() `bool Editor::GetTakeKeyboardInput ( ) [static]`

Returns whether the program should ignore keyboard input.

**Returns**

true

false

Definition at line 750 of file editor.cpp.

```
{ return editor->takeKeyboardInput; }
```

References editor, and takeKeyboardInput.

Referenced by Camera::Update(), and Graphics::Update().

#### 4.4.2.12 Initialize() `bool Editor::Initialize ( ) [static]`

Sets up the config and style of the editor.

**Returns**

true

false

Definition at line 35 of file editor.cpp.

```
                         {
      // Initializing the editor
    editor = new Editor;
    if (!editor) {
        Trace::Message("Editor failed to initialize.\n");
        return false;
    }
    editor->selected_object = -1;
    editor->selected_component = -1;
    editor->object_to_copy = -1;

    IMGUI_CHECKVERSION();
    ImGui::CreateContext();

      // Setting up ImGui flags
    ImGui::GetIO().ConfigFlags |= ImGuiConfigFlags_NavEnableKeyboard;
    ImGui::GetIO().ConfigFlags |= ImGuiConfigFlags_DockingEnable;
    ImGui::GetIO().ConfigFlags |= ImGuiConfigFlags_ViewportsEnable;

      // Setting style for ImGui
    ImGui::StyleColorsDark();
    if (ImGui::GetIO().ConfigFlags & ImGuiConfigFlags_ViewportsEnable) {
        ImGui::GetStyle().WindowRounding = 0.f;
        ImGui::GetStyle().Colors[ImGuiCol_WindowBg].w = 1.f;
    }

      // Setting up ImGui
    ImGui_ImplGlfw_InitForOpenGL(Graphics::GetWindow(), true);
    ImGui_ImplOpenGL3_Init("#version 330");

    return true;
}
```

References editor, Graphics::GetWindow(), Trace::Message(), object_to_copy, selected_component, and selected_↩ object.

Referenced by Engine::Initialize().

#### 4.4.2.13 Make_Display_String() `std::string Editor::Make_Display_String ( std::string inputString ) [static], [private]`

Removes the filepath from a filename.

**Parameters**

| | |
|---|---|
| *inputString* | Original filename (with filepath) |

**Returns**

std::string

Definition at line 758 of file editor.cpp.

```
                                                             {
    size_t slashLoc = inputString.find_last_of("/");
    size_t dotLoc = inputString.find_last_of(".");

    if (slashLoc == std::string::npos || dotLoc == std::string::npos)
        return inputString;

    std::string newString = inputString.substr(slashLoc + 1, dotLoc);

    return newString;
}
```

Referenced by Display_Components(), Display_Model(), Display_Scripts(), and Display_World_Settings().

### 4.4.2.14 Render() `void Editor::Render ( ) [static]`

Render the editor.

**Returns**

void

Definition at line 114 of file editor.cpp.

```
                        {
    ImGui::Render();
    ImGui_ImplOpenGL3_RenderDrawData(ImGui::GetDrawData());

    if (ImGui::GetIO().ConfigFlags & ImGuiConfigFlags_ViewportsEnable) {
        GLFWwindow* backup_current_context = glfwGetCurrentContext();
        ImGui::UpdatePlatformWindows();
        ImGui::RenderPlatformWindowsDefault();
        glfwMakeContextCurrent(backup_current_context);
    }
}
```

Referenced by Graphics::Render().

### 4.4.2.15 Reset() `void Editor::Reset ( ) [static]`

Sets selected object to invalid value.

**Returns**

void

Definition at line 147 of file editor.cpp.

```
                       {
    editor->selected_object = -1;
}
```

References editor, and selected_object.

Referenced by Engine::Restart().

#### 4.4.2.16 Shutdown() `void Editor::Shutdown ( ) [static]`

Destroy editor windows and systems.

**Returns**

void

Definition at line 131 of file editor.cpp.

```
                         {
    if (!editor) return;

    ImGui_ImplOpenGL3_Shutdown();
    ImGui_ImplGlfw_Shutdown();
    ImGui::DestroyContext();

    delete editor;
    editor = nullptr;
}
```

References editor.

Referenced by Engine::Shutdown().

#### 4.4.2.17 Update() `void Editor::Update ( ) [static]`

Updates the editor content and calls display functions.

**Returns**

void

Definition at line 73 of file editor.cpp.

```
                       {
      // ImGui update functions
    ImGui_ImplOpenGL3_NewFrame();
    ImGui_ImplGlfw_NewFrame();
    ImGui::NewFrame();

    //ImGui::ShowDemoWindow();

      // Updating whether program should ignore keyboard input
    if (!ImGui::GetIO().WantCaptureKeyboard) {
        editor->takeKeyboardInput = true;
    }
    else {
        editor->takeKeyboardInput = false;
    }

      // Keyboard shortcuts
    if (!editor->takeKeyboardInput) {
          // Save current settings as preset
        if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_LEFT_CONTROL) == GLFW_PRESS) {
            if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_S) == GLFW_PRESS) {
                if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_S) == GLFW_RELEASE) {
                        Engine::Write();
                }
            }
        }
    }

      // Display the different windows
    editor->Display_Dockspace();
    editor->Display_Scene();
    editor->Display_Components();
    editor->Display_World_Settings();
    editor->Display_Camera_Settings();
}
```

References Display_Camera_Settings(), Display_Components(), Display_Dockspace(), Display_Scene(), Display_↩
World_Settings(), editor, Graphics::GetWindow(), takeKeyboardInput, and Engine::Write().

Referenced by Engine::Update().

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

- editor.hpp
- editor.cpp

## 4.5 Engine Class Reference

`#include <engine.hpp>`

### Static Public Member Functions

- static bool Initialize ()

  *Initializes the engine and the systems in the engine.*
- static void Update ()

  *Updates object and camera. Object updates have a fixed time step, camera updates have variable time step.*
- static void Shutdown ()

  *Shutdown systems and then engine.*
- static bool Restart ()

  *Resets the objects in the engine.*
- static bool Restart (std::string presetName)

  *Resets the engine to the given preset.*
- static float GetDeltaTime ()

  *Returns delta time (variable)*
- static float GetDt ()

  *Returns delta time (fixed)*
- static double & GetGravConst ()

  *Returns gravitational constant.*
- static std::string GetPresetName ()

  *Returns the name of the current preset.*
- static float & GetLightPower ()

  *Returns reference to power of the light in the scene.*
- static glm::vec3 & GetLightPos ()

  *Returns reference to the position of the light in the scene.*
- static void Write ()

  *Writes the engine data to a preset file (creates new one if it doesn't already exist)*
- static void SetPresetName (std::string presetName_)

  *Sets the name of the preset file.*

**Private Attributes**

- bool isRunning

  *state of the main loop*
- float deltaTime

  *time between frames*
- float accumulator

  *amount of unused time for physics updates*
- float time

  *total time*
- const float dt = 0.01f

  *fixed delta time for physics updates*
- std::chrono::steady_clock::time_point currentTime

  *current read time*
- std::chrono::steady_clock::time_point newTime

  *newest read time*
- std::chrono::steady_clock::duration timeTaken

  *time between frames*
- double gravConst

  *gravitational constant (used in physics)*
- std::string presetName

  *name of the preset being used*
- float lightPower

  *Power of the light in the scene.*
- glm::vec3 lightPos

  *Position of the light in the scene.*

### 4.5.1 Detailed Description

Engine class

Definition at line 24 of file engine.hpp.

### 4.5.2 Member Function Documentation

#### 4.5.2.1 GetDeltaTime() `float Engine::GetDeltaTime ( ) [static]`

Returns delta time (variable)

**Returns**

float Variable delta time

Definition at line 214 of file engine.cpp.

```
214 { return engine->deltaTime; }
```

References deltaTime, and engine.

Referenced by Camera::MouseUpdate(), and Camera::Update().

#### 4.5.2.2 GetDt() `float Engine::GetDt ( ) [static]`

Returns delta time (fixed)

**Returns**

float Fixed delta time

Definition at line 221 of file engine.cpp.
```
221 { return engine->dt; }
```

References dt, and engine.

Referenced by Behavior::Update(), and Physics::Update().

#### 4.5.2.3 GetGravConst() `double & Engine::GetGravConst ( ) [static]`

Returns gravitational constant.

**Returns**

double Gravitational constant

Definition at line 228 of file engine.cpp.
```
228 { return engine->gravConst; }
```

References engine, and gravConst.

Referenced by Editor::Display_World_Settings(), and Physics::UpdateGravity().

#### 4.5.2.4 GetLightPos() `glm::vec3 & Engine::GetLightPos ( ) [static]`

Returns reference to the position of the light in the scene.

**Returns**

glm::vec3&

Definition at line 249 of file engine.cpp.
```
249 { return engine->lightPos; }
```

References engine, and lightPos.

Referenced by Editor::Display_World_Settings(), and Model_Data::Draw().

#### 4.5.2.5 GetLightPower() `float & Engine::GetLightPower ( ) [static]`

Returns reference to power of the light in the scene.

**Returns**

float&

Definition at line 242 of file engine.cpp.

```
242 { return engine->lightPower; }
```

References engine, and lightPower.

Referenced by Editor::Display_World_Settings(), and Model_Data::Draw().

#### 4.5.2.6 GetPresetName() `std::string Engine::GetPresetName ( ) [static]`

Returns the name of the current preset.

**Returns**

std::string

Definition at line 235 of file engine.cpp.

```
235 { return engine->presetName; }
```

References engine, and presetName.

Referenced by Editor::Display_World_Settings().

#### 4.5.2.7 Initialize() `bool Engine::Initialize ( ) [static]`

Initializes the engine and the systems in the engine.

**Returns**

true

false

Definition at line 42 of file engine.cpp.

```
42                        {
43       // Initializing engine
44     engine = new Engine;
45     if (!engine) {
46         Trace::Message("Engine was not initialized.\n");
47         return false;
48     }
49 
50       // Initializing random
51     if (!Random::Initialize()) return false;
52 
53       // Reading settings from json
54     File_Reader settings;
55     if (settings.Read_File(std::string(getenv("USERPROFILE")) + "/Documents/pEngine/json/settings.json")) {
56           // Setting up sub systems
57         if (!Camera::Initialize(settings)) return false;
58         if (!Graphics::Initialize(settings)) return false;
59         if (!Model_Data_Manager::Initialize()) return false;
60         if (!Texture_Manager::Initialize()) return false;
61 
62         File_Reader preset;
63 
64         engine->presetName = std::string(getenv("USERPROFILE")) + "/Documents/pEngine/json/preset/" +
       settings.Read_String("preset");
65         if (preset.Read_File(engine->presetName)) {
66             engine->gravConst = preset.Read_Double("gravConst");
67             engine->lightPos = preset.Read_Vec3("lightPos");
68             if (engine->lightPos == glm::vec3(0.f)) {
69                 engine->lightPos = glm::vec3(4, 4, 0);
70             }
71             if (!Object_Manager::Initialize(preset)) return false;
72         }
73         else {
74             engine->presetName = "no preset";
75             if (!Object_Manager::Initialize()) return false;
76         }
77 
78         engine->gravConst = 0.0;
79 
80         engine->lightPower = 1000.f;
81     }
82     else {
83         engine->presetName = "no preset";
84         engine->gravConst = 0.0;
85 
86         engine->lightPower = 1000.f;
87         engine->lightPos = glm::vec3(4, 4, 0);
88 
89           // Setting up sub systems
90         if (!Camera::Initialize()) return false;
91         if (!Graphics::Initialize()) return false;
92         if (!Model_Data_Manager::Initialize()) return false;
93         if (!Texture_Manager::Initialize()) return false;
94         if (!Object_Manager::Initialize()) return false;
95     }
96 
97       // Initializing the editor
98     if (!Editor::Initialize()) return false;
99 
100       // Setting up variables used for dt
101     engine->currentTime = std::chrono::steady_clock::now();
102     engine->accumulator = 0.f;
103     engine->time = 0.f;
104     engine->isRunning = true;
105 
106     return true;
107 }
```

References accumulator, currentTime, engine, gravConst, Random::Initialize(), Editor::Initialize(), Texture_Manager↩ ::Initialize(), Model_Data_Manager::Initialize(), Object_Manager::Initialize(), Camera::Initialize(), Graphics::Initialize(),

isRunning, lightPos, lightPower, Trace::Message(), presetName, File_Reader::Read_Double(), File_Reader::Read_↩
File(), File_Reader::Read_String(), File_Reader::Read_Vec3(), and time.

Referenced by main().

#### 4.5.2.8 Restart() [1/2] `bool Engine::Restart ( ) [static]`

Resets the objects in the engine.

**Returns**

true

false

Definition at line 164 of file engine.cpp.

```
                    {
    // Initializing object manager
  File_Reader settings;
  if (! settings.Read_File(std::string(getenv("USERPROFILE")) + "/Documents/pEngine/json/settings.json"))
 return false;

  File_Reader preset;
  if (!preset.Read_File(engine->presetName)) return false;

    // Removing all current objects
  Object_Manager::Shutdown();
  Editor::Reset();

  engine->presetName = settings.Read_String("preset");
  engine->gravConst = preset.Read_Double("gravConst");
  if (!Object_Manager::Initialize(preset)) return false;

  return true;
}
```

References engine, gravConst, Object_Manager::Initialize(), presetName, File_Reader::Read_Double(), File_Reader↩
::Read_File(), File_Reader::Read_String(), Editor::Reset(), and Object_Manager::Shutdown().

Referenced by Editor::Display_World_Settings(), and Graphics::Update().

#### 4.5.2.9 Restart() [2/2] `bool Engine::Restart ( std::string presetName ) [static]`

Resets the engine to the given preset.

**Parameters**

| | |
|---|---|
| *presetName* | Given preset |

**Returns**

true

false

Definition at line 190 of file engine.cpp.

```
                                       {
    // Initializing object manager
  File_Reader settings;
  settings.Read_File(std::string(getenv("USERPROFILE")) + "/Documents/pEngine/json/settings.json");
  Trace::Message(presetName + "\n");
  File_Reader preset;
  if (!preset.Read_File(presetName)) return false;

    // Removing all current objects
  Object_Manager::Shutdown();
  Editor::Reset();

  engine->presetName = presetName;
  engine->gravConst = preset.Read_Double("gravConst");
  if (!Object_Manager::Initialize(preset)) return false;

  return true;
}
```

References engine, gravConst, Object_Manager::Initialize(), Trace::Message(), presetName, File_Reader::Read_↩ Double(), File_Reader::Read_File(), Editor::Reset(), and Object_Manager::Shutdown().

#### 4.5.2.10 SetPresetName() `void Engine::SetPresetName ( std::string presetName_ ) [static]`

Sets the name of the preset file.

**Parameters**

| | |
|---|---|
| *preset↩ Name_* | |

**Returns**

void

Definition at line 273 of file engine.cpp.

```
                                             {
  engine->presetName = presetName_;
}
```

References engine, and presetName.

Referenced by Editor::Display_Menu_Bar().

#### 4.5.2.11 Shutdown() `void Engine::Shutdown ( ) [static]`

Shutdown systems and then engine.

**Returns**

void

Definition at line 141 of file engine.cpp.

```
                         {
    if (!engine) return;

      // Shutdown sub systems
    Editor::Shutdown();
    Random::Shutdown();
    Object_Manager::Shutdown();
    Graphics::Shutdown();
    Camera::Shutdown();
    Texture_Manager::Shutdown();
    Model_Data_Manager::Shutdown();

      // Delete engine object
    delete engine;
    engine = nullptr;
}
```

References engine, Random::Shutdown(), Editor::Shutdown(), Model_Data_Manager::Shutdown(), Texture_Manager↩ ::Shutdown(), Camera::Shutdown(), Object_Manager::Shutdown(), and Graphics::Shutdown().

Referenced by main().

#### 4.5.2.12 Update() `void Engine::Update ( ) [static]`

Updates object and camera. Object updates have a fixed time step, camera updates have variable time step.

**Returns**

void

Definition at line 115 of file engine.cpp.

```
                       {
      // Calculating dt
    engine->newTime = std::chrono::steady_clock::now();
    engine->timeTaken = engine->newTime - engine->currentTime;
    engine->deltaTime = float(engine->timeTaken.count()) *
        std::chrono::steady_clock::period::num / std::chrono::steady_clock::period::den;
    engine->currentTime = engine->newTime;
    engine->accumulator += engine->deltaTime;

    Editor::Update();
    Camera::Update();
      // Only called when it is time (fixed time step)
    while (engine->accumulator >= engine->dt) {
          // Update objects
        Object_Manager::Update();
          // Update dt related variables
        engine->accumulator -= engine->dt;
        engine->time += engine->dt;
    }
}
```

References accumulator, currentTime, deltaTime, dt, engine, newTime, time, timeTaken, Editor::Update(), Camera::↩ Update(), and Object_Manager::Update().

Referenced by Graphics::Update().

#### 4.5.2.13 Write() `void Engine::Write ( ) [static]`

Writes the engine data to a preset file (creates new one if it doesn't already exist)

**Returns**

void

Definition at line 257 of file engine.cpp.

```
                    {
    File_Writer writer;

    writer.Write_Value("gravConst", engine->gravConst);
    writer.Write_Vec3("lightPos", engine->lightPos);
    Object_Manager::Write(writer);

    writer.Write_File(engine->presetName);
}
```

References engine, gravConst, lightPos, presetName, Object_Manager::Write(), File_Writer::Write_File(), File_Writer↩ ::Write_Value(), and File_Writer::Write_Vec3().

Referenced by Editor::Display_Menu_Bar(), and Editor::Update().

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

- engine.hpp
- engine.cpp

## 4.6 File_Reader Class Reference

```
#include <file_reader.hpp>
```

### Public Member Functions

- bool Read_File (std::string filename)

  *Reads the json file data into the root variable.*
- int Read_Int (std::string valueName)

  *Reads int from the json file stored in root.*
- std::string Read_String (std::string valueName)

  *Reads std::string from the json file stored in root.*
- glm::vec3 Read_Vec3 (std::string valueName)

  *Reads glm::vec3 from the json file stored in root. glm::vec3 is constructed from an array.*
- bool Read_Bool (std::string valueName)

  *Reads bool from the json file stored in root.*
- float Read_Float (std::string valueName)

  *Reads float from the json stored in root.*
- double Read_Double (std::string valueName)

  *Reads double from the json stored in root.*
- std::string Read_Object_Name (std::string valueName)

  *Reads the name of an object from an object list (preset folder)*
- std::string Read_Object_Template_Name (std::string valueName)

  *Reads the name of the template file for object.*
- glm::vec3 Read_Object_Position (std::string valueName)

  *Reads the position of an object from an object list (preset folder)*
- glm::vec3 Read_Object_Scale (std::string valueName)

  *Reads the scale of an object.*
- std::string Read_Behavior_Name (std::string valueName)

  *Reads the name of the behavior.*

#### Private Attributes

- rapidjson::Document root

  *Holds the data of the json file.*

### 4.6.1 Detailed Description

File_Reader class

Definition at line 24 of file file_reader.hpp.

### 4.6.2 Member Function Documentation

#### 4.6.2.1 Read_Behavior_Name() `std::string File_Reader::Read_Behavior_Name ( std::string valueName )`

Reads the name of the behavior.

**Parameters**

| | |
|---|---|
| *valueName* | Behavior to read |

**Returns**

std::string Name of the behavior

Definition at line 205 of file file_reader.cpp.

```
{
    // Checking if value exists
    if (!root["behaviors"].HasMember(valueName.c_str())) {
        return std::string("");
    }

    return root["behaviors"][valueName.c_str()].GetString();
}
```

Referenced by Behavior::Read().

#### 4.6.2.2 Read_Bool() `bool File_Reader::Read_Bool ( std::string valueName )`

Reads bool from the json file stored in root.

**Parameters**

| | |
|---|---|
| *valueName* | Name of the bool in the json file |

**Returns**

true

false

Definition at line 96 of file file_reader.cpp.

```
                                              {
        // Checking if the value is a bool
      if (!root.HasMember(valueName.c_str())) {
          return false;
      }
      return root[valueName.c_str()].GetBool();
  }
```

### 4.6.2.3 Read_Double() `double File_Reader::Read_Double ( std::string valueName )`

Reads double from the json stored in root.

**Parameters**

| | |
|---|---|
| *valueName* | Name of the double in the json file |

**Returns**

double Value that was read

Definition at line 124 of file file_reader.cpp.

```
                                                    {
        // Checking if the value is a double (has decimal)
      if (!root.HasMember(valueName.c_str())) {
          return false;
      }
      return root[valueName.c_str()].GetDouble();
  }
```

Referenced by Engine::Initialize(), and Engine::Restart().

### 4.6.2.4 Read_File() `bool File_Reader::Read_File ( std::string filename )`

Reads the json file data into the root variable.

**Parameters**

| | |
|---|---|
| *filename* | Name of the file to be read |

**Returns**

true

false

Definition at line 32 of file file_reader.cpp.

```
                                            {
   // Opening the json file
  std::string fileToOpen = filename;
  FILE* file = fopen(fileToOpen.c_str(), "r");
  if (!file) return false;

  char buffer[65536];
  FileReadStream stream(file, buffer, sizeof(buffer));
  root.ParseStream<0, UTF8<>, FileReadStream>(stream);

  fclose(file);
  return true;
}
```

Referenced by Engine::Initialize(), Object::Read(), Object::ReRead(), and Engine::Restart().

### 4.6.2.5 Read_Float() `float File_Reader::Read_Float ( std::string valueName )`

Reads float from the json stored in root.

**Parameters**

| | |
|---|---|
| *valueName* | Name of the float in the json file |

**Returns**

float Value that was read

Definition at line 110 of file file_reader.cpp.

```
                                            {
   // Checking if the value is a double (has decimal)
  if (!root.HasMember(valueName.c_str())) {
      return 0.f;
  }
  return root[valueName.c_str()].GetFloat();
}
```

Referenced by Camera::Initialize(), and Physics::Read().

#### 4.6.2.6 Read_Int() `int File_Reader::Read_Int ( std::string valueName )`

Reads int from the json file stored in root.

**Parameters**

| | |
|---|---|
| *valueName* | Name of the int in the json file |

**Returns**

int Value that was read

Definition at line 52 of file file_reader.cpp.

```
                                                  {
        // Checking if the value is an int
      if (!root.HasMember(valueName.c_str())) {
          return 0;
      }
      return root[valueName.c_str()].GetInt();
}
```

Referenced by Camera::Initialize(), and Graphics::Initialize().

#### 4.6.2.7 Read_Object_Name() `std::string File_Reader::Read_Object_Name ( std::string valueName )`

Reads the name of an object from an object list (preset folder)

**Parameters**

| | |
|---|---|
| *valueName* | Specifies which object |

**Returns**

std::string Name of the object

Definition at line 138 of file file_reader.cpp.

```
                                                              {
        // Checking if the value exists
      if (!root.HasMember(valueName.c_str())) {
          return std::string("");
      }
      if (!root[valueName.c_str()].HasMember("objectName")) {
          return std::string("");
      }

      return root[valueName.c_str()]["objectName"].GetString();
}
```

Referenced by Object_Manager::ReadList().

#### 4.6.2.8 Read_Object_Position() `glm::vec3 File_Reader::Read_Object_Position ( std::string valueName )`

Reads the position of an object from an object list (preset folder)

**Parameters**

| | |
|---|---|
| *valueName* | Specifies which object |

**Returns**

glm::vec3 Position of object

Definition at line 174 of file file_reader.cpp.

```
                                                              {
    if (!root[valueName.c_str()].HasMember("position")) {
        return glm::vec3(0.f, 0.f, 0.f);
    }

    Value& array = root[valueName.c_str()]["position"];
    return glm::vec3(array[0].GetFloat(), array[1].GetFloat(), array[2].GetFloat());
}
```

Referenced by Object_Manager::ReadList().

### 4.6.2.9 Read_Object_Scale() `glm::vec3 File_Reader::Read_Object_Scale ( std::string valueName )`

Reads the scale of an object.

**Parameters**

| | |
|---|---|
| *valueName* | |

**Returns**

glm::vec3

Definition at line 189 of file file_reader.cpp.

```
                                                           {
      // Checking if value exists
    if (!root[valueName.c_str()].HasMember("scale")) {
        return glm::vec3(0.f, 0.f, 0.f);
    }

    Value& array = root[valueName.c_str()]["scale"];
    return glm::vec3(array[0].GetFloat(), array[1].GetFloat(), array[2].GetFloat());
}
```

Referenced by Object_Manager::ReadList().

### 4.6.2.10 Read_Object_Template_Name() `std::string File_Reader::Read_Object_Template_Name ( std::string valueName )`

Reads the name of the template file for object.

**Parameters**

| | |
|---|---|
| *valueName* | |

**Returns**

std::string

Definition at line 156 of file file_reader.cpp.

```
                                                                  {
      // Checking if the value exists
    if (!root.HasMember(valueName.c_str())) {
        return std::string("");
    }
    if (!root[valueName.c_str()].HasMember("templateName")) {
        return std::string("");
    }

    return root[valueName.c_str()]["templateName"].GetString();
}
```

Referenced by Object_Manager::ReadList().

#### 4.6.2.11 Read_String() `std::string File_Reader::Read_String ( std::string valueName )`

Reads std::string from the json file stored in root.

**Parameters**

| | |
|---|---|
| *valueName* | Name of the std::string in the json file |

**Returns**

std::string Value that was read

Definition at line 66 of file file_reader.cpp.

```
                                                   {
      // Checking if the value is a std::string
    if (!root.HasMember(valueName.c_str())) {
        return std::string("");
    }
    return root[valueName.c_str()].GetString();
}
```

Referenced by Model_Data_Manager::Get(), Texture_Manager::Get(), Engine::Initialize(), Shader::Initialize(), Model_↩ Data::Load(), Object::ReRead(), and Engine::Restart().

#### 4.6.2.12 Read_Vec3() `glm::vec3 File_Reader::Read_Vec3 ( std::string valueName )`

Reads glm::vec3 from the json file stored in root. glm::vec3 is constructed from an array.

**Parameters**

| | |
|---|---|
| *valueName* | Name of the glm::vec3 in the json file |

**Returns**

glm::vec3 Value that was read

Definition at line 81 of file file_reader.cpp.

```
81                                                      {
82         // Checking if the value is an array
83       if (!root.HasMember(valueName.c_str())) {
84           return glm::vec3(0.f, 0.f, 0.f);
85       }
86       return glm::vec3(root[valueName.c_str()][0].GetFloat(), root[valueName.c_str()][1].GetFloat(),
         root[valueName.c_str()][2].GetFloat());
87 }
```

Referenced by Engine::Initialize(), and Physics::Read().

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

- file_reader.hpp
- file_reader.cpp

## 4.7 File_Writer Class Reference

```
#include <file_writer.hpp>
```

**Public Member Functions**

- File_Writer ()

  *Creates root object to write data into.*
- void Write_File (std::string filename)

  *Writes all the data stored in root to the given filename.*
- void Write_Vec3 (std::string valueName, glm::vec3 value)

  *Write a glm::vec3 into root.*
- void Write_String (std::string valueName, std::string value)

  *Write a std::string into root.*
- template< typename T >
  void Write_Value (std::string valueName, T value)

  *Writes most values to root (can't do strings)*
- void Write_Behavior_Name (std::vector< std::string > &behaviorNames)

  *Writing behaviorNames into nested object and then into root.*
- void Write_Object_Data (Object ∗object)

  *Writing data of an object into root.*

**Private Attributes**

- rapidjson::Document root

  *Holds the data for the json file.*

### 4.7.1 Detailed Description

File_Writer class

Definition at line 30 of file file_writer.hpp.

### 4.7.2 Constructor & Destructor Documentation

#### 4.7.2.1 File_Writer() `File_Writer::File_Writer ( )`

Creates root object to write data into.

Definition at line 27 of file file_writer.cpp.

```
                          {
    root.SetObject();
}
```

### 4.7.3 Member Function Documentation

#### 4.7.3.1 Write_Behavior_Name() `void File_Writer::Write_Behavior_Name ( std::vector< std::string > & behaviorNames )`

Writing behaviorNames into nested object and then into root.

**Parameters**

| | |
|---|---|
| *behaviorNames* | |

Definition at line 88 of file file_writer.cpp.

```
                                                                     {
    Value behaviors(kObjectType);

      // Filling object
    for (unsigned i = 0; i < behaviorNames.size(); ++i) {
        std::string behaviorName = std::string("behavior_" + std::to_string(i));
        Value name(behaviorName.c_str(), SizeType(behaviorName.size()), root.GetAllocator());

        behaviors.AddMember(name, StringRef(behaviorNames[i].c_str()), root.GetAllocator());
    }
```

```
98
99      // Nesting object into root
100     root.AddMember("behaviors", behaviors, root.GetAllocator());
101 }
```

Referenced by Behavior::Write().

#### 4.7.3.2 Write_File() `void File_Writer::Write_File ( std::string filename )`

Writes all the data stored in root to the given filename.

**Parameters**

| | |
|---|---|
| *filename* | |

Definition at line 36 of file file_writer.cpp.

```
36                                             {
37      std::string fileToOpen = filename;
38      FILE* file = fopen(fileToOpen.c_str(), "w");
39
40      char buffer[65536];
41      FileWriteStream stream(file, buffer, sizeof(buffer));
42
43      PrettyWriter<FileWriteStream> writer(stream);
44      writer.SetMaxDecimalPlaces(3);
45      writer.SetFormatOptions(kFormatSingleLineArray);
46      root.Accept(writer);
47
48      fclose(file);
49 }
```

Referenced by Engine::Write(), and Object::Write().

#### 4.7.3.3 Write_Object_Data() `void File_Writer::Write_Object_Data ( Object * object )`

Writing data of an object into root.

**Parameters**

| | |
|---|---|
| *object* | |

Definition at line 108 of file file_writer.cpp.

```
108                                                {
109     if (!object) return;
110
111       // Getting transform data from object
112     Transform* transform = object->GetComponent<Transform>();
113     glm::vec3 startPos = { 0.f, 0.f, 0.f };
114     glm::vec3 startScale = { 1.f, 1.f, 1.f };
115     if (transform) startPos = transform->GetStartPosition();
116     if (transform) startScale = transform->GetScale();
117
118       // Putting position into value rapidjson can use
119     Value pos(kArrayType);
120     pos.PushBack(startPos.x, root.GetAllocator());
121     pos.PushBack(startPos.y, root.GetAllocator());
122     pos.PushBack(startPos.z, root.GetAllocator());
123
124       // Putting scale into value rapidjson can use
125     Value scale(kArrayType);
126     scale.PushBack(startScale.x, root.GetAllocator());
127     scale.PushBack(startScale.y, root.GetAllocator());
128     scale.PushBack(startScale.z, root.GetAllocator());
129
130       // Creating and filling object
131     Value objectData(kObjectType);
132
133     Value objectName(object->GetName().c_str(), SizeType(object->GetName().size()), root.GetAllocator());
134     objectData.AddMember(StringRef("objectName"), objectName, root.GetAllocator());
135     Value templateName(object->GetTemplateName().c_str(), SizeType(object->GetTemplateName().size()),
       root.GetAllocator());
136     objectData.AddMember(StringRef("templateName"), templateName, root.GetAllocator());
137     objectData.AddMember(StringRef("position"), pos, root.GetAllocator());
138     objectData.AddMember(StringRef("scale"), scale, root.GetAllocator());
139
140       // Nesting object into root
141     std::string objectIdName = "object_" + std::to_string(object->GetId());
142     Value name(objectIdName.c_str(), SizeType(objectIdName.size()), root.GetAllocator());
143     root.AddMember(name, objectData, root.GetAllocator());
144 }
```

References Object::GetId(), Object::GetName(), Transform::GetScale(), Transform::GetStartPosition(), and Object::↩ GetTemplateName().

Referenced by Object_Manager::Write().

### 4.7.3.4 Write_String() `void File_Writer::Write_String ( std::string valueName, std::string value )`

Write a std::string into root.

**Parameters**

| | |
|---|---|
| *valueName* | |
| *value* | |

Definition at line 75 of file file_writer.cpp.

```
75                                                                    {
76       // Storing std::string in variable rapidjson can write
77     Value name(valueName.c_str(), SizeType(valueName.size()), root.GetAllocator());
78     Value newValue(value.c_str(), SizeType(value.size()), root.GetAllocator());
79
80     root.AddMember(name, newValue, root.GetAllocator());
81 }
```

Referenced by Model::Write(), and Object::Write().

#### 4.7.3.5 Write_Value() `template<typename T >`

```
void File_Writer::Write_Value (
            std::string valueName,
            T value )  [inline]
```

Writes most values to root (can't do strings)

**Template Parameters**

|  |  |
|---|---|
| *T* |  |

**Parameters**

|  |  |
|---|---|
| *valueName* | Name of value being written to root |
| *value* | Value being written to root |

Definition at line 46 of file file_writer.hpp.

```
                                        {
        rapidjson::Value name(valueName.c_str(), rapidjson::SizeType(valueName.size()),
root.GetAllocator());
        root.AddMember(name, value, root.GetAllocator());
    }
```

References root.

Referenced by Engine::Write(), and Physics::Write().

#### 4.7.3.6 Write_Vec3() `void File_Writer::Write_Vec3 (`

```
            std::string valueName,
            glm::vec3 value )
```

Write a glm::vec3 into root.

**Parameters**

|  |  |
|---|---|
| *valueName* | Name of glm::vec3 |
| *value* | glm::vec3 to write |

Definition at line 57 of file file_writer.cpp.

```
                                                {
    // Storing glm::vec3 in array that rapidjson can write
    Value vector3(kArrayType);
    vector3.PushBack(value.x, root.GetAllocator());
    vector3.PushBack(value.y, root.GetAllocator());
    vector3.PushBack(value.z, root.GetAllocator());

    // Writing vector3 into root
    Value name(valueName.c_str(), SizeType(valueName.size()), root.GetAllocator());
    root.AddMember(name, vector3, root.GetAllocator());
}
```

Referenced by Engine::Write(), Transform::Write(), and Physics::Write().

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

- file_writer.hpp
- file_writer.cpp

## 4.8 Graphics Class Reference

```
#include <graphics.hpp>
```

### Public Member Functions

- Graphics (int width, int height)

    *Creates Graphics object with given window size.*

### Static Public Member Functions

- static bool Initialize (File_Reader &settings)

    *Initializes the Graphics system using the settings in the given data.*
- static bool Initialize ()

    *Initializes the Graphics system using default values.*
- static bool InitializeGL ()

    *Initializes the settings of the graphics system.*
- static void Update ()

    *Graphics update loop. Calls other update functions for the engine, input, and rendering. This is the main update function for the engine.*
- static void Render ()

    *Renders all of the objects in the object_manager.*
- static void Shutdown ()

    *Shutdown the graphics system.*
- static bool ErrorCheck (GLenum error)

    *Checking for error in given enum.*
- static void ErrorCallback (int error, const char ∗description)

    *Error callback for when the graphics system has an issue.*
- static std::pair< int, int > GetWindowSize ()

    *Returns window size.*
- static GLFWwindow ∗ GetWindow ()

    *Return the graphics window.*

### Private Attributes

- std::pair< int, int > windowSize

    *Size of the window.*
- GLFWwindow ∗ window

    *Window for application.*
- GLuint vertexArrayId

    *Id of the VAO.*

### 4.8.1 Detailed Description

Graphics class

Definition at line 28 of file graphics.hpp.

### 4.8.2 Constructor & Destructor Documentation

#### 4.8.2.1 Graphics()

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

Creates Graphics object with given window size.

**Parameters**

| | |
|---|---|
| *width* | |
| *height* | |

Definition at line 51 of file graphics.cpp.

```
                                        {
      windowSize.first = width;
      windowSize.second = height;
  }
```

### 4.8.3 Member Function Documentation

#### 4.8.3.1 ErrorCallback()

```
void Graphics::ErrorCallback (
        int error,
        const char * description )  [static]
```

Error callback for when the graphics system has an issue.

**Parameters**

| | |
|---|---|
| *error* | Error that occurred |
| *description* | Description of error |

**Returns**

void

Definition at line 275 of file graphics.cpp.

```
                                                                {
    Trace::Message("Error: " + std::string(description) + ": " + std::to_string(error) + "\n");
}
```

References Trace::Message().

#### 4.8.3.2 ErrorCheck() `bool Graphics::ErrorCheck ( GLenum error ) [static]`

Checking for error in given enum.

**Parameters**

| | |
|---|---|
| *error* | Possible error |

**Returns**

true

false

Definition at line 286 of file graphics.cpp.

```
                                       {
    error = glGetError();
    if (error != GL_NO_ERROR) {
        Trace::Message("Error initializing OpenGl. \n");
        return false;
    }

    return true;
}
```

References Trace::Message().

Referenced by InitializeGL().

#### 4.8.3.3 GetWindow() `GLFWwindow * Graphics::GetWindow ( ) [static]`

Return the graphics window.

**Returns**

GLFWwindow∗

Definition at line 310 of file graphics.cpp.

```
                                 {
    return graphics->window;
}
```

References graphics, and window.

Referenced by Editor::Display_Scene(), Editor::Initialize(), Editor::Update(), Camera::Update(), and Update().

#### 4.8.3.4 GetWindowSize() `std::pair< int, int > Graphics::GetWindowSize ( ) [static]`

Returns window size.

**Returns**

std::pair<int, int>

Definition at line 301 of file graphics.cpp.

```
                                        {
    return graphics->windowSize;
}
```

References graphics, and windowSize.

#### 4.8.3.5 Initialize() [1/2] `bool Graphics::Initialize ( ) [static]`

Initializes the Graphics system using default values.

**Returns**

true

false

Definition at line 115 of file graphics.cpp.

```
                         {
      // Initializing graphics
    graphics = new Graphics(1920, 1080);
    if (!graphics) {
        Trace::Message("Graphics was not initialized.");
        return false;
    }

      // Setting up error recording with graphics
    glfwSetErrorCallback(ErrorCallback);

    if (!glfwInit()) {
        Trace::Message("Could not initialize GLFW.\n");
        return false;
    }

      // Setting up the graphics window
    graphics->window = glfwCreateWindow(graphics->windowSize.first, graphics->windowSize.second,
        "pEngine", nullptr, nullptr);
    if (!graphics->window) {
        Trace::Message("Error creating window.\n");
        return false;
    }

      // Setting up callback functions
    glfwSetCursorPosCallback(graphics->window, Camera::MouseUpdate);

    glfwMakeContextCurrent(graphics->window);
    //glfwSwapInterval(1);
    InitializeGL();

    glewExperimental = GL_TRUE;
    glewInit();

      // Setting up input for keyboard and mouse using glfw library
    glfwSetInputMode(graphics->window, GLFW_STICKY_KEYS, GL_TRUE);
    glfwSetInputMode(graphics->window, GLFW_CURSOR, GLFW_CURSOR_HIDDEN);

    glGenVertexArrays(1, &graphics->vertexArrayId);
    glBindVertexArray(graphics->vertexArrayId);

    if (!Shader::Initialize()) return false;

    return true;
}
```

References graphics, Shader::Initialize(), Trace::Message(), Camera::MouseUpdate(), vertexArrayId, window, and windowSize.

Referenced by Engine::Initialize().

#### 4.8.3.6 Initialize() [2/2]

```
bool Graphics::Initialize (
            File_Reader & settings )  [static]
```

Initializes the Graphics system using the settings in the given data.

**Parameters**

| | |
|---|---|
| *settings* | Settings information |

**Returns**

true

false

Definition at line 63 of file graphics.cpp.

```
                                                  {
      // Initializing graphics
    graphics = new Graphics(settings.Read_Int("windowWidth"), settings.Read_Int("windowHeight"));
    if (!graphics) {
        Trace::Message("Graphics was not initialized.");
        return false;
    }

      // Setting up error recording with graphics
    glfwSetErrorCallback(ErrorCallback);

    if (!glfwInit()) {
        Trace::Message("Could not initialize GLFW.\n");
        return false;
    }

      // Setting up the graphics window
    graphics->window = glfwCreateWindow(graphics->windowSize.first, graphics->windowSize.second,
        "pEngine", nullptr, nullptr);
    if (!graphics->window) {
        Trace::Message("Error creating window.\n");
        return false;
    }

      // Setting up callback functions
    glfwSetCursorPosCallback(graphics->window, Camera::MouseUpdate);

    glfwMakeContextCurrent(graphics->window);
    //glfwSwapInterval(1);
    InitializeGL();

    glewExperimental = GL_TRUE;
    glewInit();

```

```
     // Setting up input for keyboard and mouse using glfw library
    glfwSetInputMode(graphics->window, GLFW_STICKY_KEYS, GL_TRUE);
    glfwSetInputMode(graphics->window, GLFW_CURSOR, GLFW_CURSOR_HIDDEN);

     glGenVertexArrays(1, &graphics->vertexArrayId);
     glBindVertexArray(graphics->vertexArrayId);

     if (!Shader::Initialize(settings)) return false;

     return true;
 }
```

References graphics, Shader::Initialize(), Trace::Message(), Camera::MouseUpdate(), File_Reader::Read_Int(), vertexArrayId, window, and windowSize.

#### 4.8.3.7 InitializeGL() `bool Graphics::InitializeGL ( ) [static]`

Initializes the settings of the graphics system.

**Returns**

true

false

Definition at line 167 of file graphics.cpp.

```
                              {
     GLenum error = GL_NO_ERROR;

     glClearColor(0.f, 0.f, 0.f, 1.f);
     if (!Graphics::ErrorCheck(error)) return false;

     glClearDepth(1.f);
     if (!Graphics::ErrorCheck(error)) return false;

     glEnable(GL_DEPTH_TEST);
     if (!Graphics::ErrorCheck(error)) return false;

     glDepthFunc(GL_LEQUAL);
     if (!Graphics::ErrorCheck(error)) return false;

     glShadeModel(GL_SMOOTH);
     if (!Graphics::ErrorCheck(error)) return false;

     glHint(GL_PERSPECTIVE_CORRECTION_HINT, GL_NICEST);
     if (!Graphics::ErrorCheck(error)) return false;

     glEnable(GL_CULL_FACE);
     if (!Graphics::ErrorCheck(error)) return false;

     return true;
 }
```

References ErrorCheck().

#### 4.8.3.8 Render() `void Graphics::Render ( ) [static]`

Renders all of the objects in the object_manager.

**Returns**

void

Definition at line 221 of file graphics.cpp.

```
                        {
    // Setting up graphics system for rendering
  glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);
  Shader::Update();

  glm::mat4 projection = perspective(radians(Camera::GetFov()), (float)graphics->windowSize.first /
      (float)graphics->windowSize.second, Camera::GetNear(), Camera::GetFar());

    // Getting the view matrix of the camera
  glm::mat4 view = lookAt(
      Camera::GetPosition(),
      Camera::GetPosition() + Camera::GetFront(),
      Camera::GetUp());

    // Rendering all of the objects
  for (unsigned i = 0; i < Object_Manager::GetSize(); ++i) {
      Object* object = Object_Manager::FindObject(i);

      Model* model = object->GetComponent<Model>();
      if (!model) continue;

      model->Draw(projection, view);
  }

  Editor::Render();

  glfwSwapBuffers(graphics->window);
}
```

References Model::Draw(), Object_Manager::FindObject(), Camera::GetFar(), Camera::GetFov(), Camera::GetFront(), Camera::GetNear(), Camera::GetPosition(), Object_Manager::GetSize(), Camera::GetUp(), graphics, Editor::Render(), Shader::Update(), window, and windowSize.

#### 4.8.3.9 Shutdown() `void Graphics::Shutdown ( ) [static]`

Shutdown the graphics system.

**Returns**

void

Definition at line 255 of file graphics.cpp.

```
                          {
  if (!graphics) return;

  Shader::Shutdown();
  glDeleteVertexArrays(1, &graphics->vertexArrayId);
    // Shutting down opengl
  glfwDestroyWindow(graphics->window);
  glfwTerminate();
    // Deleting graphics object
  delete graphics;
  graphics = nullptr;
}
```

References graphics, Shader::Shutdown(), vertexArrayId, and window.

Referenced by Engine::Shutdown().

#### 4.8.3.10 Update() `void Graphics::Update ( ) [static]`

Graphics update loop. Calls other update functions for the engine, input, and rendering. This is the main update function for the engine.

**Returns**

void

Definition at line 200 of file graphics.cpp.

```
                  {
    while(!glfwWindowShouldClose(graphics->window)) {
        // Run updates
        Engine::Update();
        Render();
        glfwPollEvents();

        // Check for restart
        if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_R) == GLFW_PRESS && Editor::GetTakeKeyboardInput()) {
            if (glfwGetKey(Graphics::GetWindow(), GLFW_KEY_R) == GLFW_RELEASE) {
                Engine::Restart();
            }
        }
    }
}
```

References Editor::GetTakeKeyboardInput(), GetWindow(), graphics, Engine::Restart(), Engine::Update(), and window.

Referenced by main().

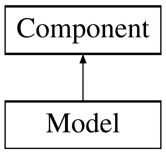
The documentation for this class was generated from the following files:

- graphics.hpp
- graphics.cpp

## 4.9 Model Class Reference

`#include <model.hpp>`

Inheritance diagram for Model:



## Public Member Functions

- Model (GLenum mode_=GL_TRIANGLES)

  *Creates a Model object with default values.*
- Model (const Model &other)

  *Copy constructor.*
- Model (File_Reader &reader, GLenum mode_=GL_TRIANGLES)

  *Creates a Model object using the data from a file.*
- Model ∗ Clone () const

  *Clones this Model object.*
- void Load (File_Reader &reader)

  *Load in the model data from a file (use model manager to not have multiple versions of the same model)*
- void Draw (glm::mat4 projection, glm::mat4 view)

  *Draw the model.*
- void Read (File_Reader &reader)

  *Reads name of model file and passes it to the Load function.*
- void Write (File_Writer &writer)

  *Gives name of model and texture to writer.*
- void SwitchModel (std::string modelName)

  *Switches the current model to that of the filename provided.*
- void SwitchTexture (std::string textureName)

  *Switches the current texture to that of the filename provided.*
- std::string GetModelName () const

  *Returns the filename of the current model.*
- std::string GetTextureName () const

  *Returns the filename of the current texture.*
- Texture ∗ GetTexture () const

  *Returns pointer to texture object.*

## Static Public Member Functions

- static CType GetCType ()

  *Gets the CType of Model (used in Object::GetComponent<>())*

## Private Attributes

- GLenum mode

  *Draw mode (Default is GL_TRIANGLES)*
- Model_Data ∗ data

  *Data about the faces of the model.*
- Texture ∗ texture

  *Texture object of model.*

## Additional Inherited Members

### 4.9.1 Detailed Description

Model class

Definition at line 32 of file model.hpp.

### 4.9.2 Constructor & Destructor Documentation

#### 4.9.2.1 Model() [1/3] Model::Model (

```
GLenum mode_ = GL_TRIANGLES )
```

Creates a Model object with default values.

**Parameters**

| | |
|---|---|
| *mode_* | Draw mode for opengl |

Definition at line 32 of file model.cpp.

```
: Component(CType::CModel), mode(mode_), data(nullptr), texture(nullptr) {}
```

Referenced by Clone().

#### 4.9.2.2 Model() [2/3] Model::Model (

```
const Model & other )
```

Copy constructor.

**Parameters**

| | |
|---|---|
| *other* | |

Definition at line 39 of file model.cpp.

```
: Component(CType::CModel) { *this = other; }
```

#### 4.9.2.3 Model() [3/3] Model::Model (

```
File_Reader & reader,
GLenum mode_ = GL_TRIANGLES )
```

Creates a Model object using the data from a file.

**Parameters**

| | |
|---|---|
| *reader* | File with Model data |
| *mode←↩ _* | Draw mode for opengl |

Definition at line 47 of file model.cpp.

```
                                        : Component(CType::CModel), mode(mode_), data(nullptr),
      texture(nullptr) {
    Read(reader);
}
```

References Read().

### 4.9.3 Member Function Documentation

#### 4.9.3.1 Clone() `Model * Model::Clone ( ) const`

Clones this Model object.

**Returns**

Model∗ Cloned Model

Definition at line 56 of file model.cpp.

```
{ return new Model(*this); }
```

References Model().

#### 4.9.3.2 Draw()

```
void Model::Draw (
        glm::mat4 projection,
        glm::mat4 view )
```

Draw the model.

**Parameters**

| | |
|---|---|
| *projection* | Projection matrix of the scene |
| *view* | View matrix of the scene |

Definition at line 75 of file model.cpp.

```
                                             {
    Transform* transform = GetParent()->GetComponent<Transform>();
    if (!data) return;

    data->Draw(this, transform, projection, view);
}
```

References data, Model_Data::Draw(), Object::GetComponent(), and Component::GetParent().

Referenced by Graphics::Render().

### 4.9.3.3 GetCType() `CType Model::GetCType ( ) [static]`

Gets the CType of Model (used in Object::GetComponent<>())

**Returns**

CType

Definition at line 158 of file model.cpp.

```
                        {
    return CType::CModel;
}
```

### 4.9.3.4 GetModelName() `std::string Model::GetModelName ( ) const`

Returns the filename of the current model.

**Returns**

std::string

Definition at line 131 of file model.cpp.

```
                                      {
    if (!data) return "no model";
    return data->GetModelName();
}
```

References data, and Model_Data::GetModelName().

Referenced by Editor::Display_Model().

#### 4.9.3.5 GetTexture() `Texture * Model::GetTexture ( ) const`

Returns pointer to texture object.

**Returns**

Texture*

Definition at line 151 of file model.cpp.

```
{ return texture; }
```

References texture.

Referenced by Model_Data::Draw().

#### 4.9.3.6 GetTextureName() `std::string Model::GetTextureName ( ) const`

Returns the filename of the current texture.

**Returns**

std::string

Definition at line 141 of file model.cpp.

```
                                        {
    if (!texture) return "no texture";
    return texture->GetTextureName();
}
```

References Texture::GetTextureName(), and texture.

Referenced by Editor::Display_Model().

#### 4.9.3.7 Load() `void Model::Load ( File_Reader & reader )`

Load in the model data from a file (use model manager to not have multiple versions of the same model)

**Parameters**

| | |
|---|---|
| *reader* | File_reader object that contains Model info |

Definition at line 64 of file model.cpp.

```
                                        {
    data = Model_Data_Manager::Get(reader);
    texture = Texture_Manager::Get(reader);
}
```

References data, Texture_Manager::Get(), Model_Data_Manager::Get(), and texture.

Referenced by Read().

#### 4.9.3.8 Read()

```
void Model::Read (
        File_Reader & reader )
```

Reads name of model file and passes it to the Load function.

**Parameters**

| | |
|---|---|
| *reader* | File that contains the name of the model's file |

Definition at line 87 of file model.cpp.

```
{ Load(reader); }
```

References Load().

Referenced by Model(), and Object::ReRead().

#### 4.9.3.9 SwitchModel()

```
void Model::SwitchModel (
        std::string modelName )
```

Switches the current model to that of the filename provided.

**Parameters**

| | |
|---|---|
| *modelName* | |

Definition at line 107 of file model.cpp.

```
                                          {
    Model_Data* proxy = Model_Data_Manager::Get(modelName);
    if (!proxy) return;

    data = proxy;
}
```

References data, and Model_Data_Manager::Get().

Referenced by Editor::Display_Model().

#### 4.9.3.10 SwitchTexture()

```
void Model::SwitchTexture (
        std::string textureName )
```

Switches the current texture to that of the filename provided.

**Parameters**

| *textureName* | |
|---|---|

Definition at line 119 of file model.cpp.

```
                                                 {
    Texture* proxy = Texture_Manager::Get(textureName);
    if (!proxy) return;

    texture = proxy;
}
```

References Texture_Manager::Get(), and texture.

Referenced by Editor::Display_Model().

#### 4.9.3.11 Write() `void Model::Write ( File_Writer & writer )`

Gives name of model and texture to writer.

**Parameters**

| *writer* | |
|---|---|

Definition at line 94 of file model.cpp.

```
                                        {
    std::string modelName = data->GetModelName();
    std::string textureName = texture->GetTextureName();

    writer.Write_String("modelToLoad", modelName.c_str());
    writer.Write_String("textureToLoad", textureName.c_str());
}
```

References data, Model_Data::GetModelName(), Texture::GetTextureName(), texture, and File_Writer::Write_String().

Referenced by Object::Write().

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

- model.hpp
- model.cpp

## 4.10 Model_Data Class Reference

`#include <model_data.hpp>`

### Public Member Functions

- Model_Data ()

    *Default constructor.*
- Model_Data (const Model_Data &other)

    *Copy constructor.*
- ∼Model_Data ()

    *Deletes all buffers of the model.*
- bool Load (File_Reader &reader)

    *Loads data of a model from given file.*
- bool Load (std::string modelName_)

    *Loads in model using given filename.*
- bool Read (std::string modelName_)

    *Reads model data from file.*
- void Draw (Model ∗parent, Transform ∗transform, glm::mat4 projection, glm::mat4 view)

    *Draws the models.*
- std::string GetModelName () const

    *Returns the filename that the models data was gotten from.*

### Private Attributes

- std::vector< float > vertices

    *Contains vertices of model.*
- std::vector< float > normals

    *Contains normals of model.*
- std::vector< float > uvs

    *Contains uv data of model.*
- std::string modelName

    *Name of the file for the model.*
- GLuint vertexbuffer

    *Vertex buffer of model.*
- GLuint normalbuffer

    *Normal buffer of model.*
- GLuint uvbuffer

    *UV buffer of model.*

### 4.10.1 Detailed Description

Model_Data class

Definition at line 33 of file model_data.hpp.

### 4.10.2 Constructor & Destructor Documentation

#### 4.10.2.1 Model_Data() [1/2] `Model_Data::Model_Data ( )`

Default constructor.

Definition at line 33 of file model_data.cpp.
```
{}
```

#### 4.10.2.2 Model_Data() [2/2] `Model_Data::Model_Data ( const Model_Data & other )`

Copy constructor.

**Parameters**

| | |
|---|---|
| *other* | |

Definition at line 40 of file model_data.cpp.
```
                                               {
    for (float vert : other.vertices) {
        vertices.emplace_back(vert);
    }
    for (float norm : other.normals) {
        normals.emplace_back(norm);
    }
    for (float uv : other.uvs) {
        uvs.emplace_back(uv);
    }

    vertexbuffer = other.vertexbuffer;
    normalbuffer = other.normalbuffer;
    uvbuffer = other.uvbuffer;
}
```

References normalbuffer, normals, uvbuffer, uvs, vertexbuffer, and vertices.

#### 4.10.2.3 ∼Model_Data() `Model_Data::∼Model_Data ( )`

Deletes all buffers of the model.

Definition at line 60 of file model_data.cpp.
```
                          {
    glDeleteBuffers(1, &vertexbuffer);
    glDeleteBuffers(1, &uvbuffer);
    glDeleteBuffers(1, &normalbuffer);
}
```

References normalbuffer, uvbuffer, and vertexbuffer.

### 4.10.3 Member Function Documentation

#### 4.10.3.1 Draw()

```
void Model_Data::Draw (
        Model * parent,
        Transform * transform,
        glm::mat4 projection,
        glm::mat4 view )
```

Draws the models.

**Parameters**

| | |
|---|---|
| *parent* | Model component |
| *transform* | Transform component |
| *projection* | Projection matrix of the scene |
| *view* | View matrix of the scene |

Definition at line 224 of file model_data.cpp.

```
{
    // Creating the MVP (Model * View * Projection) matrix
    glm::mat4 model = glm::mat4(1.f);
    model = glm::translate(model, transform->GetPosition());
    model = glm::rotate(model, (transform->GetRotation().x / 180.f) * glm::pi<float>(), glm::vec3(1, 0, 0));
    model = glm::rotate(model, (transform->GetRotation().y / 180.f) * glm::pi<float>(), glm::vec3(0, 1, 0));
    model = glm::rotate(model, (transform->GetRotation().z / 180.f) * glm::pi<float>(), glm::vec3(0, 0, 1));
    model = glm::scale(model, transform->GetScale());

    // Sending data to the shaders
    glm::mat4 MVP = projection * view * model;
    glUniformMatrix4fv(Shader::GetMatrixId(), 1, GL_FALSE, &MVP[0][0]);
    glUniformMatrix4fv(Shader::GetModelMatrixId(), 1, GL_FALSE, &model[0][0]);
    glUniformMatrix4fv(Shader::GetViewMatrixId(), 1, GL_FALSE, &view[0][0]);

    // Sending light data to the shaders
    glm::vec3 lightPos = Engine::GetLightPos();
    glUniform3f(Shader::GetLightId(), lightPos.x, lightPos.y, lightPos.z);
    glUniform1f(Shader::GetLightPowerId(), Engine::GetLightPower());

    // Setup texture for drawing if it exists
    if (parent->GetTexture())
        parent->GetTexture()->Display();

    // Setup the model vertices
    glEnableVertexAttribArray(0);
    glBindBuffer(GL_ARRAY_BUFFER, vertexbuffer);
    glVertexAttribPointer(
        0,
        3,
        GL_FLOAT,
        GL_FALSE,
        0,
        (void*)0
    );

    // Setup the model uv
    glEnableVertexAttribArray(1);
    glBindBuffer(GL_ARRAY_BUFFER, uvbuffer);
    glVertexAttribPointer(
        1,
        2,
        GL_FLOAT,
        GL_FALSE,
        0,
        (void*)0
    );

    // Setup the model normals
    glEnableVertexAttribArray(2);
    glBindBuffer(GL_ARRAY_BUFFER, normalbuffer);
    glVertexAttribPointer(
        2,
        3,
        GL_FLOAT,
        GL_FALSE,
        0,
        (void*)0
    );

      // Draw the object
    glDrawArrays(GL_TRIANGLES, 0, vertices.size());

      // Disable data sent to shaders
    glDisableVertexAttribArray(0);
    glDisableVertexAttribArray(1);
    glDisableVertexAttribArray(2);

}
```

References Texture::Display(), Shader::GetLightId(), Engine::GetLightPos(), Engine::GetLightPower(), Shader::Get↩LightPowerId(), Shader::GetMatrixId(), Shader::GetModelMatrixId(), Transform::GetPosition(), Transform::GetRotation(), Transform::GetScale(), Model::GetTexture(), Shader::GetViewMatrixId(), normalbuffer, uvbuffer, vertexbuffer, and vertices.

Referenced by Model::Draw().

#### 4.10.3.2 GetModelName() `std::string Model_Data::GetModelName ( ) const`

Returns the filename that the models data was gotten from.

**Returns**

string Name of the file that contains model data

Definition at line 299 of file model_data.cpp.

```
{ return modelName; }
```

References modelName.

Referenced by Model_Data_Manager::Get(), Model::GetModelName(), and Model::Write().

#### 4.10.3.3 Load() [1/2] `bool Model_Data::Load ( File_Reader & reader )`

Loads data of a model from given file.

**Parameters**

| | |
|---|---|
| *reader* | File_Reader object containing the model data |

**Returns**

true

false

Definition at line 73 of file model_data.cpp.

```
                                   {
    std::string modelName_ = reader.Read_String("modelToLoad");

    return Read(modelName_);
}
```

References Read(), and File_Reader::Read_String().

Referenced by Model_Data_Manager::Get().

#### 4.10.3.4 Load() [2/2] `bool Model_Data::Load ( std::string modelName_ )`

Loads in model using given filename.

**Parameters**

| | |
|---|---|
| *model↵ Name_* | Model's filename |

**Returns**

true

false

Definition at line 86 of file model_data.cpp.

```
{ return Read(modelName_); }
```

References Read().

#### 4.10.3.5 Read() `bool Model_Data::Read ( std::string modelName_ )`

Reads model data from file.

**Parameters**

| | |
|---|---|
| *model↵ Name_* | Model's filename |

**Returns**

true

false

Definition at line 95 of file model_data.cpp.

```
                                      {
  // Opening the file
std::string fileToOpen = std::string(getenv("USERPROFILE")) + "/Documents/pEngine/models/" + modelName_;
  // Setting the name of the file (used in model_data_manager)
modelName = fileToOpen;

 FILE* file = fopen(fileToOpen.c_str(), "r");
 if (!file) {
     file = fopen(modelName_.c_str(), "r");
     if (!file) {
         return false;
     }
     else {
         modelName = modelName_;
     }
 }

   // Creating variables for reading
 std::vector<unsigned> vertex_indices, uv_indices, normal_indices;
 std::vector<glm::vec3> temp_vertices;
 std::vector<glm::vec2> temp_uvs;
 std::vector<glm::vec3> temp_normals;

   // Until the whole file is read
 while (true) {
     char line_header[256];

       // Getting next line of the file
     int res = fscanf(file, "%s", line_header);
     if (res == EOF) break;

       // Checking for which data needs to be read in
     if (strcmp(line_header,"v") == 0) {
         glm::vec3 vertex;
         fscanf(file, "%f %f %f\n", &vertex.x, &vertex.y, &vertex.z);
         temp_vertices.emplace_back(vertex);
         continue;
     }

     if (strcmp(line_header, "vt") == 0) {
         glm::vec2 uv;
         fscanf(file, "%f %f\n", &uv.x, &uv.y);
         temp_uvs.emplace_back(uv);
         continue;
     }

     if (strcmp(line_header, "vn") == 0) {
         glm::vec3 normal;
         fscanf(file, "%f %f %f\n", &normal.x, &normal.y, &normal.z);
         temp_normals.emplace_back(normal);
         continue;
     }

     if (strcmp(line_header, "f") == 0) {
           // Connecting face to previous read vertices, uvs, and normals
         unsigned vertex_index[3], uv_index[3], normal_index[3];
         int matches = fscanf(file, "%d/%d/%d %d/%d/%d %d/%d/%d\n", &vertex_index[0], &uv_index[0], &normal_index[0],
             &vertex_index[1], &uv_index[1], &normal_index[1], &vertex_index[2], &uv_index[2], &normal_index[2]);//,

           // Expects models split into triangles
         if (matches != 9) {
             Trace::Message("File is incompatible with this parser. Export using different settings.");
             return false;
         }

           // Setting vertices for current face
         vertices.emplace_back((temp_vertices[vertex_index[0] - 1]).x);
         vertices.emplace_back((temp_vertices[vertex_index[0] - 1]).y);
         vertices.emplace_back((temp_vertices[vertex_index[0] - 1]).z);

         vertices.emplace_back((temp_vertices[vertex_index[1] - 1]).x);
         vertices.emplace_back((temp_vertices[vertex_index[1] - 1]).y);
         vertices.emplace_back((temp_vertices[vertex_index[1] - 1]).z);

         vertices.emplace_back((temp_vertices[vertex_index[2] - 1]).x);
         vertices.emplace_back((temp_vertices[vertex_index[2] - 1]).y);
         vertices.emplace_back((temp_vertices[vertex_index[2] - 1]).z);

```

```
              // Setting uvs for current face
            uvs.emplace_back((temp_uvs[uv_index[0] - 1]).x);
            uvs.emplace_back((temp_uvs[uv_index[0] - 1]).y);

            uvs.emplace_back((temp_uvs[uv_index[1] - 1]).x);
            uvs.emplace_back((temp_uvs[uv_index[1] - 1]).y);

            uvs.emplace_back((temp_uvs[uv_index[2] - 1]).x);
            uvs.emplace_back((temp_uvs[uv_index[2] - 1]).y);

              // Setting normals for current face
            normals.emplace_back((temp_normals[normal_index[0] - 1]).x);
            normals.emplace_back((temp_normals[normal_index[0] - 1]).y);
            normals.emplace_back((temp_normals[normal_index[0] - 1]).z);

            normals.emplace_back((temp_normals[normal_index[1] - 1]).x);
            normals.emplace_back((temp_normals[normal_index[1] - 1]).y);
            normals.emplace_back((temp_normals[normal_index[1] - 1]).z);

            normals.emplace_back((temp_normals[normal_index[2] - 1]).x);
            normals.emplace_back((temp_normals[normal_index[2] - 1]).y);
            normals.emplace_back((temp_normals[normal_index[2] - 1]).z);
        }
    }

      // Bind vertex data to buffers
    glGenBuffers(1, &vertexbuffer);
    glBindBuffer(GL_ARRAY_BUFFER, vertexbuffer);
    glBufferData(GL_ARRAY_BUFFER, vertices.size() * sizeof(float), &vertices[0], GL_STATIC_DRAW);

      // Bind uv data to buffers
    glGenBuffers(1, &uvbuffer);
    glBindBuffer(GL_ARRAY_BUFFER, uvbuffer);
    glBufferData(GL_ARRAY_BUFFER, uvs.size() * sizeof(float), &uvs[0], GL_STATIC_DRAW);

      // Bind normals data to buffers
    glGenBuffers(1, &normalbuffer);
    glBindBuffer(GL_ARRAY_BUFFER, normalbuffer);
    glBufferData(GL_ARRAY_BUFFER, normals.size() * sizeof(float), &normals[0], GL_STATIC_DRAW);

    return true;
}
```

References Trace::Message(), modelName, normalbuffer, normals, uvbuffer, uvs, vertexbuffer, and vertices.

Referenced by Load().

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

- model_data.hpp
- model_data.cpp

## 4.11 Model_Data_Manager Class Reference

`#include <model_data_manager.hpp>`

### Static Public Member Functions

- static bool Initialize ()

  *Initializes the model_data_manager.*
- static Model_Data ∗ Get (File_Reader &reader)

  *Checks if model data has already been read in. If yes then it returns a pointer to that data. If no it reads it in and adds it to the model list.*
- static Model_Data ∗ Get (std::string modelName)

  *Checks if model data has already been read in. If yes then it returns a pointer to that data. If no it reads it in and adds it to the model list.*
- static void Shutdown ()

  *Deletes all of the Model_Data objects in the models list then deletes model_data_manager.*

## Private Attributes

- std::vector< Model_Data ∗ > models
  *List of the different Model_Data objects.*

### 4.11.1 Detailed Description

Model_Data_Manager class

Definition at line 25 of file model_data_manager.hpp.

### 4.11.2 Member Function Documentation

#### 4.11.2.1 Get() [1/2]

```
Model_Data ∗ Model_Data_Manager::Get (
            File_Reader & reader ) [static]
```

Checks if model data has already been read in. If yes then it returns a pointer to that data. If no it reads it in and adds it to the model list.

**Parameters**

| | |
|---|---|
| *reader* | File_Reader object containing model data |

**Returns**

Model_Data∗ Model data either read or gotten from list

Definition at line 44 of file model_data_manager.cpp.

```
                                                         {
    std::string filename = reader.Read_String("modelToLoad");
      // Checks name of file against other model data objects
    for (Model_Data* model_data : model_data_manager->models) {
        if (model_data->GetModelName().compare(filename) == 0) {
            return model_data;
        }
    }

      // Creates new Model_Data object, then adds it to list
    Model_Data* data = new Model_Data;
    data->Load(reader);
    model_data_manager->models.emplace_back(data);

    return data;
}
```

References Model_Data::GetModelName(), Model_Data::Load(), model_data_manager, models, and File_Reader::↩
Read_String().

Referenced by Model::Load(), and Model::SwitchModel().

#### 4.11.2.2 Get() [2/2] Model_Data * Model_Data_Manager::Get ( std::string *modelName* ) [static]

Checks if model data has already been read in. If yes then it returns a pointer to that data. If no it reads it in and adds it to the model list.

**Parameters**

| | |
|---|---|
| *modelName* | Filename of the model to get |

**Returns**

Model_Data∗ Model data either read or gotten from list

Definition at line 69 of file model_data_manager.cpp.

```
                                          {
    // Checks name of file against other model data objects
   for (Model_Data* model_data : model_data_manager->models) {
       if (model_data->GetModelName().compare(modelName) == 0) {
           return model_data;
       }
   }

    // Creates new Model_Data object, then adds it to list
   Model_Data* data = new Model_Data;
   if (!data->Load(modelName)) {
       delete data;
       return nullptr;
   }
   model_data_manager->models.emplace_back(data);

   return data;
}
```

References Model_Data::GetModelName(), Model_Data::Load(), model_data_manager, and models.

#### 4.11.2.3 Initialize() bool Model_Data_Manager::Initialize ( ) [static]

Initializes the model_data_manager.

**Returns**

true

false

Definition at line 24 of file model_data_manager.cpp.

```
                                        {
    // Initializing model_data_manager
   model_data_manager = new Model_Data_Manager;
   if (!model_data_manager) {
       Trace::Message("Model Data Manager was not initialized.\n");
       return false;
   }

   model_data_manager->models.reserve(10);
   return true;
}
```

References Trace::Message(), model_data_manager, and models.

Referenced by Engine::Initialize().

#### 4.11.2.4 Shutdown() `void Model_Data_Manager::Shutdown ( ) [static]`

Deletes all of the Model_Data objects in the models list then deletes model_data_manager.

**Returns**

void

Definition at line 94 of file model_data_manager.cpp.

```
                                   {
    if (!model_data_manager) return;

      // Deleting all of the Model_Data objects
    for (Model_Data* model_data : model_data_manager->models) {
        if (!model_data) continue;

         delete model_data;
         model_data = nullptr;
     }

     delete model_data_manager;
     model_data_manager = nullptr;
}
```

References model_data_manager, and models.

Referenced by Engine::Shutdown().

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

- model_data_manager.hpp
- model_data_manager.cpp

## 4.12 Object Class Reference

`#include <object.hpp>`

### Public Member Functions

- Object ()
  *Default constructor.*
- Object (const Object &other)
  *Copy constructor.*
- Object ∗ Clone () const
  *Clones this object.*
- void Update ()
  *Updates object (only physics for now)*
- void AddComponent (Component ∗component)
  *Adds component to object. Only one of each type of component.*
- template<typename T >
  T ∗ GetComponent ()
  *Get a component of the object.*

- template<typename T >
  void RemoveComponent ()

  *Removes component from object.*
- void SetId (int id_)

  *Sets the id of object.*
- int GetId () const

  *Returns the id of object.*
- void SetName (std::string name_)

  *Sets name of object.*
- std::string GetName () const

  *Returns name of object.*
- std::string & GetNameRef ()

  *Returns reference to the name.*
- void SetTemplateName (std::string templateName_)

  *Sets the name of the template file.*
- std::string GetTemplateName () const

  *Returns the name of the template file.*
- bool Read (std::string objectFilename)

  *Reads object from file. This includes the components of an object.*
- bool ReRead (std::string objectFilename)

  *Reading data into object that already exists.*
- void Write (std::string filePath)

  *Writes the data of the object to a template file.*
- std::unordered_map< CType, Component * > GetComponentList ()

  *Returns the list of components.*
- void Clear ()

  *Clears the components from the object.*

## Private Member Functions

- template<typename T >
  T * GetComponentConst () const

  *Get a component of the object (const)*

## Private Attributes

- std::unordered_map< CType, Component * > components

  *List of components.*
- std::string name

  *Name of the object.*
- std::string templateName

  *Name of the template file used.*
- int id

  *Location of object in object_manager.*

### 4.12.1 Detailed Description

Object class

Definition at line 25 of file object.hpp.

### 4.12.2 Constructor & Destructor Documentation

#### 4.12.2.1 Object() [1/2] `Object::Object ( )`

Default constructor.

Definition at line 28 of file object.cpp.

```
: id(-1) {}
```

Referenced by Clone().

#### 4.12.2.2 Object() [2/2] `Object::Object ( const Object & other )`

Copy constructor.

**Parameters**

| | |
|---|---|
| *other* | Object to be copied |

Definition at line 35 of file object.cpp.

```
                                        {
    SetName(other.GetName());
    SetTemplateName(other.GetTemplateName());

      // Copying Behavior component
    Behavior* behavior = other.GetComponentConst<Behavior>();
    if (behavior) {
        Behavior* newBehavior = new Behavior(*behavior);
        AddComponent(newBehavior);
    }

      // Copying Model component
    Model* model = other.GetComponentConst<Model>();
    if (model) {
        Model* newModel = new Model(*model);
        AddComponent(newModel);
    }

      // Copying Physics component
    Physics* physics = other.GetComponentConst<Physics>();
    if (physics) {
        Physics* newPhysics = new Physics(*physics);
        AddComponent(newPhysics);
    }

    // Copying transform component
    Transform* transform = other.GetComponentConst<Transform>();
    if (transform) {
        Transform* newTransform = new Transform(*transform);
        AddComponent(newTransform);
    }
}
```

References AddComponent(), GetComponentConst(), GetName(), GetTemplateName(), SetName(), and Set←TemplateName().

### 4.12.3 Member Function Documentation

#### 4.12.3.1 AddComponent() `void Object::AddComponent ( Component * component )`

Adds component to object. Only one of each type of component.

**Parameters**

| | |
|---|---|
| *component* | Component to be added |

Definition at line 95 of file object.cpp.

```
                                            {
    component->SetParent(this);
    components.emplace(component->GetCType(), component);
}
```

References components, Component::GetCType(), and Component::SetParent().

Referenced by Editor::Display_Scene(), Object(), Read(), and ReRead().

#### 4.12.3.2 Clear() `void Object::Clear ( )`

Clears the components from the object.

Definition at line 275 of file object.cpp.

```
                      {
    Behavior* behavior = GetComponent<Behavior>();
    Model* model = GetComponent<Model>();
    Physics* physics = GetComponent<Physics>();

    if (behavior) {
        delete behavior;
        behavior = nullptr;
    }
    if (model) {
        delete model;
        model = nullptr;
    }
    if (physics) {
        delete physics;
        physics = nullptr;
    }
}
```

#### 4.12.3.3 Clone() `Object * Object::Clone ( ) const`

Clones this object.

**Returns**

Object∗

Definition at line 73 of file object.cpp.

```
                          {
    return new Object(*this);
}
```

References Object().

#### 4.12.3.4 GetComponent() `template<typename T >`
`T* Object::GetComponent ( ) [inline]`

Get a component of the object.

**Template Parameters**

| | |
|---|---|
| *T* | Component class to return |

**Parameters**

| | |
|---|---|
| *type* | Type of component |

**Returns**

T∗ Pointer to the component

Definition at line 44 of file object.hpp.

```
                        {
            // Searching for component using the type (enum as int)
           auto found = components.find(T::GetCType());
           if (found == components.end()) {
               return nullptr;
           }
            // Cast found component into correct type
           return (T*)found->second;
       }
```

References components.

Referenced by Model::Draw(), Physics::Update(), and Physics::UpdateGravity().

#### 4.12.3.5 GetComponentConst() `template<typename T >`
`T* Object::GetComponentConst ( ) const [inline], [private]`

Get a component of the object (const)

**Template Parameters**

|  |  |
|---|---|
| *T* | Component class to return |

**Parameters**

|  |  |
|---|---|
| *type* | Type of component |

**Returns**

T∗ Pointer to the component

Definition at line 96 of file object.hpp.
```
                                        {
                 // Searching for component using the type (enum as int)
               auto found = components.find(T::GetCType());
               if (found == components.end()) {
                    return nullptr;
                }
                  // Cast found component into correct type
                return (T*)found->second;
           }
```

References components.

Referenced by Object().

### 4.12.3.6 GetComponentList() `std::unordered_map< CType, Component * > Object::GetComponentList ( )`

Returns the list of components.

**Returns**

std::unordered_map<CType, Component∗>

Definition at line 267 of file object.cpp.
```
                                                             {
    return components;
}
```

References components.

#### 4.12.3.7 GetId() `int Object::GetId ( ) const`

Returns the id of object.

**Returns**

unsigned Position in Object_Manager

Definition at line 112 of file object.cpp.
```
{ return id; }
```

References id.

Referenced by Object_Manager::CheckName(), Behavior::ClassSetup(), Editor::Display_Components(), and File_↩
Writer::Write_Object_Data().

#### 4.12.3.8 GetName() `std::string Object::GetName ( ) const`

Returns name of object.

**Returns**

string Name of object

Definition at line 128 of file object.cpp.
```
{ return name; }
```

References name.

Referenced by Object_Manager::CheckName(), Object_Manager::FindObject(), Object(), and File_Writer::Write_↩
Object_Data().

#### 4.12.3.9 GetNameRef() `std::string & Object::GetNameRef ( )`

Returns reference to the name.

**Returns**

std::string&

Definition at line 135 of file object.cpp.
```
{ return name; }
```

References name.

Referenced by Behavior::ClassSetup().

#### 4.12.3.10 GetTemplateName() `std::string Object::GetTemplateName ( ) const`

Returns the name of the template file.

**Returns**

std::string

Definition at line 149 of file object.cpp.

```
{ return templateName; }
```

References templateName.

Referenced by Object(), and File_Writer::Write_Object_Data().

#### 4.12.3.11 Read() `bool Object::Read ( std::string objectFilename )`

Reads object from file. This includes the components of an object.

**Parameters**

| | |
|---|---|
| *objectFilename* | |

**Returns**

true

false

Definition at line 158 of file object.cpp.

```
                                        {
      // Getting data from file
    File_Reader object_reader;
    if (!object_reader.Read_File(objectFilename)) return false;

      // Reading Behavior component form file
    Behavior* object_behavior = new Behavior(object_reader);
    AddComponent(object_behavior);

      // Reading Model component from file
    Model* object_model = new Model(object_reader);
    AddComponent(object_model);

      // Reading Physics component from file
    Physics* object_physics = new Physics(object_reader);
    AddComponent(object_physics);

      // Reading Transform component from file
    Transform* object_transform = new Transform(object_reader);
    AddComponent(object_transform);

    return true;
}
```

References AddComponent(), and File_Reader::Read_File().

Referenced by Object_Manager::ReadList().

#### 4.12.3.12 RemoveComponent() `template<typename T >`

`void Object::RemoveComponent ( ) [inline]`

Removes component from object.

**Template Parameters**

| | |
|---|---|
| *T* | |

Definition at line 60 of file object.hpp.

```
                                {
            // Searching for component using the type (enum as int)
          auto found = components.find(T::GetCType());
          if (found == components.end()) return;
            // Delete component
          delete found->second;
          found->second = nullptr;
            // Remove pointer from map
          components.erase(found->first);
      }
```

References components.

Referenced by Editor::Display_Model(), Editor::Display_Physics(), and Editor::Display_Scripts().

#### 4.12.3.13 ReRead() `bool Object::ReRead ( std::string objectFilename )`

Reading data into object that already exists.

**Parameters**

| | |
|---|---|
| *objectFilename* | Name of template file |

**Returns**

true

false

Definition at line 189 of file object.cpp.

```
                                            {
      // Getting data from file
    File_Reader object_reader;
    if (!object_reader.Read_File(objectFilename)) return false;

    if (name.compare("") == 0)
        SetName(object_reader.Read_String("name"));

    templateName = objectFilename;

      // Reading Model component from file
    Model* object_model = GetComponent<Model>();
    if (!object_model) {
        object_model = new Model;
        AddComponent(object_model);
    }
    object_model->Read(object_reader);

      // Reading Physics component from file
    Physics* object_physics = GetComponent<Physics>();
    if (!object_physics) {
        object_physics = new Physics;
        AddComponent(object_physics);
    }
    object_physics->Read(object_reader);

      // Reading Transform component from file
    Transform* object_transform = GetComponent<Transform>();
    if (!object_transform) {
        object_transform = new Transform;
        AddComponent(object_transform);
    }
    object_transform->Read(object_reader);

      // Reading Behavior component form file
    Behavior* object_behavior = GetComponent<Behavior>();
    if (object_behavior) object_behavior->Clear();
    if (!object_behavior) {
        object_behavior = new Behavior;
        AddComponent(object_behavior);
    }
    object_behavior->Read(object_reader);
    object_behavior->SetupClassesForLua();

    return true;
}
```

References AddComponent(), Behavior::Clear(), name, Behavior::Read(), Model::Read(), Transform::Read(), Physics↩ ::Read(), File_Reader::Read_File(), File_Reader::Read_String(), SetName(), Behavior::SetupClassesForLua(), and templateName.

### 4.12.3.14 SetId() `void Object::SetId ( int id_ )`

Sets the id of object.

**Parameters**

| | |
|---|---|
| *id↩ _↩* | Position in Object_Manager |

Definition at line 105 of file object.cpp.

```
105 { id = id_; }
```

Referenced by Object_Manager::RemoveObject().

### 4.12.3.15 SetName() `void Object::SetName ( std::string name_ )`

Sets name of object.

**Parameters**

| | |
|---|---|
| *name_* | Name of object |

Definition at line 119 of file object.cpp.

```
119                                     {
120     name = Object_Manager::CheckName(name_, id);
121 }
```

References Object_Manager::CheckName(), and name.

Referenced by Behavior::ClassSetup(), Editor::Display_Scene(), Object(), Object_Manager::ReadList(), and ReRead().

#### 4.12.3.16 SetTemplateName() `void Object::SetTemplateName ( std::string templateName_ )`

Sets the name of the template file.

**Parameters**

| | |
|---|---|
| *templateName_* | Name of the template file |

Definition at line 142 of file object.cpp.

```
142 { templateName = templateName_; }
```

References templateName.

Referenced by Object().

#### 4.12.3.17 Update() `void Object::Update ( )`

Updates object (only physics for now)

Definition at line 81 of file object.cpp.

```
81                    {
82     Behavior* behavior = GetComponent<Behavior>();
83     if (behavior)
84         behavior->Update();
85     Physics* physics = GetComponent<Physics>();
86     if (physics)
87         physics->Update();
88 }
```

References Behavior::Update(), and Physics::Update().

Referenced by Object_Manager::Update().

#### 4.12.3.18 Write() `void Object::Write ( std::string filePath )`

Writes the data of the object to a template file.

**Parameters**

| | |
|---|---|
| *filePath* | Filepath for the object being written |

Definition at line 241 of file object.cpp.

```
                                        {
    File_Writer object_writer;
    object_writer.Write_String("name", name);
    templateName = filePath + "/" + name + ".json";
    Trace::Message(templateName + "\n");

    Model* object_model = GetComponent<Model>();
    if (object_model) object_model->Write(object_writer);

    Transform* object_transform = GetComponent<Transform>();
    if (object_transform) object_transform->Write(object_writer);

    Physics* object_physics = GetComponent<Physics>();
    if (object_physics) object_physics->Write(object_writer);

    Behavior* object_behavior = GetComponent<Behavior>();
    if (object_behavior) object_behavior->Write(object_writer);

    object_writer.Write_File(templateName);
}
```

References Trace::Message(), name, templateName, Behavior::Write(), Model::Write(), Transform::Write(), Physics::↩
Write(), File_Writer::Write_File(), and File_Writer::Write_String().

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

- object.hpp
- object.cpp

## 4.13 Object_Manager Class Reference

```
#include <object_manager.hpp>
```

### Public Member Functions

- void ReadList (File_Reader &preset)

  *Reads in objects from a preset list that is given.*

### Static Public Member Functions

- static bool Initialize (File_Reader &preset)

  *Initializes the object_manager object. Reads in objects for the given preset.*
- static bool Initialize ()

  *Initialize object manager with default values.*
- static void AddObject (Object ∗object)

  *Adds object to object_manager.*
- static Object ∗ FindObject (int id)

  *Finds a object using its id (location in object list) giving instant access.*

- static Object ∗ FindObject (std::string objectName)

    *Finds object with the matching name.*
- static unsigned GetSize ()

    *Gets the size of the object_manager object list.*
- static void Update ()

    *Calls the update function for each object in the object list.*
- static void Shutdown ()

    *Deletes all objects in the manager and then the object manager.*
- static std::string CheckName (std::string objectName, int id)

    *Checks if the name of the given object is already being used. If it is being used it applies a number to the back.*
- static void RemoveObject (int id)

    *Removes an object from the object_manager.*
- static void Write (File_Writer &writer)

    *Gives all of the object data to writer for output to file.*

**Private Attributes**

- std::vector< Object ∗ > objects

    *Current objects being tracked by the engine.*

### 4.13.1 Detailed Description

Object_Manager class

Definition at line 25 of file object_manager.hpp.

### 4.13.2 Member Function Documentation

#### 4.13.2.1 AddObject() `void Object_Manager::AddObject ( Object * object ) [static]`

Adds object to object_manager.

**Parameters**

| | |
|---|---|
| *object* | Object to be added |

**Returns**

void

Definition at line 72 of file object_manager.cpp.

```
                                            {
    // Tells object its location in object_manager object list
  object->SetId(object_manager->objects.size());
  object_manager->objects.emplace_back(object);
}
```

References object_manager, and objects.

Referenced by Editor::Display_Scene(), and ReadList().

#### 4.13.2.2 CheckName() `std::string Object_Manager::CheckName ( std::string objectName, int id ) [static]`

Checks if the name of the given object is already being used. If it is being used it applies a number to the back.

**Parameters**

| | |
|---|---|
| *objectName* | |
| *id* | |

**Returns**

std::string

Definition at line 192 of file object_manager.cpp.

```
                                                            {
    // Checking if the name matches any other objects
  int objWithName = 0;
  for (Object* objToCheck : object_manager->objects) {
      if (id != -1 && objToCheck->GetId() == id) continue;
      if (objToCheck->GetName().find(objectName) != std::string::npos)
          ++objWithName;
  }

    // Updating the name
  if (objWithName > 0)
      return objectName + "_" + std::to_string(objWithName);

  return objectName;
}
```

References Object::GetId(), Object::GetName(), object_manager, and objects.

Referenced by Object::SetName().

#### 4.13.2.3 FindObject() [1/2] `Object * Object_Manager::FindObject ( int id ) [static]`

Finds a object using its id (location in object list) giving instant access.

**Parameters**

| | |
|---|---|
| *id* | Location of object in object_manager object list |

**Returns**

Object∗

Definition at line 84 of file object_manager.cpp.

```
                                                 {
    if (id >= (int)object_manager->objects.size()) return nullptr;
    return object_manager->objects[id];
}
```

References object_manager, and objects.

Referenced by Behavior::ClassSetup(), Editor::Display_Components(), Editor::Display_Scene(), Graphics::Render(), Shutdown(), Update(), and Physics::UpdateGravity().

#### 4.13.2.4 FindObject() [2/2] `Object * Object_Manager::FindObject ( std::string objectName ) [static]`

Finds object with the matching name.

**Parameters**

| | |
|---|---|
| *objectName* | Name to look for |

**Returns**

Object∗

Definition at line 95 of file object_manager.cpp.

```
                                                                  {
    for (Object* object : object_manager->objects) {
        if (objectName.compare(object->GetName()) == 0)
            return object;
    }

     return nullptr;
}
```

References Object::GetName(), object_manager, and objects.

#### 4.13.2.5 GetSize() `unsigned Object_Manager::GetSize ( ) [static]`

Gets the size of the object_manager object list.

**Returns**

unsigned Size of object list

Definition at line 109 of file object_manager.cpp.

```
109 { return object_manager->objects.size(); }
```

References object_manager, and objects.

Referenced by Editor::Display_Scene(), Graphics::Render(), and Physics::UpdateGravity().

#### 4.13.2.6 Initialize() [1/2] `bool Object_Manager::Initialize ( ) [static]`

Initialize object manager with default values.

**Returns**

true

false

Definition at line 52 of file object_manager.cpp.

```
                                   {
      // Initializing object_manager
    object_manager = new Object_Manager;
    if (!object_manager) {
        Trace::Message("Object Manager was not initialized.");
        return false; // Failed to initialize
    }

      // Adding objects from preset into engine
    object_manager->objects.reserve(10);

    return true; // Successful initialization
}
```

References Trace::Message(), object_manager, and objects.

Referenced by Engine::Initialize(), and Engine::Restart().

#### 4.13.2.7 Initialize() [2/2] `bool Object_Manager::Initialize ( File_Reader & preset ) [static]`

Initializes the object_manager object. Reads in objects for the given preset.

**Parameters**

| | |
|---|---|
| *preset* | List of objects for this preset |

**Returns**

true

false

Definition at line 31 of file object_manager.cpp.

```
                                                    {
      // Initializing object_manager
    object_manager = new Object_Manager;
    if (!object_manager) {
        Trace::Message("Object Manager was not initialized.");
        return false; // Failed to initialize
    }

      // Adding objects from preset into engine
    object_manager->objects.reserve(10);
    object_manager->ReadList(preset);

    return true; // Successful initialization
}
```

References Trace::Message(), object_manager, objects, and ReadList().

#### 4.13.2.8 ReadList() `void Object_Manager::ReadList ( File_Reader & preset )`

Reads in objects from a preset list that is given.

**Parameters**

| | |
|---|---|
| *preset* | List of objects to be added |

Definition at line 147 of file object_manager.cpp.

```
                                                    {
      // Track which object we are on
    unsigned object_num = 0;

      // Reads objects until there is a failed read
    while (true) {
          // Getting the name of the objects file
        std::string object_name = preset.Read_Object_Name("object_" + std::to_string(object_num));
        std::string template_name = preset.Read_Object_Template_Name("object_" + std::to_string(object_num));
        if (template_name.compare("") == 0) break;

          // Constructing the object
        Object* object = new Object;
        if (!object->Read(std::string(getenv("USERPROFILE")) + "/Documents/pEngine/json/objects/" + template_name)) {
            delete object;
            continue;
        }

        object->SetName(object_name);
        object->SetTemplateName(std::string(getenv("USERPROFILE")) + "/Documents/pEngine/json/objects/" + template_name);
          // Reading in the objects position
        glm::vec3 position = preset.Read_Object_Position("object_" + std::to_string(object_num));
        glm::vec3 scale = preset.Read_Object_Scale("object_" + std::to_string(object_num));
        Transform* transform = object->GetComponent<Transform>();
        transform->SetPosition(position);
        transform->SetStartPosition(position);
        transform->SetScale(scale);
        Behavior* behavior = object->GetComponent<Behavior>();
        behavior->SetupClassesForLua();

          // Adding the object to the manager
        AddObject(object);

        ++object_num;
    }
}
```

References AddObject(), Object::Read(), File_Reader::Read_Object_Name(), File_Reader::Read_Object_Position(), File_Reader::Read_Object_Scale(), File_Reader::Read_Object_Template_Name(), Object::SetName(), Transform::↩ SetPosition(), Transform::SetScale(), Transform::SetStartPosition(), and Behavior::SetupClassesForLua().

Referenced by Initialize().

#### 4.13.2.9 RemoveObject() `void Object_Manager::RemoveObject ( int id ) [static]`

Removes an object from the object_manager.

**Parameters**

| | |
|---|---|
| *id* | id of object to remove |

**Returns**

void

Definition at line 214 of file object_manager.cpp.

```
                                            {
    if (id >= (int)object_manager->objects.size()) return;
    Object* objectToDelete = object_manager->objects[id];

      // Moves all the objects to the right of one being deleted to the left
    unsigned offset = 0;
    for (unsigned objectNum = id + 1; objectNum < object_manager->objects.size(); ++objectNum) {
        Object* objectToSwitch = object_manager->objects[objectNum];
        object_manager->objects[id + offset] = objectToSwitch;
        objectToSwitch->SetId(id + offset++);
    }

      // Deleting the object
    delete objectToDelete;
    objectToDelete = nullptr;
    object_manager->objects.pop_back();
}
```

References object_manager, objects, and Object::SetId().

Referenced by Editor::Display_Scene().

#### 4.13.2.10 Shutdown() `void Object_Manager::Shutdown ( ) [static]`

Deletes all objects in the manager and then the object manager.

**Returns**

void

Definition at line 127 of file object_manager.cpp.

```
                                    {
    if (!object_manager) return; // If the object_manager doesn't exist

      // Deleting each object in the manager
    for (unsigned i = 0; i < object_manager->objects.size(); ++i) {
        Object* object = object_manager->FindObject(i);
        if (object)
            delete object;
    }

      // Deleting the manager
    delete object_manager;
    object_manager = nullptr;
}
```

References FindObject(), object_manager, and objects.

Referenced by Engine::Restart(), and Engine::Shutdown().

#### 4.13.2.11 Update() `void Object_Manager::Update ( ) [static]`

Calls the update function for each object in the object list.

**Returns**

void

Definition at line 116 of file object_manager.cpp.

```
                                  {
    for (unsigned i = 0; i < object_manager->objects.size(); ++i) {
        object_manager->FindObject(i)->Update();
    }
}
```

References FindObject(), object_manager, objects, and Object::Update().

Referenced by Engine::Update().

#### 4.13.2.12 Write() `void Object_Manager::Write ( File_Writer & writer ) [static]`

Gives all of the object data to writer for output to file.

**Parameters**

| | |
|---|---|
| *writer* | |

**Returns**

void

Definition at line 238 of file object_manager.cpp.

```
                                  {
    for (Object* object : object_manager->objects) {
        writer.Write_Object_Data(object);
    }
}
```

References object_manager, objects, and File_Writer::Write_Object_Data().

Referenced by Engine::Write().

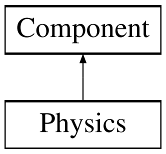
The documentation for this class was generated from the following files:

- object_manager.hpp
- object_manager.cpp

## 4.14 Physics Class Reference

```
#include <physics.hpp>
```

Inheritance diagram for Physics:



### Public Member Functions

- Physics ()

  *Creates Physics object with default values.*
- Physics (const Physics &other)

  *Copy constructor.*
- Physics (File_Reader &reader)

  *Creates Physics object using file.*
- Physics ∗ Clone () const

  *Clone Physics object.*
- void SetAcceleration (glm::vec3 accel)

  *Sets acceleration of object.*

- glm::vec3 GetAcceleration () const

  *Returns acceleration of object.*
- glm::vec3 & GetAccelerationRef ()

  *Returns reference to the acceleration of the object.*
- void SetForces (glm::vec3 force)

  *Sets forces acting on object.*
- void AddForce (glm::vec3 force)

  *Adds a force to the current forces acting on the object.*
- glm::vec3 GetForces () const

  *Returns the forces acting on the object.*
- glm::vec3 & GetForcesRef ()

  *Returns reference to the forces acting on the object.*
- void ApplyForce (glm::vec3 direction, float power)

  *Applies force in the given direction using the given power.*
- void SetVelocity (glm::vec3 vel)

  *Sets the velocity of the object.*
- glm::vec3 GetVelocity () const

  *Returns the current velocity of the object.*
- glm::vec3 & GetVelocityRef ()

  *Returns reference to velocity of the object.*
- void SetRotationalVelocity (glm::vec3 rotVel)

  *Sets rotational velocity.*
- glm::vec3 GetRotationalVelocity () const

  *Returns rotational velocity.*
- glm::vec3 & GetRotationalVelocityRef ()

  *Returns reference to rotational velocity.*
- void SetMass (float ma)

  *Sets the mass of the object.*
- float GetMass () const

  *Returns the mass of the object.*
- float & GetMassRef ()

  *Returns reference to mass of the object.*
- void Update ()

  *Updates the physics of the object.*
- void UpdateGravity ()

  *Calculates the gravitational pull each object has on each other.*
- void Read (File_Reader &reader)

  *Reads data for Physics object from file.*
- void Write (File_Writer &writer)

  *Gives physics data to the writer object.*

## Static Public Member Functions

- static CType GetCType ()

  *Gets the CType of Physics (used in Object::GetComponent<>())*

**Private Attributes**

- glm::vec3 acceleration

  *Acceleration of object.*
- glm::vec3 forces

  *Forces acting on object (reset at end of each update)*
- glm::vec3 velocity

  *Velocity of object.*
- glm::vec3 initialVelocity

  *Starting velocity.*
- glm::vec3 initialAcceleration

  *Starting acceleration.*
- glm::vec3 rotationalVelocity

  *How fast is the object rotating.*
- float mass

  *Mass of object.*

**Additional Inherited Members**

### 4.14.1 Detailed Description

Physics class

Definition at line 25 of file physics.hpp.

### 4.14.2 Constructor & Destructor Documentation

#### 4.14.2.1 Physics() [1/3] `Physics::Physics ( )`

Creates Physics object with default values.

Definition at line 32 of file physics.cpp.

```
                   : Component(CType::CPhysics),
      acceleration(glm::vec3(0.f, 0.f, 0.f)), forces(glm::vec3(0.f, 0.f, 0.f)),
      velocity(glm::vec3(0.f, 0.f, 0.f)), rotationalVelocity(glm::vec3(0.f, 0.f, 0.f)), mass(1.f) {}
```

Referenced by Clone().

#### 4.14.2.2 Physics() [2/3] `Physics::Physics ( const Physics & other )`

Copy constructor.

**Parameters**

| | |
|---|---|
| *other* | Physics object to be copied |

Definition at line 41 of file physics.cpp.

```
                                    : Component(CType::CPhysics) {
    *this = other;
}
```

#### 4.14.2.3 Physics() [3/3] `Physics::Physics ( File_Reader & reader )`

Creates Physics object using file.

**Parameters**

| | |
|---|---|
| *reader* | File to use for making physics object |

Definition at line 50 of file physics.cpp.

```
                                   : Component(CType::CPhysics),
    acceleration(glm::vec3(0.f, 0.f, 0.f)), forces(glm::vec3(0.f, 0.f, 0.f)),
    velocity(glm::vec3(0.f, 0.f, 0.f)), rotationalVelocity(glm::vec3(0.f, 0.f, 0.f)), mass(1.f) {
    Read(reader);
}
```

References Read().

### 4.14.3 Member Function Documentation

#### 4.14.3.1 AddForce() `void Physics::AddForce ( glm::vec3 force )`

Adds a force to the current forces acting on the object.

**Parameters**

| | |
|---|---|
| *force* | |

Definition at line 98 of file physics.cpp.

```
{ forces += force; }
```

References forces.

Referenced by ApplyForce().

#### 4.14.3.2 ApplyForce() `void Physics::ApplyForce ( glm::vec3 direction, float power )`

Applies force in the given direction using the given power.

**Parameters**

| | |
|---|---|
| *direction* | |
| *power* | |

Definition at line 120 of file physics.cpp.

```
{
    direction = glm::normalize(direction);
    direction *= power;

    AddForce(direction);
}
```

References AddForce().

Referenced by Behavior::ClassSetup().

#### 4.14.3.3 Clone() `Physics * Physics::Clone ( ) const`

Clone Physics object.

**Returns**

Physics∗ Cloned Physics object

Definition at line 61 of file physics.cpp.

```
{
    return new Physics(*this);
}
```

References Physics().

#### 4.14.3.4 GetAcceleration() `glm::vec3 Physics::GetAcceleration ( ) const`

Returns acceleration of object.

**Returns**

glm::vec3

Definition at line 77 of file physics.cpp.

```
{ return acceleration; }
```

References acceleration.

### 4.14.3.5 GetAccelerationRef() `glm::vec3 & Physics::GetAccelerationRef ( )`

Returns reference to the acceleration of the object.

**Returns**

glm::vec3&

Definition at line 84 of file physics.cpp.

```
84 { return acceleration; }
```

References acceleration.

Referenced by Behavior::ClassSetup().

### 4.14.3.6 GetCType() `CType Physics::GetCType ( ) [static]`

Gets the CType of Physics (used in Object::GetComponent<>())

**Returns**

CType

Definition at line 281 of file physics.cpp.

```
281                          {
282     return CType::CPhysics;
283 }
```

### 4.14.3.7 GetForces() `glm::vec3 Physics::GetForces ( ) const`

Returns the forces acting on the object.

**Returns**

glm::vec3

Definition at line 105 of file physics.cpp.

```
105 { return forces; }
```

References forces.

#### 4.14.3.8 GetForcesRef() `glm::vec3 & Physics::GetForcesRef ( )`

Returns reference to the forces acting on the object.

**Returns**

glm::vec3&

Definition at line 112 of file physics.cpp.
```
112 { return forces; }
```

References forces.

Referenced by Behavior::ClassSetup().

#### 4.14.3.9 GetMass() `float Physics::GetMass ( ) const`

Returns the mass of the object.

**Returns**

float

Definition at line 160 of file physics.cpp.
```
160 { return mass; }
```

References mass.

#### 4.14.3.10 GetMassRef() `float & Physics::GetMassRef ( )`

Returns reference to mass of the object.

**Returns**

float&

Definition at line 167 of file physics.cpp.
```
167 { return mass; }
```

References mass.

Referenced by Editor::Display_Physics().

#### 4.14.3.11 GetRotationalVelocity() `glm::vec3 Physics::GetRotationalVelocity ( ) const`

Returns rotational velocity.

**Returns**

glm::vec3

Definition at line 181 of file physics.cpp.

```
{ return rotationalVelocity; }
```

References rotationalVelocity.

#### 4.14.3.12 GetRotationalVelocityRef() `glm::vec3 & Physics::GetRotationalVelocityRef ( )`

Returns reference to rotational velocity.

**Returns**

glm::vec3&

Definition at line 188 of file physics.cpp.

```
{ return rotationalVelocity; }
```

References rotationalVelocity.

Referenced by Editor::Display_Physics().

#### 4.14.3.13 GetVelocity() `glm::vec3 Physics::GetVelocity ( ) const`

Returns the current velocity of the object.

**Returns**

glm::vec3

Definition at line 139 of file physics.cpp.

```
{ return velocity; }
```

References velocity.

#### 4.14.3.14 GetVelocityRef() `glm::vec3 & Physics::GetVelocityRef ( )`

Returns reference to velocity of the object.

**Returns**

glm::vec3&

Definition at line 146 of file physics.cpp.

```
{ return velocity; }
```

References velocity.

Referenced by Behavior::ClassSetup(), and Editor::Display_Physics().

#### 4.14.3.15 Read() `void Physics::Read ( File_Reader & reader )`

Reads data for Physics object from file.

**Parameters**

| | |
|---|---|
| *reader* | File to be read from |

Definition at line 257 of file physics.cpp.

```
                                        {
    initialAcceleration = reader.Read_Vec3("acceleration");
    initialVelocity = reader.Read_Vec3("velocity");
    SetAcceleration(initialAcceleration);
    SetVelocity(initialVelocity);
    SetMass(reader.Read_Float("mass"));
}
```

References initialAcceleration, initialVelocity, File_Reader::Read_Float(), File_Reader::Read_Vec3(), SetAcceleration(), SetMass(), and SetVelocity().

Referenced by Physics(), and Object::ReRead().

#### 4.14.3.16 SetAcceleration() `void Physics::SetAcceleration ( glm::vec3 accel )`

Sets acceleration of object.

**Parameters**

| | |
|---|---|
| *accel* | |

Definition at line 70 of file physics.cpp.

```
70 { acceleration = accel; }
```

References acceleration.

Referenced by Behavior::ClassSetup(), and Read().

#### 4.14.3.17 SetForces() `void Physics::SetForces (`

```
glm::vec3 force )
```

Sets forces acting on object.

**Parameters**

|  |  |
|---|---|
| *force* |  |

Definition at line 91 of file physics.cpp.

```
91 { forces = force; }
```

References forces.

Referenced by Behavior::ClassSetup().

#### 4.14.3.18 SetMass() `void Physics::SetMass (`

```
float ma )
```

Sets the mass of the object.

**Parameters**

|  |  |
|---|---|
| *ma* |  |

Definition at line 153 of file physics.cpp.

```
153 { mass = ma; }
```

References mass.

Referenced by Read().

#### 4.14.3.19 SetRotationalVelocity() `void Physics::SetRotationalVelocity (`

```
glm::vec3 rotVel )
```

Sets rotational velocity.

**Parameters**

| | |
|---|---|
| *rotVel* | New rotational velocity |

Definition at line 174 of file physics.cpp.

```
174 { rotationalVelocity = rotVel; }
```

References rotationalVelocity.

### 4.14.3.20 SetVelocity() `void Physics::SetVelocity ( glm::vec3 vel )`

Sets the velocity of the object.

**Parameters**

| | |
|---|---|
| *vel* | |

Definition at line 132 of file physics.cpp.

```
132 { velocity = vel; }
```

References velocity.

Referenced by Behavior::ClassSetup(), and Read().

### 4.14.3.21 Update() `void Physics::Update ( )`

Updates the physics of the object.

Definition at line 194 of file physics.cpp.

```
194                     {
195     // Finding the acceleration of the object using F=ma
196   acceleration = forces / mass;
197
198     // Updating velocity
199   velocity += (acceleration * Engine::GetDt());
200
201     // Updating position
202   Transform* transform = GetParent()->GetComponent<Transform>();
203   glm::vec3 position = transform->GetPosition();
204   transform->SetOldPosition(position);
205   position = (velocity * Engine::GetDt()) + position;
206   transform->SetPosition(position);
207
208     // Updating rotation
209   glm::vec3 rotation = transform->GetRotation();
210   rotation = (rotationalVelocity * Engine::GetDt()) + rotation;
211   transform->SetRotation(rotation);
212
213     // Resetting the forces acting on the object
214   forces = glm::vec3(0.f, 0.f, 0.f);
215 }
```

References acceleration, forces, Object::GetComponent(), Engine::GetDt(), Component::GetParent(), Transform::↩GetPosition(), Transform::GetRotation(), mass, rotationalVelocity, Transform::SetOldPosition(), Transform::SetPosition(), Transform::SetRotation(), and velocity.

Referenced by Object::Update().

#### 4.14.3.22 UpdateGravity() `void Physics::UpdateGravity ( )`

Calculates the gravitational pull each object has on each other.

Definition at line 221 of file physics.cpp.

```
{
  // Gets the needed components for the current object
Object* object = GetParent();
Transform* transform = object->GetComponent<Transform>();
Physics* physics = object->GetComponent<Physics>();
glm::vec3 position = transform->GetPosition();

  // For each object
for (unsigned i = 0; i < Object_Manager::GetSize(); ++i) {
    if ((int)i == object->GetId()) continue;
      // Gets needed components for the object being checked
    Object* other = Object_Manager::FindObject(i);
    Physics* otherPhysics = other->GetComponent<Physics>();
    Transform* otherTransform = other->GetComponent<Transform>();
    glm::vec3 otherPosition = otherTransform->GetPosition();
      // Finding the distance between the objects
    double distance = sqrt(pow(double(otherPosition.x - position.x), 2.0) +
        pow(double(otherPosition.y - position.y), 2.0) +
        pow(double(otherPosition.z - position.z), 2.0));
      // Calculating the force the objects apply on each other
    double magnitude = Engine::GetGravConst() * ((physics->mass * otherPhysics->mass)) / pow(distance,
  2.0);
      // Getting the direction (normalized)
    glm::vec3 direction = otherPosition - position;
    glm::vec3 normDirection = glm::normalize(direction);
      // Applying gravitational force to normalized direction
    glm::vec3 force = normDirection * float(magnitude);
      // Adding the gravitational force to the forces on object
    physics->AddForce(force);
}
}
```

References Object_Manager::FindObject(), Object::GetComponent(), Engine::GetGravConst(), Component::Get↩Parent(), Transform::GetPosition(), Object_Manager::GetSize(), and mass.

Referenced by Behavior::ClassSetup().

#### 4.14.3.23 Write() `void Physics::Write ( File_Writer & writer )`

Gives physics data to the writer object.

**Parameters**

| | |
|---|---|
| *writer* | |

Definition at line 270 of file physics.cpp.

```
                                       {
    writer.Write_Vec3("acceleration", initialAcceleration);
    writer.Write_Vec3("velocity", initialVelocity);
    writer.Write_Value("mass", mass);
}
```

References initialAcceleration, initialVelocity, mass, File_Writer::Write_Value(), and File_Writer::Write_Vec3().

Referenced by Object::Write().

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

- physics.hpp
- physics.cpp

## 4.15 Random Class Reference

`#include <random.hpp>`

### Static Public Member Functions

- static bool Initialize ()

  *Initializes the random system.*
- static void Shutdown ()

  *Delete the random object.*
- static glm::vec3 random_vec3 (float low, float high)

  *Creates a random vec3.*
- static float random_float (float low, float high)

  *Creates random float.*

### Private Attributes

- std::random_device rd

  *Random device.*

### 4.15.1 Detailed Description

Random class

Definition at line 23 of file random.hpp.

### 4.15.2 Member Function Documentation

#### 4.15.2.1 Initialize() `bool Random::Initialize ( ) [static]`

Initializes the random system.

**Returns**

true

false

Definition at line 24 of file random.cpp.

```
                           {
      // Initializing random
    random = new Random;
    if (!random) {
        Trace::Message("Random failed to initialize.");
        return false;
    }

    return true;
}
```

References Trace::Message(), and random.

Referenced by Engine::Initialize().

#### 4.15.2.2 random_float() `float Random::random_float ( float low, float high ) [static]`

Creates random float.

**Parameters**

| | |
|---|---|
| *low* | Lower boundary in random gen |
| *high* | Upper boundary in random gen |

**Returns**

float

Definition at line 70 of file random.cpp.

```
                                                  {
      // Setup random gen
    std::mt19937 gen(random->rd());
    std::uniform_real_distribution<> dist(low, high);
      // Gen random float
    return dist(gen);
}
```

References random, and rd.

Referenced by Behavior::ClassSetup().

#### 4.15.2.3 random_vec3() `glm::vec3 Random::random_vec3 ( float low, float high ) [static]`

Creates a random vec3.

**Parameters**

| | |
|---|---|
| *low* | Lower boundary in random gen |
| *high* | Upper boundary in random gen |

**Returns**

vec3

Definition at line 54 of file random.cpp.

```
                                                    {
        // Setup random gen
      std::mt19937 gen(random->rd());
      std::uniform_real_distribution<> dist(low, high);
        // Gen random vec3
      glm::vec3 result_vec3 = { dist(gen), dist(gen), dist(gen) };
      return result_vec3;
}
```

References random, and rd.

Referenced by Behavior::ClassSetup().

#### 4.15.2.4 Shutdown() `void Random::Shutdown ( ) [static]`

Delete the random object.

**Returns**

void

Definition at line 40 of file random.cpp.

```
                         {
      if (!random) return;

      delete random;
      random = nullptr;
}
```

References random.

Referenced by Engine::Shutdown().

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

- random.hpp
- random.cpp

## 4.16 Shader Class Reference

```
#include <shader.hpp>
```

### Static Public Member Functions

- static bool Initialize (File_Reader &settings)

  *Initializes the shader object.*
- static bool Initialize ()

  *Initialize shader with default values.*
- static void Update ()

  *Tells program to use shader.*
- static void Shutdown ()

  *Shutdown shader.*
- static std::string ReadFile (std::string filename)

  *Reads shader file into std::string.*
- static void LoadShader (std::string vertexPath, std::string fragmentPath)

  *Loads the vertex and fragment shader using given filepaths.*
- static GLuint GetProgram ()

  *Returns the program id.*
- static GLuint GetMatrixId ()

  *Returns the mvp buffer id.*
- static GLuint GetViewMatrixId ()

  *Returns the view matrix buffer id.*
- static GLuint GetModelMatrixId ()

  *Returns the model matrix buffer id.*
- static GLuint GetLightId ()

  *Returns the light pos buffer id.*
- static GLuint GetLightPowerId ()

  *Returns the light power buffer id.*

### Private Attributes

- GLuint program

  *Program id for the engine.*
- GLuint matrixId

  *MVP matrix id.*
- GLuint viewMatrixId

  *View matrix id.*
- GLuint modelMatrixId

  *Model matrix id.*
- GLuint lightId

  *Light id for world.*
- GLuint lightPowerId

  *Id for light power buffer.*

### 4.16.1 Detailed Description

Shader class

Definition at line 26 of file shader.hpp.

### 4.16.2 Member Function Documentation

#### 4.16.2.1 GetLightId() `GLuint Shader::GetLightId ( ) [static]`

Returns the light pos buffer id.

**Returns**

GLuint

Definition at line 192 of file shader.cpp.

```
192 { return shader->lightId; }
```

References lightId, and shader.

Referenced by Model_Data::Draw().

#### 4.16.2.2 GetLightPowerId() `GLuint Shader::GetLightPowerId ( ) [static]`

Returns the light power buffer id.

**Returns**

GLuint

Definition at line 199 of file shader.cpp.

```
199 { return shader->lightPowerId; }
```

References lightPowerId, and shader.

Referenced by Model_Data::Draw().

#### 4.16.2.3 GetMatrixId() `GLuint Shader::GetMatrixId ( ) [static]`

Returns the mvp buffer id.

**Returns**

GLuint

Definition at line 171 of file shader.cpp.

```
{ return shader->matrixId; }
```

References matrixId, and shader.

Referenced by Model_Data::Draw().

#### 4.16.2.4 GetModelMatrixId() `GLuint Shader::GetModelMatrixId ( ) [static]`

Returns the model matrix buffer id.

**Returns**

GLuint

Definition at line 185 of file shader.cpp.

```
{ return shader->modelMatrixId; }
```

References modelMatrixId, and shader.

Referenced by Model_Data::Draw().

#### 4.16.2.5 GetProgram() `GLuint Shader::GetProgram ( ) [static]`

Returns the program id.

**Returns**

GLuint

Definition at line 164 of file shader.cpp.

```
{ return shader->program; }
```

References program, and shader.

Referenced by Texture::Load().

#### 4.16.2.6 GetViewMatrixId() `GLuint Shader::GetViewMatrixId ( ) [static]`

Returns the view matrix buffer id.

**Returns**

GLuint

Definition at line 178 of file shader.cpp.

```
{ return shader->viewMatrixId; }
```

References shader, and viewMatrixId.

Referenced by Model_Data::Draw().

#### 4.16.2.7 Initialize() [1/2] `bool Shader::Initialize ( ) [static]`

Initialize shader with default values.

**Returns**

true

false

Definition at line 50 of file shader.cpp.

```
                          {
    shader = new Shader;
    if (!shader) {
        Trace::Message("Shader failed to initialize.\n");
        return false;
    }

    //LoadShader("src/shaders/vertex.glsl", "src/shaders/fragment.glsl");
    LoadShader(std::string(getenv("USERPROFILE")) + "/Documents/pEngine/shaders/vertex.glsl",
        std::string(getenv("USERPROFILE")) + "/Documents/pEngine/shaders/fragment.glsl");
    return true;
}
```

References LoadShader(), Trace::Message(), and shader.

Referenced by Graphics::Initialize().

#### 4.16.2.8 Initialize() [2/2] `bool Shader::Initialize ( File_Reader & settings ) [static]`

Initializes the shader object.

**Parameters**

| | |
|---|---|
| *settings* | File_Reader object that contains name of shaders to use |

**Returns**

true

false

Definition at line 31 of file shader.cpp.

```
                                            {
    shader = new Shader;
    if (!shader) {
        Trace::Message("Shader failed to initialize.\n");
        return false;
    }

    //LoadShader("src/shaders/vertex.glsl", "src/shaders/fragment.glsl");
    LoadShader(std::string(getenv("USERPROFILE")) + "/Documents/pEngine/shaders/" +
    settings.Read_String("vertexShader") + ".glsl",
        std::string(getenv("USERPROFILE")) + "/Documents/pEngine/shaders/" +
    settings.Read_String("fragShader") + ".glsl");
    return true;
}
```

References LoadShader(), Trace::Message(), File_Reader::Read_String(), and shader.

#### 4.16.2.9 LoadShader()

```
void Shader::LoadShader (
            std::string vertexPath,
            std::string fragmentPath ) [static]
```

Loads the vertex and fragment shader using given filepaths.

**Parameters**

| | |
|---|---|
| *vertexPath* | // Vertex shader filepath |
| *fragmentPath* | // Fragment shader filepath |

**Returns**

void

Definition at line 121 of file shader.cpp.

```
                                                                        {
      // Creating shaders
    GLuint vertShader = glCreateShader(GL_VERTEX_SHADER);
    GLuint fragShader = glCreateShader(GL_FRAGMENT_SHADER);

      // Reading shaders
    std::string vertShaderStr = ReadFile(vertexPath);
    std::string fragShaderStr = ReadFile(fragmentPath);
    const char *vertShaderSrc = vertShaderStr.c_str();
    const char *fragShaderSrc = fragShaderStr.c_str();

      // Compiling shaders
    glShaderSource(vertShader, 1, &vertShaderSrc, nullptr);
    glCompileShader(vertShader);

    glShaderSource(fragShader, 1, &fragShaderSrc, nullptr);
    glCompileShader(fragShader);

      // Attaching shaders to engine
    shader->program = glCreateProgram();
    glAttachShader(shader->program, vertShader);
    glAttachShader(shader->program, fragShader);

      // Cleanup
    glDeleteShader(vertShader);
    glDeleteShader(fragShader);

      // Setting up program
    glLinkProgram(shader->program);
    glUseProgram(shader->program);

    shader->matrixId = glGetUniformLocation(shader->program, "MVP");
    shader->viewMatrixId = glGetUniformLocation(shader->program, "V");
    shader->modelMatrixId = glGetUniformLocation(shader->program, "M");
    shader->lightId = glGetUniformLocation(shader->program, "LightPosition_worldspace");
    shader->lightPowerId = glGetUniformLocation(shader->program, "LightPower");
}
```

References lightId, lightPowerId, matrixId, modelMatrixId, program, ReadFile(), shader, and viewMatrixId.

Referenced by Initialize().

#### 4.16.2.10 ReadFile() `std::string Shader::ReadFile ( std::string *filepath* ) [static]`

Reads shader file into std::string.

**Parameters**

| | |
|---|---|
| *filepath* | Shader file |

**Returns**

std::string

Definition at line 92 of file shader.cpp.

```
                                             {
    std::string content;

      // Opening the shader file
    std::ifstream file(filepath.c_str(), std::ios::in);
    if (!file.is_open()) {
        Trace::Message("Failed to read file: " + filepath + "\n");
        return "";
    }

      // Saving shader file into std::string
    std::string line = "";
    while (!file.eof()) {
        getline(file, line);
        content.append(line + "\n");
    }

      // Closing file and returning std::string
    file.close();
    return content;
}
```

References Trace::Message().

Referenced by LoadShader().

#### 4.16.2.11 Shutdown() `void Shader::Shutdown ( ) [static]`

Shutdown shader.

**Returns**

void

Definition at line 77 of file shader.cpp.

```
                        {
    if (!shader) return;

    glDeleteProgram(shader->program);

    delete shader;
    shader = nullptr;
}
```

References program, and shader.

Referenced by Graphics::Shutdown().

#### 4.16.2.12 Update() `void Shader::Update ( ) [static]`

Tells program to use shader.

**Returns**

void

Definition at line 68 of file shader.cpp.

```
                      {
    glUseProgram(shader->program);
}
```

References program, and shader.

Referenced by Graphics::Render().

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

- shader.hpp
- shader.cpp

## 4.17 Texture Class Reference

`#include <texture.hpp>`

### Public Member Functions

- ∼Texture ()
  *Deletes texture data.*
- bool Load (std::string textureName_)
  *Loads in texture with given filename.*
- void Display ()
  *Setup texture for drawing.*
- std::string GetTextureName () const
  *Returns texture name.*
- GLuint GetTextureNum () const
  *Returns texture data id.*

### Static Private Member Functions

- static GLuint LoadDDS (FILE ∗fp)
  *Loads in the given dds file.*

### Private Attributes

- std::string textureName
  *Name of texture.*
- GLuint textureNum
  *Loaded texture data id.*
- GLuint textureId
  *Textures buffer id.*
- bool hasBeenSet
  *Whether there is a texture or not.*

### 4.17.1 Detailed Description

Texture class

Definition at line 23 of file texture.hpp.

### 4.17.2 Constructor & Destructor Documentation

#### 4.17.2.1 ∼Texture() `Texture::∼Texture ( )`

Deletes texture data.

Definition at line 24 of file texture.cpp.

```
24                {
25     glDeleteTextures(1, &textureNum);
26 }
```

References textureNum.

### 4.17.3 Member Function Documentation

#### 4.17.3.1 Display() `void Texture::Display ( )`

Setup texture for drawing.

Definition at line 63 of file texture.cpp.

```
{
    if (!hasBeenSet) return;

    glActiveTexture(GL_TEXTURE0);
    glBindTexture(GL_TEXTURE_2D, textureNum);
    glUniform1i(textureId, 0);
}
```

References hasBeenSet, textureId, and textureNum.

Referenced by Model_Data::Draw().

#### 4.17.3.2 GetTextureName() `std::string Texture::GetTextureName ( ) const`

Returns texture name.

**Returns**

std::string

Definition at line 76 of file texture.cpp.

```
{ return textureName; }
```

References textureName.

Referenced by Texture_Manager::Get(), Model::GetTextureName(), and Model::Write().

#### 4.17.3.3 GetTextureNum() `GLuint Texture::GetTextureNum ( ) const`

Returns texture data id.

**Returns**

GLuint

Definition at line 83 of file texture.cpp.

```
{ return textureNum; }
```

References textureNum.

#### 4.17.3.4 Load() `bool Texture::Load ( std::string textureName_ )`

Loads in texture with given filename.

**Parameters**

| | |
|---|---|
| *texture↩ Name_* | Filename of texture |

**Returns**

true

false

Definition at line 35 of file texture.cpp.

```
                                            {
    FILE *fp;
    std::string filename = std::string(getenv("USERPROFILE")) + "/Documents/pEngine/textures/" +
    textureName_;
    textureName = filename ;

      // Opening the file
    fp = fopen(filename.c_str(), "rb");
    if (!fp) {
        fp = fopen(textureName_.c_str(), "rb");
        if (!fp) {
            return false;
        }
        else {
            textureName = textureName_;
        }
    }

    textureNum = Texture::LoadDDS(fp);
    textureId = glGetUniformLocation(Shader::GetProgram(), "myTextureSampler");
    hasBeenSet = true;

    return true;
}
```

References Shader::GetProgram(), hasBeenSet, LoadDDS(), textureId, textureName, and textureNum.

Referenced by Texture_Manager::Get().

### 4.17.3.5 LoadDDS() `GLuint Texture::LoadDDS ( FILE * fp ) [static], [private]`

Loads in the given dds file.

**Parameters**

| | |
|---|---|
| *fp* | The file stream |

**Returns**

GLuint

Definition at line 94 of file texture.cpp.

```
                              {
    unsigned char header[124];

      // Making sure it is a dds
    char filecode[4];
    fread(filecode, 1, 4, fp);
     if (strncmp(filecode, "DDS ", 4) != 0) {
         fclose(fp);
         return 0;
     }

       // Getting the surface description
     fread(&header, 124, 1, fp);

     unsigned int height      = *(unsigned int*)&(header[8 ]);
     unsigned int width         = *(unsigned int*)&(header[12]);
     unsigned int linearSize     = *(unsigned int*)&(header[16]);
     unsigned int mipMapCount = *(unsigned int*)&(header[24]);
     unsigned int fourCC      = *(unsigned int*)&(header[80]);

     unsigned char * buffer;
     unsigned int bufsize;

     bufsize = mipMapCount > 1 ? linearSize * 2 : linearSize;
     buffer = (unsigned char*)malloc(bufsize * sizeof(unsigned char));
     fread(buffer, 1, bufsize, fp);

       // Close the file
     fclose(fp);

     unsigned int format;
     switch(fourCC) {
         case FOURCC_DXT1:
             format = GL_COMPRESSED_RGBA_S3TC_DXT1_EXT;
             break;
         case FOURCC_DXT3:
             format = GL_COMPRESSED_RGBA_S3TC_DXT3_EXT;
             break;
         case FOURCC_DXT5:
             format = GL_COMPRESSED_RGBA_S3TC_DXT5_EXT;
             break;
         default:
             free(buffer);
             return 0;
     }

     GLuint textureID;
     glGenTextures(1, &textureID);

     glBindTexture(GL_TEXTURE_2D, textureID);
     glPixelStorei(GL_UNPACK_ALIGNMENT,1);

     unsigned int blockSize = (format == GL_COMPRESSED_RGBA_S3TC_DXT1_EXT) ? 8 : 16;
     unsigned int offset = 0;

     for (unsigned int level = 0; level < mipMapCount && (width || height); ++level) {
         unsigned int size = ((width+3)/4)*((height+3)/4)*blockSize;
         glCompressedTexImage2D(GL_TEXTURE_2D, level, format, width, height,
             0, size, buffer + offset);

         offset += size;
         width  /= 2;
         height /= 2;

         if(width < 1) width = 1;
         if(height < 1) height = 1;

     }

     free(buffer);

     return textureID;
}
```

References FOURCC_DXT1, FOURCC_DXT3, and FOURCC_DXT5.

Referenced by Load().

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

- texture.hpp
- texture.cpp

## 4.18 Texture_Manager Class Reference

```
#include <texture_manager.hpp>
```

### Static Public Member Functions

- static bool Initialize ()

  *Initializes the texture_manager.*
- static Texture ∗ Get (File_Reader &reader)

  *Looks for texture in list of loaded textures. If found it returns a pointer. If not found it creates texture, adds it to the list of textures and returns a pointer to it.*
- static Texture ∗ Get (std::string textureName)

  *Looks for texture in list of loaded textures. If found it returns a pointer. If not found it creates texture, adds it to the list of textures and returns a pointer to it.*
- static void Shutdown ()

  *Deletes all texture object and then the manager.*

### Private Attributes

- std::vector< Texture ∗ > textures

  *List of loaded textures.*

### 4.18.1 Detailed Description

Texture_Manager class

Definition at line 25 of file texture_manager.hpp.

### 4.18.2 Member Function Documentation

#### 4.18.2.1 Get() [1/2]

```
Texture ∗ Texture_Manager::Get (
        File_Reader & reader )  [static]
```

Looks for texture in list of loaded textures. If found it returns a pointer. If not found it creates texture, adds it to the list of textures and returns a pointer to it.

**Parameters**

| | |
|---|---|
| *reader* | File_Reader object that contains name of texture |

**Returns**

Texture∗

Definition at line 45 of file texture_manager.cpp.

```
                                                    {
    // Getting texture's filename
    std::string filename = reader.Read_String("textureToLoad");
    // Looking for texture in list of loaded textures
    for (Texture* texture : texture_manager->textures) {
        if (texture->GetTextureName().compare(filename) == 0) {
            return texture;
        }
    }

    // Creating new texture
    Texture* texture = new Texture;
    texture->Load(filename);
    texture_manager->textures.emplace_back(texture);

    return texture;
}
```

References Texture::GetTextureName(), Texture::Load(), File_Reader::Read_String(), texture_manager, and textures.

Referenced by Model::Load(), and Model::SwitchTexture().

### 4.18.2.2 Get() [2/2] Texture ∗ Texture_Manager::Get ( std::string *textureName* ) [static]

Looks for texture in list of loaded textures. If found it returns a pointer. If not found it creates texture, adds it to the list of textures and returns a pointer to it.

**Parameters**

| | |
|---|---|
| *textureName* | Name of texture |

**Returns**

Texture∗

Definition at line 71 of file texture_manager.cpp.

```
                                                      {
    // Looking for texture in list of loaded textures
    for (Texture* texture : texture_manager->textures) {
        if (texture->GetTextureName().compare(textureName) == 0) {
            return texture;
        }
    }

    // Creating new texture
    Texture* texture = new Texture;
    if (!texture->Load(textureName)) {
        delete texture;
        return nullptr;
    }
    texture_manager->textures.emplace_back(texture);

    return texture;
}
```

References Texture::GetTextureName(), Texture::Load(), texture_manager, and textures.

#### 4.18.2.3 Initialize() `bool Texture_Manager::Initialize ( ) [static]`

Initializes the texture_manager.

**Returns**

true

false

Definition at line 24 of file texture_manager.cpp.

```
                                    {
      // Initializing texture_manager
    texture_manager = new Texture_Manager;
    if (!texture_manager) {
        Trace::Message("Texture Manager was not initialized.\n");
        return false;
    }

      // Reserving space in the texture_manager
    texture_manager->textures.reserve(10);
    return true;
}
```

References Trace::Message(), texture_manager, and textures.

Referenced by Engine::Initialize().

#### 4.18.2.4 Shutdown() `void Texture_Manager::Shutdown ( ) [static]`

Deletes all texture object and then the manager.

**Returns**

void

Definition at line 95 of file texture_manager.cpp.

```
                              {
    if (!texture_manager) return;

    for (Texture* texture : texture_manager->textures) {
        if (!texture) continue;

         delete texture;
         texture = nullptr;
     }

     delete texture_manager;
     texture_manager = nullptr;
 }
```

References texture_manager, and textures.

Referenced by Engine::Shutdown().

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

- texture_manager.hpp
- texture_manager.cpp

## 4.19 Trace Class Reference

```
#include <trace.hpp>
```

### Static Public Member Functions

- static void Initialize ()

  *Initializes the trace system.*
- static void Message (std::string message)

  *Prints a message into the output file.*
- static void Shutdown ()

  *Closes output file and deletes trace object.*

### Private Attributes

- std::fstream trace_stream

  *Output file.*

### 4.19.1 Detailed Description

Trace class

Definition at line 21 of file trace.hpp.

### 4.19.2 Member Function Documentation

#### 4.19.2.1 Initialize() `void Trace::Initialize ( ) [static]`

Initializes the trace system.

**Returns**

void

Definition at line 26 of file trace.cpp.

```
                  {
    trace = new Trace;

      // Opens output file
    trace->trace_stream.open(std::string(getenv("USERPROFILE")) + "/Documents/pEngine/trace.log",
    std::ofstream::out);
    if (!trace->trace_stream) std::cout « "Trace file wasn't opened successfully.\n";
}
```

References trace, and trace_stream.

Referenced by main().

#### 4.19.2.2 Message() `void Trace::Message ( std::string message ) [static]`

Prints a message into the output file.

**Parameters**

| | |
|---|---|
| *message* | Message to be printed |

**Returns**

void

Definition at line 40 of file trace.cpp.

```
                                  {
    if (!trace->trace_stream) return;

    trace->trace_stream « message;
    std::cout « message;
}
```

References trace, and trace_stream.

Referenced by Graphics::ErrorCallback(), Graphics::ErrorCheck(), Random::Initialize(), Engine::Initialize(), Model↩_Data_Manager::Initialize(), Object_Manager::Initialize(), Texture_Manager::Initialize(), Editor::Initialize(), Shader::↩Initialize(), Camera::Initialize(), Graphics::Initialize(), Model_Data::Read(), Shader::ReadFile(), Engine::Restart(), and Object::Write().

#### 4.19.2.3 Shutdown() `void Trace::Shutdown ( ) [static]`

Closes output file and deletes trace object.

**Returns**

void

Definition at line 52 of file trace.cpp.

```
                       {
    // Closing output file
  if (trace->trace_stream) trace->trace_stream.close();

  delete trace;
  trace = nullptr;
}
```

References trace, and trace_stream.

Referenced by main().

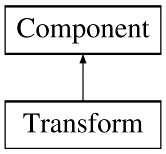
The documentation for this class was generated from the following files:

- trace.hpp
- trace.cpp

## 4.20 Transform Class Reference

`#include <transform.hpp>`

Inheritance diagram for Transform:



## Public Member Functions

- Transform ()

  *Creates Transform object with default values.*
- Transform (const Transform &other)

  *Copy constructor.*
- Transform (File_Reader &reader)

  *Creates Transform object using file.*
- Transform ∗ Clone () const

  *Clones current Transform object.*
- void SetPosition (glm::vec3 pos)

  *Sets position of object.*
- glm::vec3 GetPosition () const

  *Returns position of object.*
- glm::vec3 & GetPositionRef ()

  *Returns position reference of object.*
- void SetOldPosition (glm::vec3 oldPos)

  *Sets old position of object.*
- glm::vec3 GetOldPosition () const

  *Returns old position of object.*
- void SetScale (glm::vec3 sca)

  *Sets scale of object.*
- glm::vec3 GetScale () const

  *Returns scale of object.*
- glm::vec3 & GetScaleRef ()

  *Returns scale reference of object.*
- void SetRotation (glm::vec3 rot)

  *Sets rotation of object.*
- glm::vec3 GetRotation () const

  *Returns rotation of object.*
- glm::vec3 & GetRotationRef ()

  *Returns rotation reference of object.*
- void SetStartPosition (glm::vec3 startPosition_)

  *Sets the start position of the object.*
- glm::vec3 GetStartPosition () const

  *Returns the saved start position of the object.*
- glm::vec3 & GetStartPositionRef ()

  *Returns a reference to the start position of the object.*
- void Read (File_Reader &reader)

  *Reads data for Transform object from file.*
- void Write (File_Writer &writer)

  *Gives transform data to writer object.*

## Static Public Member Functions

- static CType GetCType ()

  *Gets the CType of Transform (used in Object::GetComponent<>())*

### Private Attributes

- glm::vec3 position

  *Position of object.*
- glm::vec3 oldPosition

  *Previous position of object.*
- glm::vec3 scale

  *Scale of object.*
- glm::vec3 rotation

  *Rotation of object.*
- glm::vec3 startPosition

  *Starting position of the object.*

### Additional Inherited Members

### 4.20.1 Detailed Description

Transform class

Definition at line 25 of file transform.hpp.

### 4.20.2 Constructor & Destructor Documentation

#### 4.20.2.1 Transform() [1/3] `Transform::Transform ( )`

Creates Transform object with default values.

Definition at line 19 of file transform.cpp.

```
                       : Component(CType::CTransform),
    position(glm::vec3(0.f, 0.f, 0.f)), scale(glm::vec3(1.f, 1.f, 1.f)), rotation(glm::vec3(0.f, 0.f, 0.f))
    {}
```

Referenced by Clone().

#### 4.20.2.2 Transform() [2/3] `Transform::Transform ( const Transform & other )`

Copy constructor.

**Parameters**

| | |
|---|---|
| *other* | |

Definition at line 27 of file transform.cpp.

```
                                                  : Component(CType::CTransform) {
    *this = other;
}
```

#### 4.20.2.3 Transform() [3/3] `Transform::Transform ( File_Reader & reader )`

Creates Transform object using file.

**Parameters**

| | |
|---|---|
| *reader* | File to use for making Transform object |

Definition at line 36 of file transform.cpp.

```
                                               : Component(CType::CTransform),
    position(glm::vec3(0.f, 0.f, 0.f)), scale(glm::vec3(1.f, 1.f, 1.f)), rotation(glm::vec3(0.f, 0.f, 0.f)) {
    Read(reader);
}
```

References Read().

### 4.20.3 Member Function Documentation

#### 4.20.3.1 Clone() `Transform * Transform::Clone ( ) const`

Clones current Transform object.

**Returns**

Transform∗ Cloned Transform

Definition at line 46 of file transform.cpp.

```
                                     {
    return new Transform(*this);
}
```

References Transform().

#### 4.20.3.2 GetCType() `CType Transform::GetCType ( ) [static]`

Gets the CType of Transform (used in Object::GetComponent<>())

**Returns**

CType

Definition at line 171 of file transform.cpp.

```
                        {
    return CType::CTransform;
}
```

#### 4.20.3.3 GetOldPosition() `glm::vec3 Transform::GetOldPosition ( ) const`

Returns old position of object.

**Returns**

glm::vec3

Definition at line 83 of file transform.cpp.

```
{ return oldPosition; }
```

References oldPosition.

#### 4.20.3.4 GetPosition() `glm::vec3 Transform::GetPosition ( ) const`

Returns position of object.

**Returns**

glm::vec3

Definition at line 62 of file transform.cpp.

```
{ return position; }
```

References position.

Referenced by Model_Data::Draw(), Physics::Update(), and Physics::UpdateGravity().

#### 4.20.3.5 GetPositionRef() `glm::vec3 & Transform::GetPositionRef ( )`

Returns position reference of object.

**Returns**

glm::vec3&

Definition at line 69 of file transform.cpp.

```
69 { return position; }
```

References position.

Referenced by Behavior::ClassSetup(), and Editor::Display_Transform().

#### 4.20.3.6 GetRotation() `glm::vec3 Transform::GetRotation ( ) const`

Returns rotation of object.

**Returns**

float

Definition at line 118 of file transform.cpp.

```
118 { return rotation; }
```

References rotation.

Referenced by Model_Data::Draw(), and Physics::Update().

#### 4.20.3.7 GetRotationRef() `glm::vec3 & Transform::GetRotationRef ( )`

Returns rotation reference of object.

**Returns**

glm::vec3&

Definition at line 125 of file transform.cpp.

```
125 { return rotation; }
```

References rotation.

Referenced by Behavior::ClassSetup(), and Editor::Display_Transform().

#### 4.20.3.8 GetScale() `glm::vec3 Transform::GetScale ( ) const`

Returns scale of object.

**Returns**

glm::vec3

Definition at line 97 of file transform.cpp.

```
97 { return scale; }
```

References scale.

Referenced by Model_Data::Draw(), and File_Writer::Write_Object_Data().

#### 4.20.3.9 GetScaleRef() `glm::vec3 & Transform::GetScaleRef ( )`

Returns scale reference of object.

**Returns**

glm::vec3&

Definition at line 104 of file transform.cpp.

```
104 { return scale; }
```

References scale.

Referenced by Behavior::ClassSetup(), and Editor::Display_Transform().

#### 4.20.3.10 GetStartPosition() `glm::vec3 Transform::GetStartPosition ( ) const`

Returns the saved start position of the object.

**Returns**

glm::vec3

Definition at line 139 of file transform.cpp.

```
139 { return startPosition; }
```

References startPosition.

Referenced by File_Writer::Write_Object_Data().

#### 4.20.3.11 GetStartPositionRef() `glm::vec3 & Transform::GetStartPositionRef ( )`

Returns a reference to the start position of the object.

**Returns**

glm::vec3&

Definition at line 146 of file transform.cpp.

```
146 { return startPosition; }
```

References startPosition.

Referenced by Behavior::ClassSetup(), and Editor::Display_Transform().

#### 4.20.3.12 Read() `void Transform::Read ( File_Reader & reader )`

Reads data for Transform object from file.

**Parameters**

| | |
|---|---|
| *reader* | File to read from |

Definition at line 153 of file transform.cpp.

```
153                                 {
154     //SetRotation(reader.Read_Float("rotation"));
155 }
```

Referenced by Object::ReRead(), and Transform().

#### 4.20.3.13 SetOldPosition() `void Transform::SetOldPosition ( glm::vec3 oldPos )`

Sets old position of object.

**Parameters**

| | |
|---|---|
| *oldPos* | |

Definition at line 76 of file transform.cpp.

```
76 { oldPosition = oldPos; }
```

References oldPosition.

Referenced by Physics::Update().

#### 4.20.3.14 SetPosition() `void Transform::SetPosition ( glm::vec3 pos )`

Sets position of object.

**Parameters**

| | |
|---|---|
| *pos* | |

Definition at line 55 of file transform.cpp.

```
55 { position = pos; }
```

References position.

Referenced by Behavior::ClassSetup(), Object_Manager::ReadList(), and Physics::Update().

#### 4.20.3.15 SetRotation() `void Transform::SetRotation ( glm::vec3 rot )`

Sets rotation of object.

**Parameters**

| | |
|---|---|
| *rot* | |

Definition at line 111 of file transform.cpp.

```
111 { rotation = rot; }
```

References rotation.

Referenced by Behavior::ClassSetup(), and Physics::Update().

#### 4.20.3.16 SetScale() `void Transform::SetScale ( glm::vec3 sca )`

Sets scale of object.

**Parameters**

| | |
|---|---|
| *sca* | |

Definition at line 90 of file transform.cpp.

```
90 { scale = sca; }
```

References scale.

Referenced by Behavior::ClassSetup(), and Object_Manager::ReadList().

#### 4.20.3.17 SetStartPosition() `void Transform::SetStartPosition ( glm::vec3 startPosition_ )`

Sets the start position of the object.

**Parameters**

| | |
|---|---|
| *start↩ Position_* | |

Definition at line 132 of file transform.cpp.

```
{ startPosition = startPosition_; }
```

References startPosition.

Referenced by Behavior::ClassSetup(), Editor::Display_Scene(), and Object_Manager::ReadList().

#### 4.20.3.18 Write() `void Transform::Write ( File_Writer & writer )`

Gives transform data to writer object.

**Parameters**

| | |
|---|---|
| *writer* | |

Definition at line 162 of file transform.cpp.

```
                                        {
    writer.Write_Vec3("rotation", rotation);
}
```

References rotation, and File_Writer::Write_Vec3().

Referenced by Object::Write().

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

- transform.hpp
- transform.cpp

## 4.21 Vector3_Func Class Reference

```
#include <vector3_func.hpp>
```

### Static Public Member Functions

- static glm::vec3 normalize (const glm::vec3 vec)

  *Wrapper for the glm normalize function.*
- static float distance (const glm::vec3 vec1, const glm::vec3 vec2)

  *Wrapper for the glm distance function.*
- static glm::vec3 get_direction (const glm::vec3 vec1, const glm::vec3 vec2)

  *Wrapper for subtracting two glm vectors to make a new vector.*
- static glm::vec3 zero_vec3 ()

  *Creates a glm::vec3 filled with zeroes.*
- static float length (const glm::vec3 vec3)

  *Wrapper for the glm length function.*
- static glm::vec3 add_float (const glm::vec3 vec, float num)

  *Adds float to each part of a glm::vec3.*
- static glm::vec3 add_vec3 (const glm::vec3 vec1, const glm::vec3 vec2)

  *Add two glm::vec3 together.*

### 4.21.1 Detailed Description

Vector3_Func class

Definition at line 21 of file vector3_func.hpp.

### 4.21.2 Member Function Documentation

#### 4.21.2.1 add_float()

```
glm::vec3 Vector3_Func::add_float (
        const glm::vec3 vec,
        float num ) [static]
```

Adds float to each part of a glm::vec3.

**Parameters**

| | |
|---|---|
| *vec* | |
| *num* | |

**Returns**

glm::vec3

Definition at line 73 of file vector3_func.cpp.

```
                                                        {
    glm::vec3 returnVec3;
    returnVec3.x = vec.x + num;
    returnVec3.y = vec.y + num;
    returnVec3.z = vec.z + num;

    return vec;
}
```

Referenced by Behavior::ClassSetup().

#### 4.21.2.2 add_vec3() `glm::vec3 Vector3_Func::add_vec3 ( const glm::vec3 vec1, const glm::vec3 vec2 ) [static]`

Add two glm::vec3 together.

**Parameters**

| | |
|---|---|
| *vec1* | |
| *vec2* | |

**Returns**

glm::vec3

Definition at line 90 of file vector3_func.cpp.

```
                                                                      {
    glm::vec3 returnVec3;

    returnVec3.x = vec1.x + vec2.x;
    returnVec3.y = vec1.y + vec2.y;
    returnVec3.z = vec1.z + vec2.z;

    return vec1;
}
```

Referenced by Behavior::ClassSetup().

#### 4.21.2.3 distance() `float Vector3_Func::distance ( const glm::vec3 vec1, const glm::vec3 vec2 ) [static]`

Wrapper for the glm distance function.

**Parameters**

| | |
|---|---|
| *vec1* | First input vec3 |
| *vec2* | Second input vec3 |

**Returns**

float

Definition at line 32 of file vector3_func.cpp.

```
{
    return glm::distance(vec1, vec2);
}
```

Referenced by Behavior::ClassSetup().

#### 4.21.2.4 get_direction()

```
glm::vec3 Vector3_Func::get_direction (
            const glm::vec3 vec1,
            const glm::vec3 vec2 )  [static]
```

Wrapper for subtracting two glm vectors to make a new vector.

**Parameters**

| | |
|---|---|
| *vec1* | First input vec3 |
| *vec2* | Second input vec3 |

**Returns**

glm::vec3

Definition at line 43 of file vector3_func.cpp.

```
{
    return vec1 - vec2;
}
```

Referenced by Behavior::ClassSetup().

#### 4.21.2.5 length()

```
float Vector3_Func::length (
            const glm::vec3 vec )  [static]
```

Wrapper for the glm length function.

**Parameters**

| | |
|---|---|
| *vec* | Input vec3 |

**Returns**

float

Definition at line 62 of file vector3_func.cpp.

```
                                              {
    return glm::length(vec);
}
```

Referenced by Behavior::ClassSetup().

#### 4.21.2.6 normalize() `glm::vec3 Vector3_Func::normalize ( const glm::vec3 vec ) [static]`

Wrapper for the glm normalize function.

**Parameters**

| | |
|---|---|
| *vec* | Input vec3 |

**Returns**

glm::vec3

Definition at line 21 of file vector3_func.cpp.

```
                                                   {
    return glm::normalize(vec);
}
```

Referenced by Behavior::ClassSetup().

#### 4.21.2.7 zero_vec3() `glm::vec3 Vector3_Func::zero_vec3 ( ) [static]`

Creates a glm::vec3 filled with zeroes.

**Returns**

glm::vec3

Definition at line 52 of file vector3_func.cpp.

```
                                   {
    return glm::vec3(0.f, 0.f, 0.f);
}
```

Referenced by Behavior::ClassSetup().

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

- vector3_func.hpp
- vector3_func.cpp

# 5 File Documentation

## 5.1 behavior.cpp File Reference

```
#include <glm.hpp>
#include "behavior.hpp"
#include "engine.hpp"
#include "object.hpp"
#include "object_manager.hpp"
#include "physics.hpp"
#include "random.hpp"
#include "transform.hpp"
#include "vector3_func.hpp"
```

### 5.1.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-22

**Copyright**

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## 5.2 behavior.hpp File Reference

```
#include <vector>
#include <vec3.hpp>
#include <lua.hpp>
#include <sol/sol.hpp>
#include "component.hpp"
#include "file_reader.hpp"
#include "file_writer.hpp"
```

**Classes**

- class Behavior

### 5.2.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-06-22

**Copyright**

Copyright (c) 2021

## 5.3 camera.cpp File Reference

```
#include <glfw3.h>
#include <glm.hpp>
#include "editor.hpp"
#include "engine.hpp"
#include "graphics.hpp"
#include "camera.hpp"
#include "trace.hpp"
```

**Variables**

- static Camera ∗ camera = nullptr
  *Camera object.*

### 5.3.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

Copyright (c) 2021

## 5.4 camera.hpp File Reference

```
#include <utility>
#include <vec3.hpp>
#include "file_reader.hpp"
```

### Classes

- class Camera

### 5.4.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

Copyright (c) 2021

## 5.5 component.cpp File Reference

```
#include "component.hpp"
```

### 5.5.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

Copyright (c) 2021

## 5.6 component.hpp File Reference

### Classes

- class Component

### Typedefs

- typedef Component::CType CType

  *Typedef for CType (used in other files)*

### 5.6.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

Copyright (c) 2021

## 5.7 editor.cpp File Reference

```
#include <imgui.h>
#include "imgui_impl_glfw.h"
#include "imgui_impl_opengl3.h"
#include "imgui_internal.h"
#include "ImGuiFileDialog.h"
#include <vec3.hpp>
#include "camera.hpp"
#include "editor.hpp"
#include "engine.hpp"
#include "graphics.hpp"
#include "object_manager.hpp"
```

### Variables

- static Editor ∗ editor = nullptr
  *Editor object.*

### 5.7.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-07-14

**Copyright**

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## 5.8 editor.hpp File Reference

```
#include "behavior.hpp"
#include "object.hpp"
#include "model.hpp"
#include "physics.hpp"
#include "trace.hpp"
#include "transform.hpp"
```

### Classes

- class Editor

### 5.8.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-07-14

**Copyright**

Copyright (c) 2021

## 5.9 engine.cpp File Reference

```
#include <cmath>
#include <string>
#include "engine.hpp"
#include "graphics.hpp"
#include "object_manager.hpp"
#include "object.hpp"
#include "component.hpp"
#include "model_data_manager.hpp"
#include "physics.hpp"
#include "camera.hpp"
#include "editor.hpp"
#include "file_reader.hpp"
#include "random.hpp"
#include "texture_manager.hpp"
```

#### Variables

- static Engine ∗ engine = nullptr

    *Engine object.*

### 5.9.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-06-04

**Copyright**

Copyright (c) 2021

## 5.10 engine.hpp File Reference

```
#include <chrono>
#include <string>
#include <vec3.hpp>
```

### Classes

- class Engine

### 5.10.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-04

**Copyright**

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## 5.11 file_reader.cpp File Reference

```
#include <fstream>
#include <iostream>
#include <filereadstream.h>
#include "file_reader.hpp"
#include "trace.hpp"
```

### 5.11.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-04

**Copyright**

Copyright (c) 2021

## 5.12 file_reader.hpp File Reference

```
#include <string>
#include <document.h>
#include <vec3.hpp>
```

### Classes

- class File_Reader

### 5.12.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-04

**Copyright**

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## 5.13 file_writer.cpp File Reference

```
#include <fstream>
#include <iostream>
#include "file_writer.hpp"
#include "trace.hpp"
#include "transform.hpp"
```

### 5.13.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-07-27

**Copyright**

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## 5.14 file_writer.hpp File Reference

```
#include <string>
#include <vector>
#include <document.h>
#include <filewritestream.h>
#include <prettywriter.h>
#include <vec3.hpp>
#include "object.hpp"
```

#### Classes

- class File_Writer

### 5.14.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-07-27

**Copyright**

Copyright (c) 2021

## 5.15 graphics.cpp File Reference

```
#include <string>
#include <vector>
#include <cmath>
#include <glew.h>
#include <vec3.hpp>
#include <vec2.hpp>
#include <mat4x4.hpp>
#include <glm.hpp>
#include <gtc/matrix_transform.hpp>
#include <gtx/transform.hpp>
#include "engine.hpp"
#include "graphics.hpp"
#include "object_manager.hpp"
#include "model.hpp"
#include "transform.hpp"
#include "camera.hpp"
#include "editor.hpp"
#include "trace.hpp"
#include "shader.hpp"
```

### Variables

- static Graphics ∗ graphics = nullptr
  *Graphics object.*

### 5.15.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

Copyright (c) 2021

## 5.16 graphics.hpp File Reference

```
#include <utility>
#include <GL/gl.h>
#include <glfw3.h>
#include "file_reader.hpp"
```

### Classes

- class Graphics

### 5.16.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

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## 5.17 main.cpp File Reference

```
#include "trace.hpp"
#include "engine.hpp"
#include "graphics.hpp"
```

### Functions

- int main (int, char ∗[ ])
  *Main function.*

### 5.17.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-05-06

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### 5.17.2 Function Documentation

#### 5.17.2.1 main()

```
int main (
    int ,
    char * [ ] )
```

Main function.

**Returns**

int

Definition at line 22 of file main.cpp.

```
                        {
    // Initializing systems
  Trace::Initialize();
  if (!Engine::Initialize()) return -1;
    // Engine update loop
  Graphics::Update();

    // Shutting down systems
  Engine::Shutdown();
  Trace::Shutdown();

  return 0;
}
```

References Trace::Initialize(), Engine::Initialize(), Trace::Shutdown(), Engine::Shutdown(), and Graphics::Update().

## 5.18 model.cpp File Reference

```
#include <cstdio>
#include "object.hpp"
#include "model.hpp"
#include "model_data_manager.hpp"
#include "transform.hpp"
#include "texture.hpp"
#include "texture_manager.hpp"
#include "trace.hpp"
```

### 5.18.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-06-06

**Copyright**

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## 5.19 model.hpp File Reference

```
#include <vector>
#include <array>
#include <string>
#include <GL/gl.h>
#include "component.hpp"
#include "file_reader.hpp"
#include "file_writer.hpp"
#include "model_data.hpp"
#include "texture.hpp"
```

**Classes**

- class Model

### 5.19.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-06

**Copyright**

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## 5.20 model_data.cpp File Reference

```
#include <cstdio>
#include <cstring>
#include <glew.h>
#include <glm.hpp>
#include <gtc/matrix_transform.hpp>
#include <gtx/transform.hpp>
#include "engine.hpp"
#include "model.hpp"
#include "model_data.hpp"
#include "trace.hpp"
#include "shader.hpp"
```

### 5.20.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-06

**Copyright**

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## 5.21 model_data.hpp File Reference

```
#include <vector>
#include <array>
#include <string>
#include <vec3.hpp>
#include <vec2.hpp>
#include <mat4x4.hpp>
#include <GL/gl.h>
#include "transform.hpp"
```

### Classes

- class Model_Data

### 5.21.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-06-06

**Copyright**

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## 5.22 model_data_manager.cpp File Reference

```
#include "model_data_manager.hpp"
#include "trace.hpp"
```

### Variables

- static Model_Data_Manager ∗ model_data_manager = nullptr

  *Model_Data_Manager object.*

### 5.22.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-06

**Copyright**

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## 5.23 model_data_manager.hpp File Reference

```
#include <vector>
#include <string>
#include "model_data.hpp"
#include "file_reader.hpp"
```

#### Classes

- class Model_Data_Manager

### 5.23.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-06

**Copyright**

Copyright (c) 2021

## 5.24 object.cpp File Reference

```
#include "object.hpp"
#include "behavior.hpp"
#include "model.hpp"
#include "object_manager.hpp"
#include "physics.hpp"
#include "transform.hpp"
#include "file_reader.hpp"
```

### 5.24.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

Copyright (c) 2021

## 5.25 object.hpp File Reference

```
#include <unordered_map>
#include <string>
#include "component.hpp"
#include "trace.hpp"
```

**Classes**

- class Object

### 5.25.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

Copyright (c) 2021

## 5.26 object_manager.cpp File Reference

```
#include <string>
#include "behavior.hpp"
#include "object_manager.hpp"
#include "trace.hpp"
#include "transform.hpp"
```

#### Variables

- static Object_Manager * object_manager = nullptr

  *Object_Manager object.*

### 5.26.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

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## 5.27 object_manager.hpp File Reference

```
#include <vector>
#include "object.hpp"
#include "file_reader.hpp"
#include "file_writer.hpp"
```

#### Classes

- class Object_Manager

### 5.27.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

Copyright (c) 2021

## 5.28 physics.cpp File Reference

```
#include <cmath>
#include <glm.hpp>
#include "engine.hpp"
#include "object_manager.hpp"
#include "object.hpp"
#include "physics.hpp"
#include "transform.hpp"
```

### 5.28.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

Copyright (c) 2021

## 5.29 physics.hpp File Reference

```
#include <vec3.hpp>
#include "component.hpp"
#include "file_reader.hpp"
#include "file_writer.hpp"
```

#### Classes

- class Physics

### 5.29.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

Copyright (c) 2021

## 5.30 random.cpp File Reference

```
#include "random.hpp"
#include "trace.hpp"
```

#### Variables

- static Random $*$ random = nullptr

  *Random object.*

### 5.30.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-07-13

**Copyright**

Copyright (c) 2021

## 5.31 random.hpp File Reference

```
#include <random>
#include <vec3.hpp>
```

#### Classes

- class Random

### 5.31.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-07-13

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## 5.32 shader.cpp File Reference

```
#include <fstream>
#include <glew.h>
#include "shader.hpp"
#include "trace.hpp"
```

#### Variables

- static Shader ∗ shader = nullptr

  *Shader object.*

### 5.32.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-19

**Copyright**

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## 5.33 shader.hpp File Reference

```
#include <string>
#include <GL/gl.h>
#include "file_reader.hpp"
```

### Classes

- class Shader

### 5.33.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-06-19

**Copyright**

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## 5.34 texture.cpp File Reference

```
#include <glew.h>
#include "shader.hpp"
#include "texture.hpp"
#include "trace.hpp"
```

### Macros

- #define FOURCC_DXT1 0x31545844

  *Equivalent to "DXT1" in ASCII.*
- #define FOURCC_DXT3 0x33545844

  *Equivalent to "DXT3" in ASCII.*
- #define FOURCC_DXT5 0x35545844

  *Equivalent to "DXT5" in ASCII.*

### 5.34.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-07-14

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## 5.35 texture.hpp File Reference

```
#include <string>
#include <GL/gl.h>
```

**Classes**

- class Texture

### 5.35.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-07-14

**Copyright**

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## 5.36 texture_manager.cpp File Reference

```
#include "texture_manager.hpp"
#include "trace.hpp"
```

### Variables

- static Texture_Manager ∗ texture_manager = nullptr

  *Texture_Manager object.*

### 5.36.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-07-14

**Copyright**

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## 5.37 texture_manager.hpp File Reference

```
#include <string>
#include <vector>
#include "file_reader.hpp"
#include "texture.hpp"
```

### Classes

- class Texture_Manager

### 5.37.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-07-14

**Copyright**

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## 5.38 trace.cpp File Reference

```
#include <iostream>
#include <cstdarg>
#include "trace.hpp"
```

**Variables**

- static Trace ∗ trace = nullptr

  *Trace object.*

### 5.38.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

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## 5.39 trace.hpp File Reference

```
#include <string>
#include <fstream>
```

### Classes

- class Trace

### 5.39.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

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## 5.40 transform.cpp File Reference

```
#include "transform.hpp"
```

### 5.40.1 Detailed Description

**Author**

Kelson Wysocki ( `kelson.wysocki@gmail.com`)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

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## 5.41 transform.hpp File Reference

```
#include <vec3.hpp>
#include "component.hpp"
#include "file_reader.hpp"
#include "file_writer.hpp"
```

**Classes**

- class Transform

### 5.41.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-06-05

**Copyright**

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## 5.42 vector3_func.cpp File Reference

```
#include "vector3_func.hpp"
```

### 5.42.1 Detailed Description

**Author**

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**Version**

0.1

**Date**

2021-07-26

**Copyright**

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## 5.43 vector3_func.hpp File Reference

```
#include <glm.hpp>
#include <vec3.hpp>
```

### Classes

- class Vector3_Func

### 5.43.1 Detailed Description

**Author**

Kelson Wysocki ( kelson.wysocki@gmail.com)

**Version**

0.1

**Date**

2021-07-26

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