

# Marbulous

This document describes the most important things that were changed between the second submission until the last submitted version of the day of the game event (June 28<sup>th</sup>, 2016).

The documentation of the second submission (doc2.pdf) is still current for the most part but was not altered in any way.

## Off-Screen MSAA

Off-Screen multisample anti-aliasing was implemented. This was implemented by binding two multisample textures as color attachments to a framebuffer and a multisample renderbuffer for depth values. To enable sampling the usual framebuffer was used to "blit" the textures. To blit both color buffers the second was temporarily bound to the first which was undone afterwards for every render pass.

## Text Output

Text rendering was implemented. To achieve this the FreeType library was used. Time, optionally a record and level name will be rendered by default. By pressing F1 the Help screen is shown which also includes a line for debug output. Any changes to the graphics pipeline by pressing F2 - F10 will now also be printed to the text output if the help screen is active.

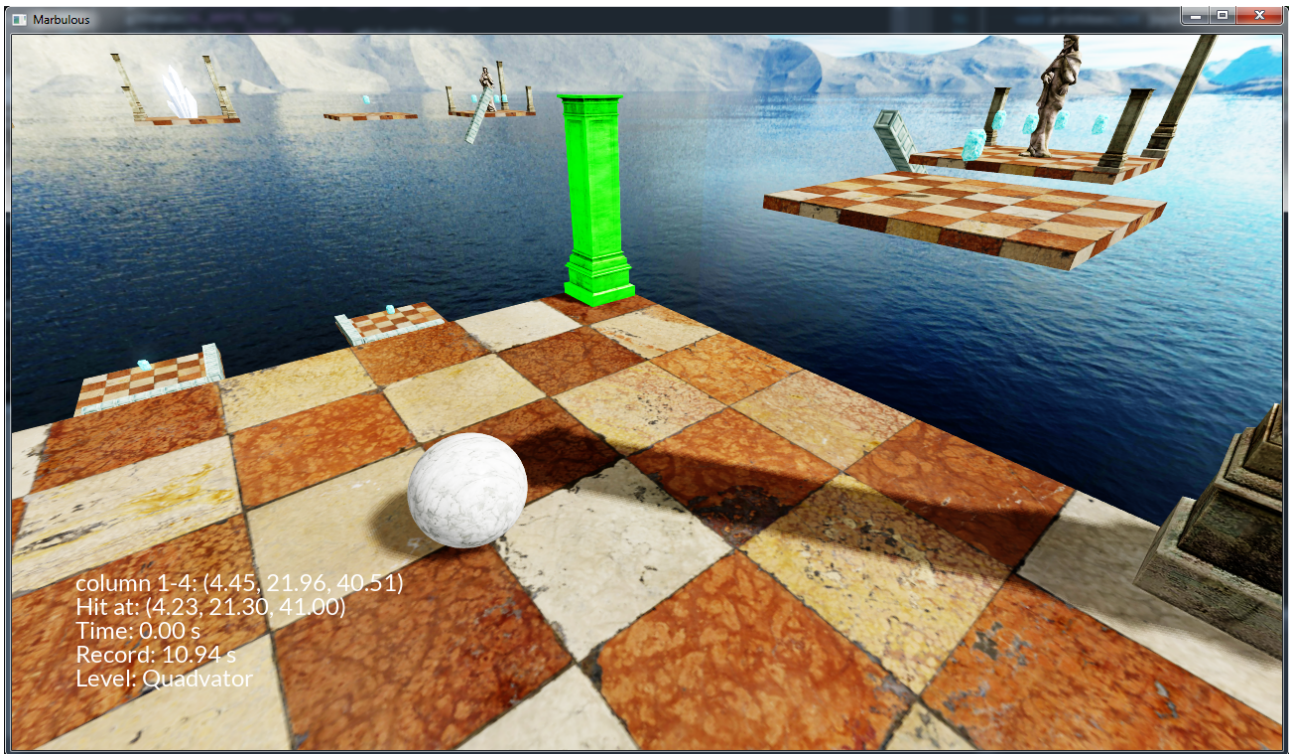
## Level Editor

Basic level editing functionality was implemented. To access it you must switch to third person mode by pressing 'F' and unlock the mouse by pressing 'LCtrl'. In this mode you can control the camera in first person (as in the last submission). You can also left-click any game object which selects it. The selected object will be colored green to indicate the selection.

The object will be determined by raycasting via Bullet. The position of the selected object as well as the exact position of the raycast hit will be printed to the console and text output. This is very helpful when positioning items by editing level JSON-files.

When an object is selected position, rotation and scale can also be manipulated with the numpad keys:

- 4, 6: X-Axis
- 8, 2: Z-Axis
- 7, 1: Y-Axis
- 9, 3: XYZ-Axes
- Hold 0: rotation instead of position
- Hold 5: scale instead of positioning



With this system and the flexible and simple level format it is relatively easy to create new levels. No source changes are needed. New models can be used by exporting them to obj-format with any 3D software.

## New Levels

New levels were added and old ones were polished. Currently the game has six levels in which you can compete against the timer. Feel free to create your own levels. ;-)

## Config File

A comprehensive configuration file was implemented with JSON. It lies in the root folder of the executable and is called config.json. This file specifies a lot of variables of the game which manipulate the rendering pipeline, change physics parameters of the game and define resource paths and audio files. It also includes a joystick configuration which can be changed if the current joystick layout does not fit. The default configuration was implemented for a PlayStation 4 Joypad. Joystick support can also be deactivated completely.

Many parameters can be manipulated at runtime and reloaded by pressing 'Backspace'. Most changes will affect the game immediately, some after a level change and some other after a restart of the game.

## Small stuff

New sounds were added and rebalanced. The player jump height is now dynamic. If you hold the jump key/button longer you jump higher.

## New collision shape

A new collision shape was added: "convex". This generates an arbitrary convex shape out of the mesh data. It uses the btConvexHullShape of Bullet. This shape should only be used for static or kinematic objects (with mass of 0). For dynamic objects it can lead to unexpected behavior.

When the model has a lot of vertices it is recommended to set the "vertex-reduce" flag which is active by default. This causes the game to calculate a minimalistic convex shape out of the mesh data which makes collisions faster to calculate but the models may take longer to load. The "vertex-reduce"-Flag can be changed globally in the configuration file or on a per object basis in the level files.

## Controls

Most controls are the same, some have changed and some are new:

- Player (Third Person)
  - WASD/Arrow keys: move in the given direction
  - Space/Right Ctrl: jump
  - Mouse: change orientation
  - Mouse wheel/Page up/down: change distance from player
- System
  - Ctrl: unlock the mouse
  - Escape: Close the game
  - Num1 – Num0: load level 1 to 10
  - R: reload shaders
  - C: clear models (reloaded at next level change)
  - P: Pause
  - Backspace: Reload configuration file
  - Divide: show Bullet debug drawer
  - Multiply: show blurred texture
- F: first person camera
  - WASD: move around
  - Mouse: look around
  - Space/Right Ctrl: Move up
  - X/Right Shift: Move down
  - Left Shift: Move faster
  - Left-click: Select game object
  - Right-click: Deselect game object
- Audio
  - Return: next song
  - Insert: Sound volume +10 %
  - Delete: Sound volume -10 %
  - Home: Music volume +10 %
  - End: Music volume -10 %
  - M: mute audio

The joystick has the same actions on multiple buttons to counteract different controller layouts. The layout can be changed in the configuration file config.json. The default layout is optimized for a PlayStation 4 joy pad.

- Third person:
  - Left stick: Move player
  - Right stick: move camera
  - Button 0, 1, 4, 5: jump
  - Shoulder triggers: Zoom it/out
- Button 9: restart level
- Button 3: Pause
- Button 2: Exit
- Button 8: switch to first person camera
  - Left stick: move camera
  - Right stick: look around
  - Shoulder triggers: move up/down