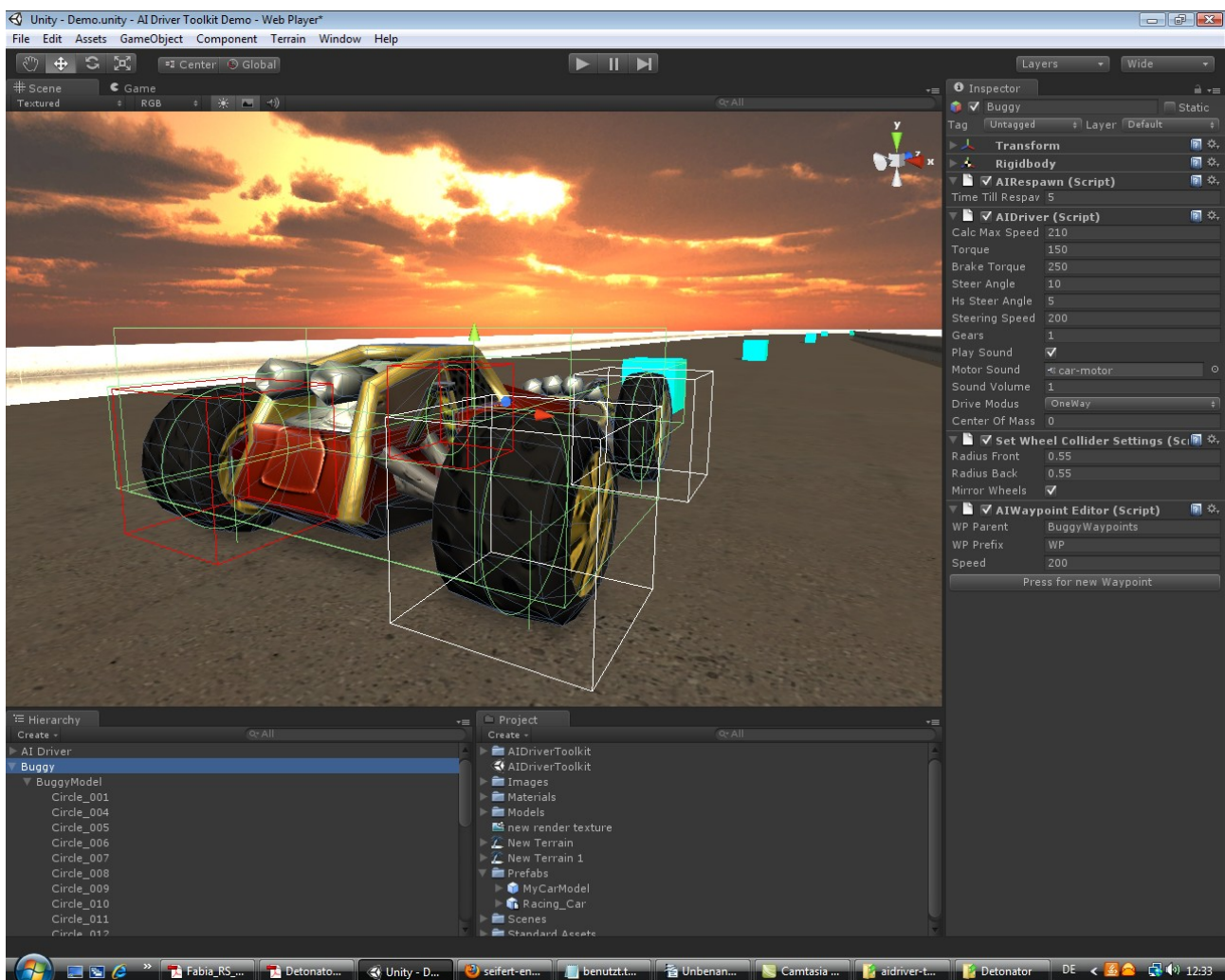


AI Driver Toolkit V3

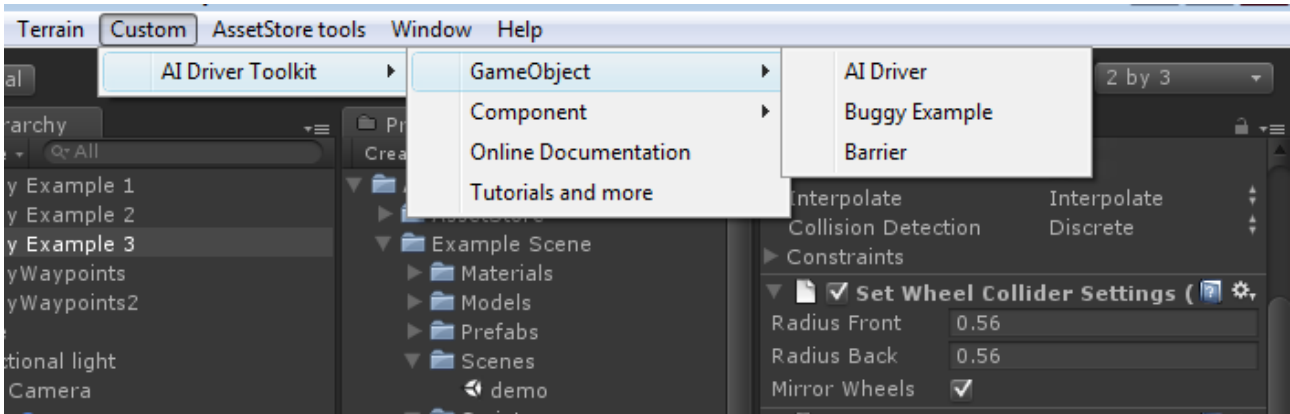
Create races against NPCs or animate cars and other vehicles in your urban games. The AI Driver Toolkit brings life into your game by giving your vehicle models artificial intelligence.

It supports two driving behaviours: Waypoints and Obstacle Avoidance.



Getting Started

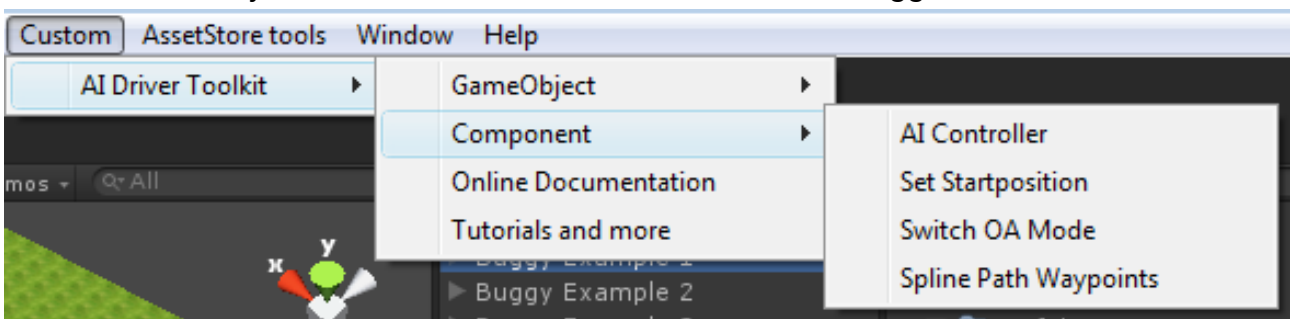
After importing and extracting the AI Driver Toolkit unitypackage there appears some new menu buttons in the GameObject menu.



The „AI Driver“ object is the main object of the toolkit. It's the base to create your own AI controlled vehicle.

The second object is the buggy object. It's a pre defined example car, where you can see how does the toolkit works. For a quick start or for prototyping the buggy object should be the right decision.

If you want to make wilderness race including using the Obstacle Avoidance controlling, you need invisible barriers. With menu „Barrier“ you create invisible cubes with trigger collider to define the racing way. For testing you can make them visible or you can make real colliders instead of trigger collider.



The Components

AI Controller

The component Bundel „AI Controller“ includes all components to add AI behaviour to vehicles which needs other vehicle controllers like Edy's vehicle physics or the Unity Car Tutorial.

Set Startposition

The script „Set Startposition“ let start the vehicle on a defined waypoint instead of the position where the vehicle will be manually placed. For using add this script to your ai vehicle and set „Start Waypoint“ to the array number of your waypoint. If you want to spawn your object over the original waypoint position, change „Height Offset“.

SwitchOAMode

The script „SwitchOAMode“ switchs the „Use Obstacle Avoidance“ parameter. For using this: Add this script to an object which has an trigger collider. For example: Create a cube, deactivate „Mesh Renderer“ and activate the „Is Trigger“ parameter of the Box Collider. Assign „Ignore Raycasts“ Layer to the object. Then you can add „SwitchOAMode“, define the destination value of „Use Obstacle Avoidance“ and define by the tag which vehicles have to react. Position this cube in the way, where the vehicle has to drive.

Spline Path Waypoints

The script „Spline Path Waypoints“ replace the linear way between your waypoints by a spline path. You need much more less waypoints in your game (see the picture below).

Hint: Because of this the component is usefull in „waypoint mode“ AND in using the „obstacle avoidance mode“.



Add this component to your AI car if you want to get spline path instead of a straight path. If you have more cars which use the same waypoints, add this script only to one car!

Explanation: When the game starts the script adds new waypoints for defining the spline. E.g. waypoints added between wp_1 and wp_2 will get the properties of wp_1.

Steps

How smooth have to be the spline (how much waypoints will be created between the pre defined waypoints).

Loop

If you are using „Drive Mode“ „Laps“ please activate this parameter, too.

Color

The color of the spline

Active

If you want to deactivate this component, use these parameters instead of deactivating the main component check box.

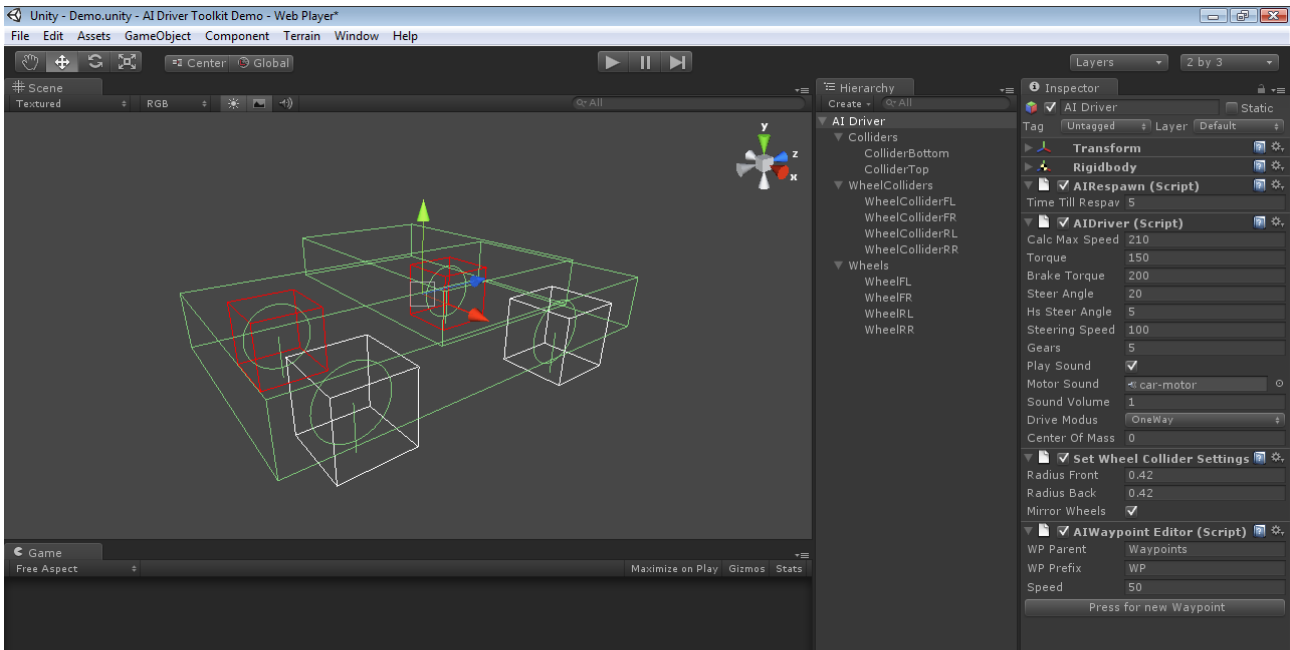
Show

Show the created waypoints during game play. (good for testing and optimizing your game)

The AI Driver Object

An AI Driver object is made of different objects. These are:

- **Colliders:** For detecting collisions of your vehicle. Don't change the main folder! You can change the positions and the sizes of the sub objects „ColliderBottom“ and „ColliderTop“ to adjust them to the body of your vehicle model.
- **WheelColliders:** Don't change the main folder! You can change all parameters of the sub objects to tweak the drive behaviour except the radius and the transform properties. These properties will be set by the „Wheel Collider Settings“-Editor.
- **Wheels:** These are containers for the visual wheel models of the vehicle model. Don't change the main folder! Position the wheel models in the center of each sub object. For more information see below „Create a new AI vehicle“.
- **ViewPoint:** This object is used when „Use Obstacle Avoidance“ is active. All front raycasts are sent from this point. You can change the height only.
- **ViewPointCollider:** This object is used when „Use Obstacle Avoidance“ is active. It's for detecting collision in front of the raycast. Position and size will be automatically set.



AI Driver Controller - Editor

These are the parameters of the AI Driver - Editor, which declares the driving behaviours.

Hs Steer Angle

The „HighSpeed Steer Angle“ describes the maximum steer angle when the vehicle has reached the Calc Max Speed.

Caution: Be sure that „Hs Steer Angle“ is lower than „Steer Angle“!

Steering Speed

This parameter controlled how fast wheels reaches the caculated steer Angle (see above „Steer Angle“). A high value causes a fast turning of the steering wheel.

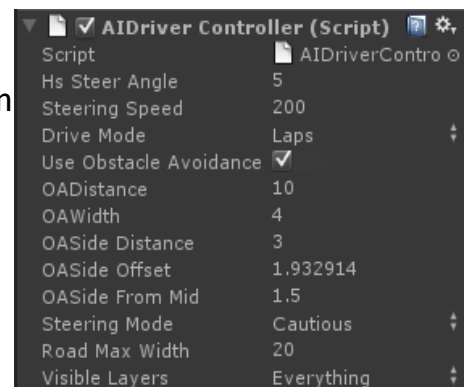
Caution: A high „Steering Speed“ could overturns the vehicle in curves!

Drive Mode

If you want to drive from a start point to an end point choose „One Way“. If you want to drive loops choose „Laps“.

Steer Absolute

When „Use Obstacle Avoidance“ is activated by default AI steers dependent on



the distance to the barriers. If you activate „Steer Absolute“ Ai tries to steers always the current max steer angle. Normaly this parameter is deactivated.

Use Obstacle Avoidance

There are two options to control the vehicle. The first option is the controlling by waypoint. The AI needs waypoints to drives from waypoint to waypoint.

The second option is controlling by Obstacle Avoidance. The Ai needs colliders which defines the road. The AI detects the left and right colliders (see below) and drives along the road.

Hint: Both options needs waypoints which defines the speed areas and respawn points. But the second option need more less waypoints then the first.

OADistance

The length of the front raycasts (green lines).

OAWidth

How wide the front side raycasts goes to the sides (blue lines)

OA Side Distance

The length of the side raycasts (mangenta lines).

OASide Offset

If you add AI Components to an none AI Driver Object, you can change the distance of the side - raycasts from the middle. Normaly the distance will be automaticly calculated to the bottom collider.

OASide From Mid

Distance between the sidely raycasts from the center.

Steering Mode

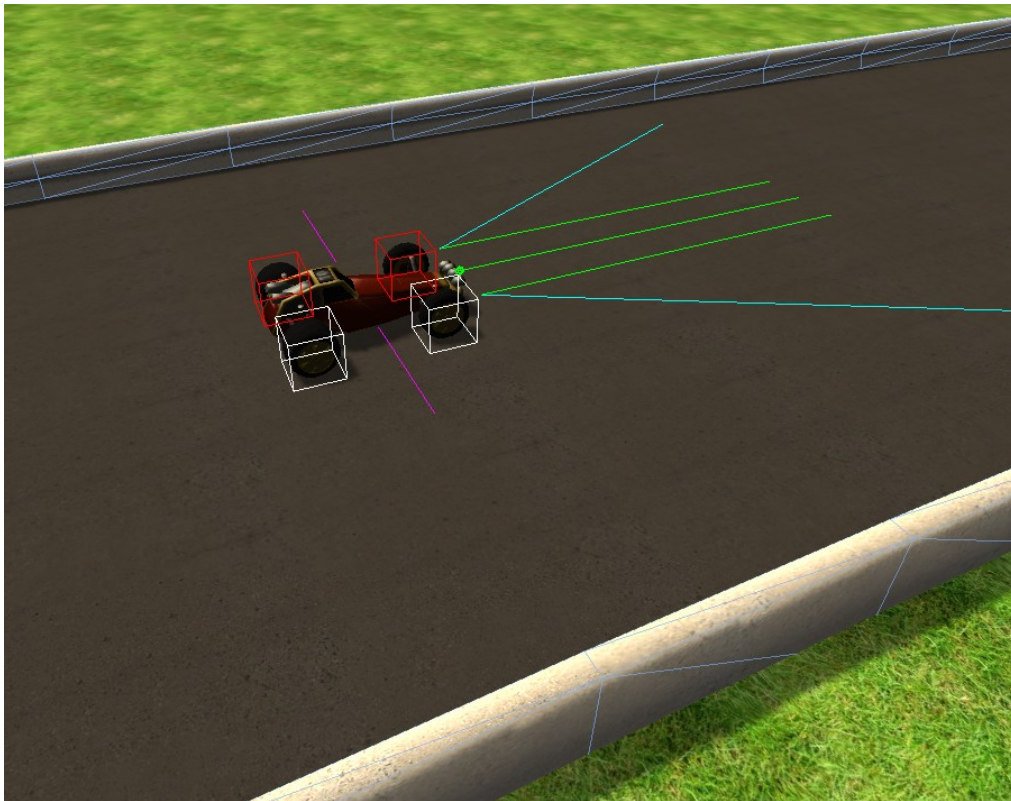
Defines the behaviour when the AI vehicle drives beside another vehicle. If you need a dominate vehicle, choose „Tough“. If you want a cautious vehicle, choose „Cautious“.

Road Max Width

Please set the maximum width of the road to this parameters. It descript the maximum distance between the vehicle AI and waypoint, when it pasts a waypoint.

Visible Layers

If you want that AI has to ignore additional layers, deactivate them in this list.



AI Driver Motor - Editor

Max Speed

This is the the base of calculate the motor sound and the steer angles.

Torque

The torque for your vehicle accelaration. The vehicle is moved by the front wheels.

Brake Torque

It's the brake torque of your front wheels.

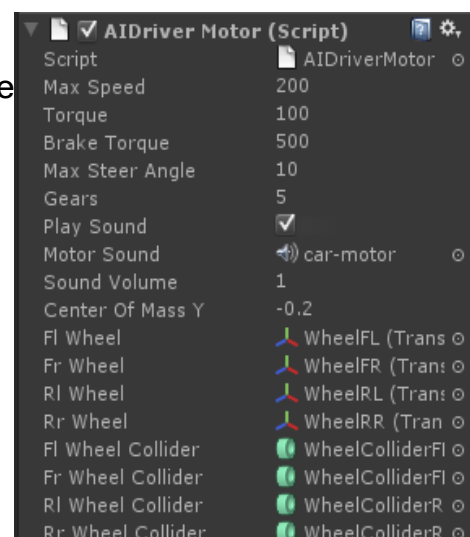
Max Steer Angle

This parameter is the maximum steer angle when you drive very slow. The real steer angle depends on the „Steer Angle“, the „Hs Steer Angle“, the „Calc Max Speed“ and the current speed.

Caution: A high „Steer Angle“ could overturns the vehicle in curves!

Gears

The number of gears. If you deactivate the motor sound“ this parameter is not



important.

Play Sound

Activate or deactivate the motor sound“.

Motor Sound

The sound file for the motor sound.

Sound Volume

The volume of the motor.

Center of Mass

If you have problems to stabilize your vehicle, you can change the position of the Object „Center of Mass“ in your AI Driver Object.

Wheel Collider Settings - Editor

Some WheelCollider- and wheel-Parameters are controlled by this special editor.

Radius Front

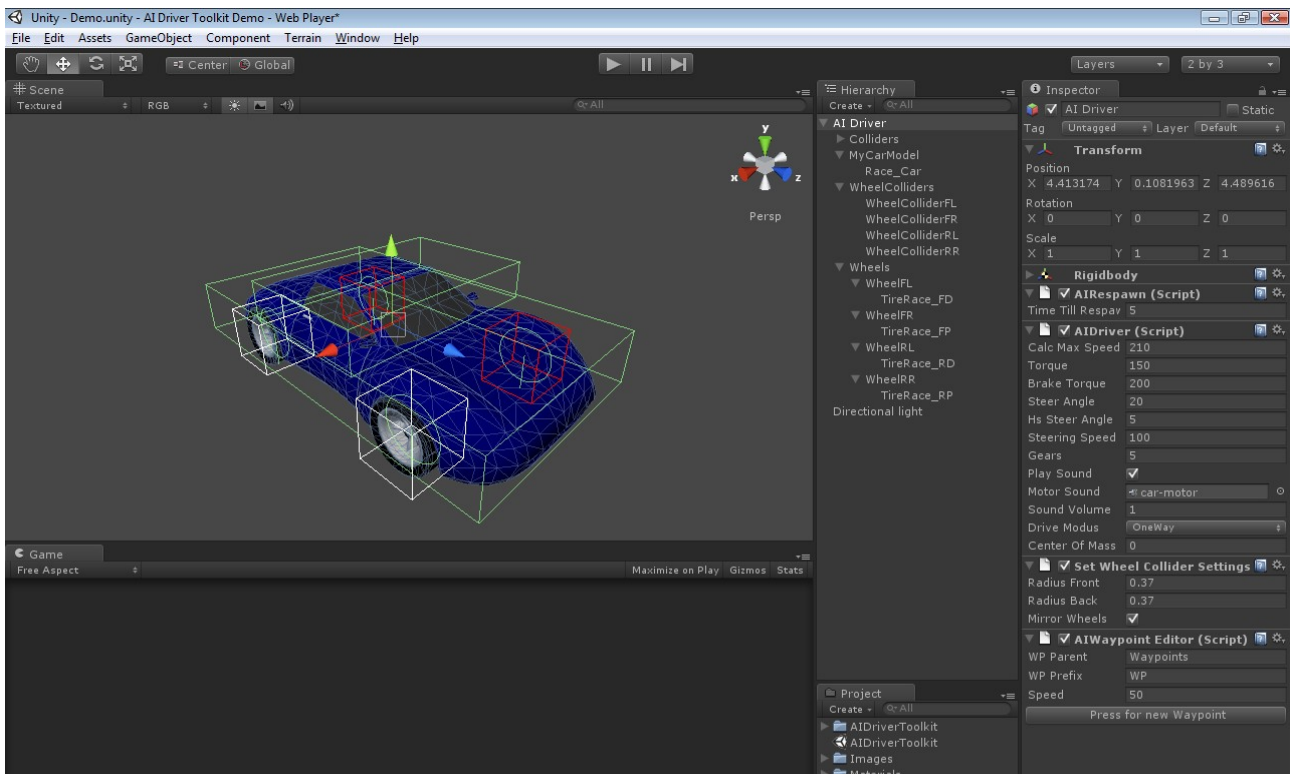
Define radius of the two front WheelColliders.

Radius Back

Define radius of the two rear WheelColliders.

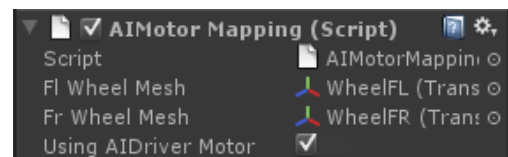
Mirror Wheels

Mirror the positions of the WheelColliders and the visual wheel objects. The leading wheels are the wheels on the right side. The moveable object appears in white cubes by selecting the AI Driver object.



AI Motor Mapping - Editor

This Editor is mostly important, when you are using additional vehicle physics like Edy's or Unity's Car Tutorial Scripts.



Fl Wheel Mesh

Drag the left front wheel mesh of the vehicle into this slot.

Fr Wheel Mesh

Drag the right front wheel mesh of the vehicle into this slot.

Using AIDriver Motor

If you're using additional vehicle physics like Edy's deactivate this parameter.

Hint: If you're using other vehicle physics, you will see raycasts only when you assign the wheel meshes to this slots!

AI Respawn Controller - Editor

Every AI Driver object has it's own respawn system.

Time Till Respawn

The Respawn System measure the timespan between every waypoint. If the timespan higher than this parameter the vehicle will be respawn.

AI Waypoint - Editor

The AI Waypoint Editor creates the waypoints for this object.

WP Parent

The parent object of the waypoint which will be created.

Caution: If you have more than one AI Driver objects in the scene, please note that no multiple objects have the same „WP Parent“ and „WP Prefix“.

WP Prefix

This is the prefix of your waypoint names.

Caution: By starting the game at first the AI Driver object drives to the XXX_1 object. If you change the prefix after creating the waypoints, you could get a problem ;)

Speed

Every waypoint defines the current maximum speed of the AI Driver object. If it drives slower the vehicle accelerate, if it's too fast the vehicle brakes (see above the AI Driver parameters).

Batch Creating

If you activate this parameter, you add by every click into the scene a new waypoint until you deactivate this parameter.

ShowRaycast

For find the right parameter settings for Obstacle Avoidance, you can look watch to the raycasts of the AI.

Show

If it activated, the raycasts will be shown in the scene editor while playing.

AI Waypoint

Every waypoint has a AI Waypoint script.

Speed

Define the new max speed for your vehicle. The vehicle tries to reach this speed in a short time by accelerating or breaking.

Use Trigger

If you deactivate „Use Obstacle Avoidance“, the AI drives from waypoint center to waypoint center. The size of the waypoint will be ignored. If you activate this parameter and change the size, the AI switch his target waypoint as soon as it collides with the waypoint - the size has now influence! Often this can be very

helpful when using „Controlling by waypoints“ (deactivate „Use Obstacle Avoidance“).

Draw Line to Next

This component shows connection lines between the waypoints. Please change only the values from waypoint „1“ (e.g. „WP_1“) of a waypoint group. A Waypoint Group are all waypoints with same prefix and same parent.

Show

If you activate this parameter the connection lines will be drawn while the Edit mode. The value will be inherited to all other waypoints of this waypoint group.

How AI controls vehicles

AI Driver Toolkit is created for vehicles, which have to drive defined ways.

There are two options how the AI find the right way:

1. Obstacle Avoidance (activate "Use Obstacle Avoidance")
2. Waypoints (deactivate "Use Obstacle Avoidance")

First case: The AI use raycasts which detects the road limits (like walls). Where If the AI find no limits it try to drive this direction. So the whole road needs these limits. Hint: You can use invisible limits like BoxColliders with activated IsTrigger parameters. So the player can't see them.

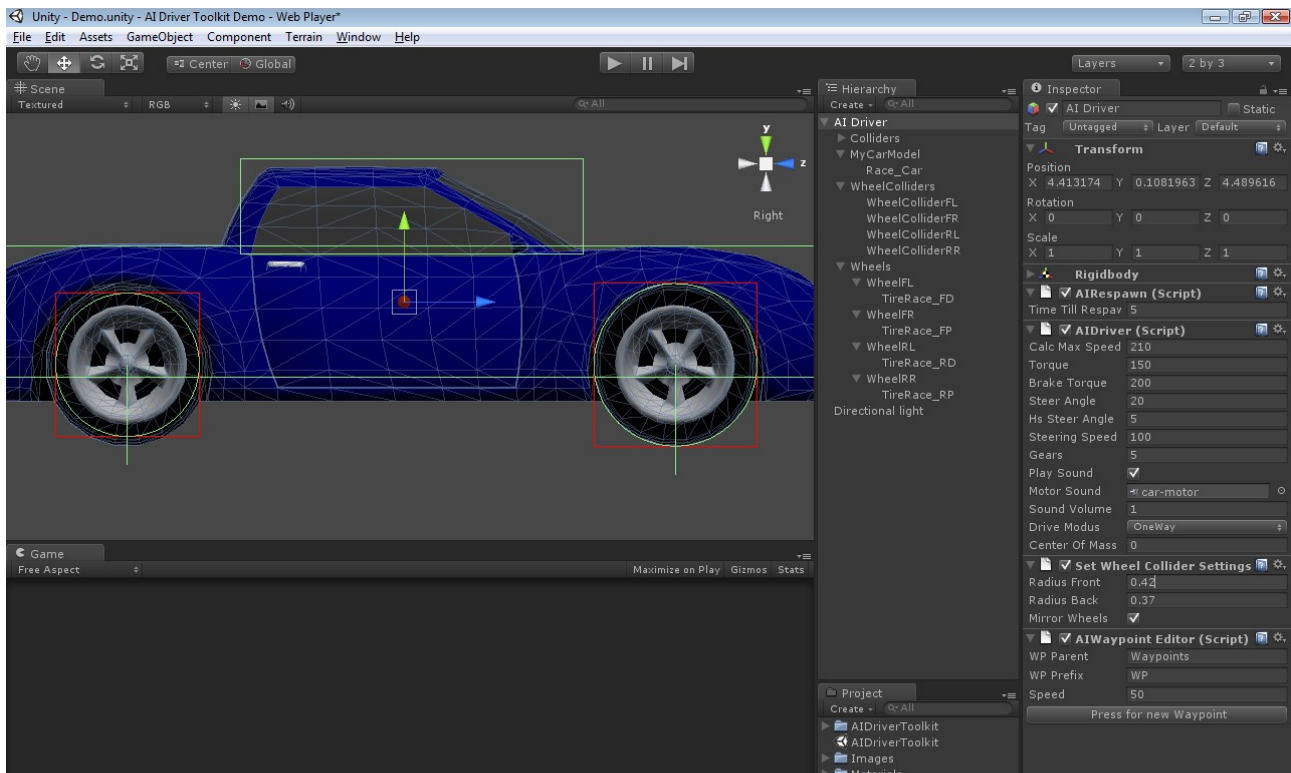
Second case: The controlling works with waypoints: The AI drives from waypoint to waypoint. If you want vehicles, which drives a hard defined way, this is the better option.

Caution: Both cases use waypoints for defining the speed of the car and for respawning. The difference is that you need more less waypoints in Obstacle Avoidance than using the Waypoint- Controlling.

Create a new AI Vehicle

In this chapter I describe how to combine your own 3D Model and the AI Driver Toolkit to create a new AI controlled vehicle.

- 1) Drag the 3D model to the AI Driver object.
- 2) Positioned it nearly the center. It's good if the wheels have a similar position like the pre positioned WheelColliders (the green cyrcles) of the AI Driver object.
- 3) Adjust the colliders.
- 6) Drag the wheel models into wheel containers (the left wheel model into the WheelFL object etc.) and positioned them into the center.
- 7) Activate „Mirror Wheels“ and placed the wheels by draging the containers of the right wheels to the correct positions. The left wheels will automatically placed.
- 8) Adjust the size of the WheelColliders by changing the „Radius Front“ and „Radius Back“ parameters in the „Wheel Collider Settings“.



Creating routes - Using the Waypoint Editor

To define the route of an AI Driver object, you have to use the AI Waypoint Editor.

- 1) If you use more than one AI Driver object in the scene define a new unique „WP Parent“ (or do the second point). This is the name of the parent object where all waypoints of this AI Driver object will be placed.
- 2) If you use more than one AI Driver object in the scene define a new unique „WP Prefix“ (or do the first point). This is the prefix of every waypoint you create for this AI Driver object.
- 3) Define the speed for the next waypoint (you can change the speed of each waypoint manually in the inspector).
- 4) Click the Waypoint Editor button (the text switch from „Press for new Waypoint“ to „Right Click in Scene View“)
- 5) Click by your right mouse button into the scene view where the new waypoint have to be placed.
- 6) Repeat step 3 to 5...
- 7) Choose the correct „Drive Modus“ in the AI Driver Editor. If you want to drive from a start point to an end point choose „One Way“. If you want to drive loops choose „Laps“.

Using Obstacle Avoidance

To define the route of an AI Driver object, you need some colliders for limiting the road and the AI Waypoint Editor for defining speed areas and respawn points.

- 1) Activate „Use Obstacle Avoidance“
- 2) Define waypoints like above, but you don't need so much waypoints like above . *Hint: The waypoints will be used only for controlling the speed of the AI and for defining respawning positions!!!*
- 3) Define your road with colliders (e.g. BoxCollider) which are on both sides of the road.
- 4) Set your Obstacle Avoidance parameters. *Caution: The height of your ViewPoint has to be lower than the height of your Colliders!*
- 5) Go!

Using the separate AI and other vehicle physics

AI Driver toolkit allows you to combine the AI with other vehicle physics. In this case, the AI works like a player who makes input for steering and accelerating from -1 to 1. The AI Motor Mapping is responsible for mapping the AI and the vehicle physics. AI Driver Toolkit has two examples already for demonstrating how this combining could work.

Unity's Car Tutorial

- 1) Have a look into „AI Driver Toolkit“ → “Scripts“ → “Additional“. There is a script called „Car-Modified“. This is a copy of the Car-Script of the tutorial including some modifications. Please copy all modifications from that script into the car script. All modifications are marked with "AI Driver Toolkit modification".
- 2) Select your vehicle (which includes already the tutorial car behaviours) and add „AI Controller“ (see above „Getting Started“).
- 3) Drag the front wheels of the vehicle to the slots FLWheelMesh, FRWheelMesh of AI Motor Mapping.
- 4) Have a look to „AI Driver Toolkit“ → “Scripts“ → AIMotormapping -Script. Please activate all c# lines which are between „//Unity Car Tutorial -B“ and

„//Unity Car Tutorial -E“

- 5) Create a folder called "Plugins" and move the folder „Javascrpts“ from the tutorial ("Scripts"-->"Javascrpts") into „Plugins“.
- 6) Design your AI like above.

Edy's Vehicle Physics

- 1) Select your vehicle (which includes already the tutorial car behaviours) and add „AI Controller“ (see above „Getting Started“).
- 2) Drag the front wheels of the vehicle to the slots FLWheelMesh, FRWheelMesh of AI Motor Mapping.
- 3) Have a look to „AI Driver Toolkit“ → “Scripts“ → AIMotormapping -Script. Please activate all c# lines which are between „//Edy's -B“ and „//Edy's -E“
- 4) Create a folder called "Plugins" and move the folder „EdyVehiclePhysics“ into „Plugins“.
- 5) Design your AI like above.

Contact

No application is perfect and every tool has bugs. So if you find problems or have some ideas to optimize this tool, you can contact me at hummelwalker@seifert-ing.de or Twitter [@hummelwalker](https://twitter.com/hummelwalker).