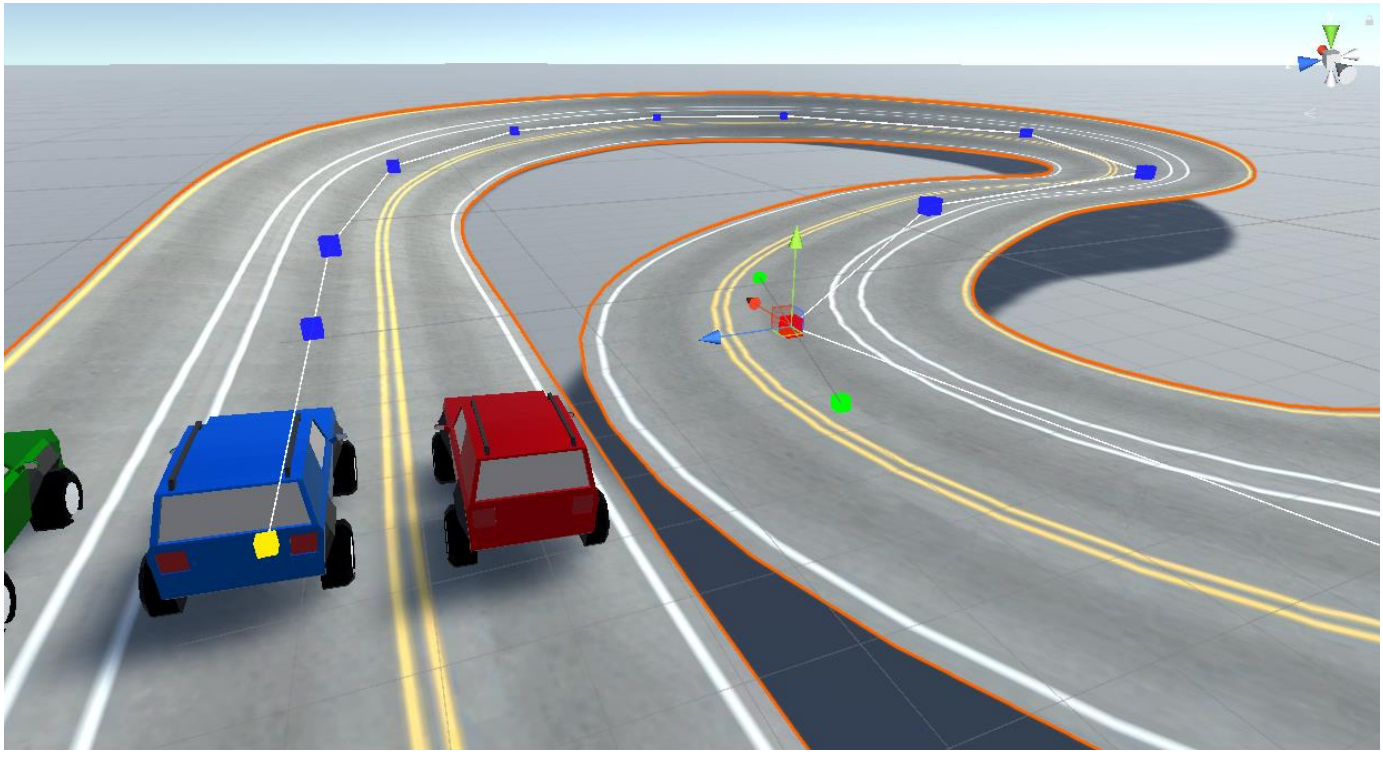
Spline Studio is a **fully featured Spline creation and edition tool** that allows creating splines in seconds, with a friendly and easy to use interface, perfectly integrated in Unity.

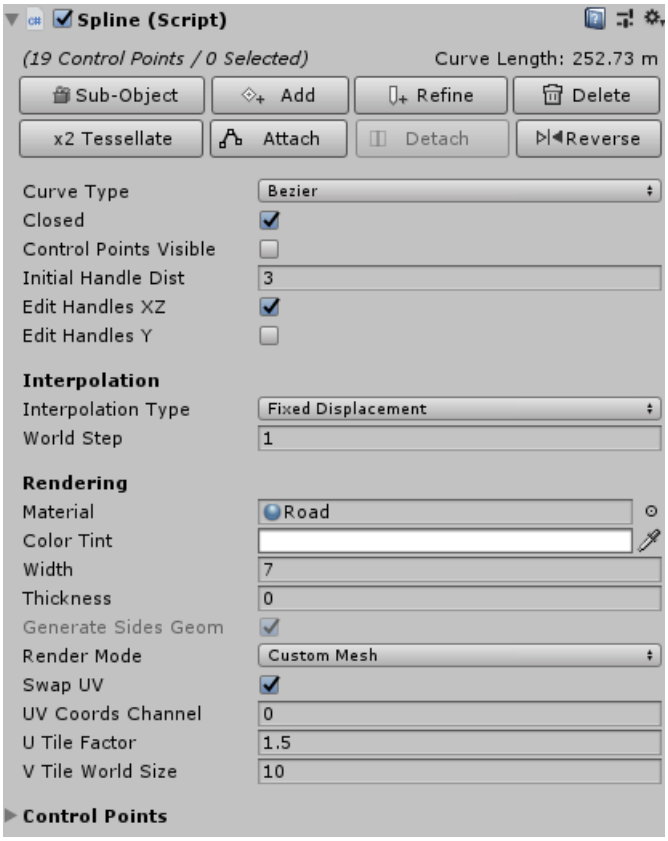
Features

- Supports **open & closed Linear, Hermite, Bézier and Catmull Rom** curves
- Fully customizable interpolation mode to control the level of detail
- **Visual editing tools**, integrated in Unity's Editor to have full local control of splines and individual control points
- Support for control point's **Camber or Tilt**
- **Full Undo** support
- Customizable **width and thickness**
- Full control on materials, color and UV texture coordinates
- Compatible with Unity's Line Renderer, and optionally offering a customizable Mesh Renderer that supports even more features (including mesh Offset)
- The built-in Spline Controller component allows moving GameObjects along splines, and animate them using the Unity's animation system or an automatic walking mode.
    - **Motion Smoothing/Damping** included
    - **Several automatic orientation** modes
    - Supports **position and rotation offset**
    - Automatic walking included, with customizable **speed units and loop modes**
    - **Milestone System** to trigger events when control points are reached
- **Full source code included**



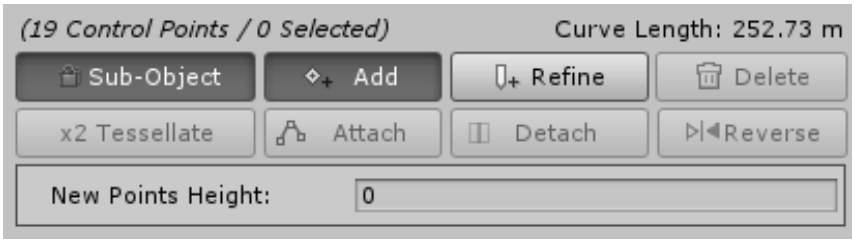
Spline Component

The Spline component is the one responsible of creating and editing splines. You can add it to any empty (or not) GameObject, and it will allow you start creating control points immediately.



Adding Control Points

To start adding control points, simply click on the *Add* button, and start clicking on the scene view to add them:

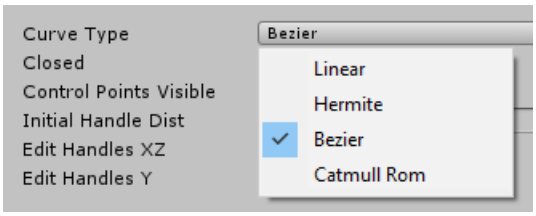


When the Add mode is active, a parameter called **New Points Height** appears, to allow you specifying the height of the new points created.

Types of Curves

Once your curve has two or more Control Points, it will be rendered in the Scene View (depending on render settings, see below).

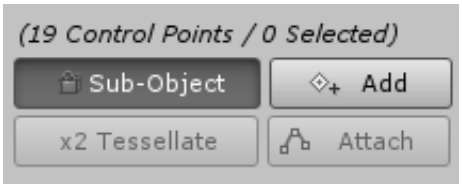
You can choose between several types of curves, that affect the way interpolated points are created:



- **Linear**: will create a simple, **linear** curve, with no kind of curve interpolation between control points. Just straight segments.
- **Hermite**: interpolated points will form a curve of the type **Hermite**. In this type of curve, points have no control handles, just a position.
- **Bézier (Recommended)**: interpolated points will form a curve of the type **Bézier**. In this type of curve, points DO have control handles to control the way the curve is created. This type of curve is the most versatile, although it might require a bit more work due to control handles.
- **Catmull Rom (Recommended):** interpolated points will form a curve of the type **Catmull Rom**. In this type of curve, points have no control handles, just a position. This type of curve is quite easy and handy in cases where you don't need so much control about curve's shape.

Sub-Object Mode

Once your Spline has control points, you can move, rotate or scale them activating the **Sub-Object mode.**



When the Sub-Object mode is enabled, the regular transform tools in Unity are disabled, and the Editor will allow you to work with control points only (unless you change the selection using the Scene Tree View, in such case the Sub-Object mode will be disabled).

When Sub-Object mode is enabled, Control Points and spline bones are rendered on the scene view:

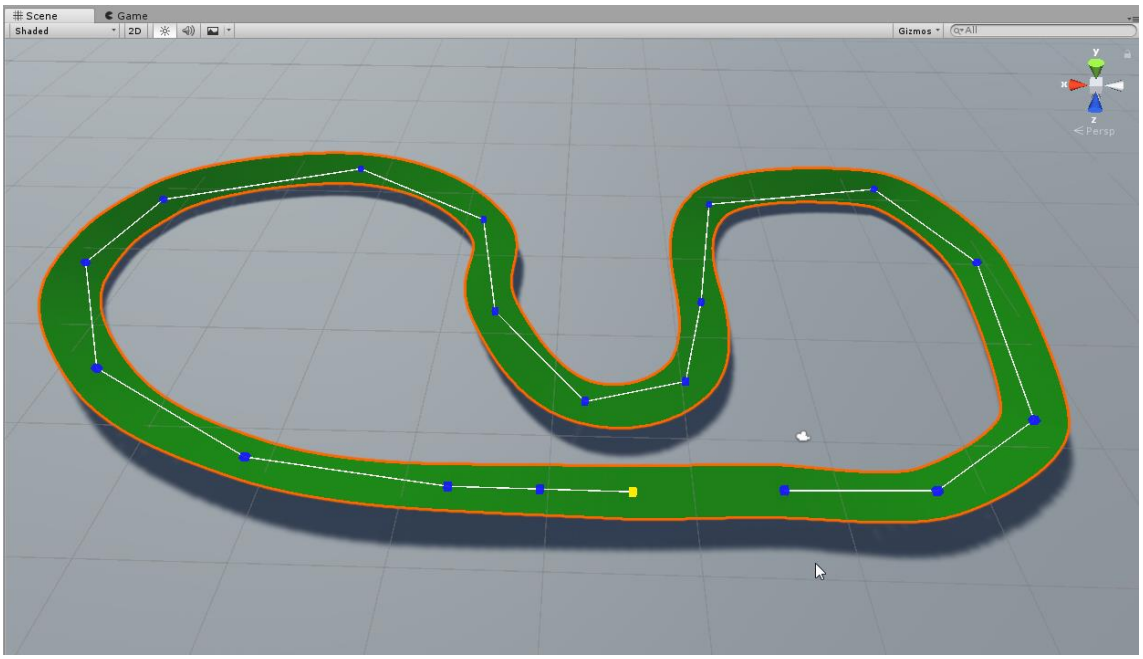


Figure 1: Control Points rendered in the Sub-Object Mode

***Please Note**: the first point of the spline is painted in Yellow, while all others are blue.*

When in Sub-Object mode, you can select Control Points by clicking on them individually, or selecting by rectangle like in any other app:

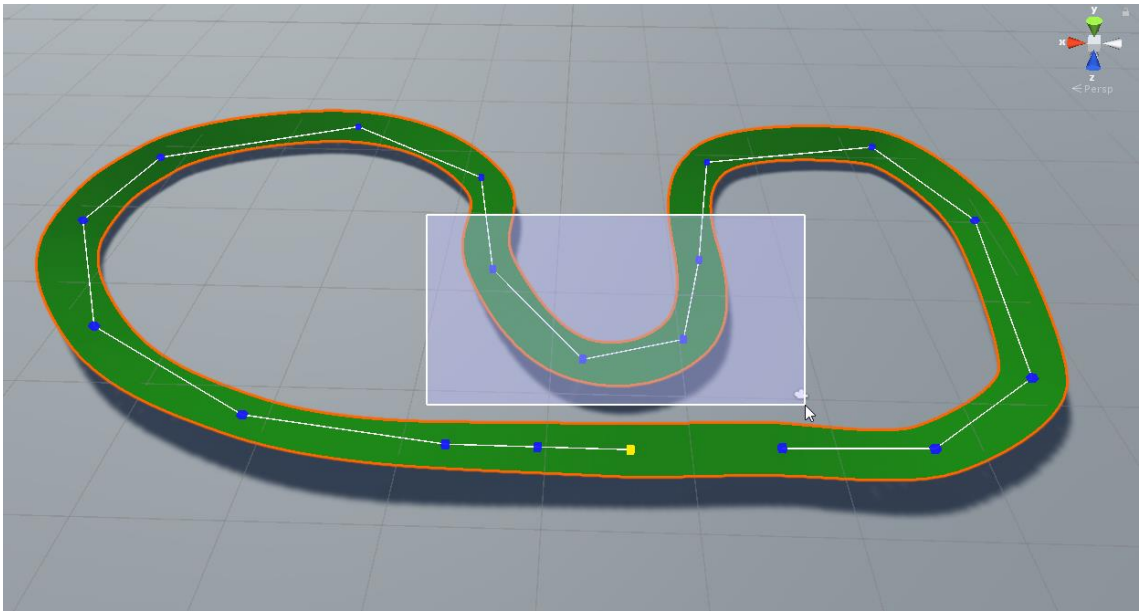


Figure 2: Selecting by Mouse Rect

Once one (or more) Control Points are selected, you will see that they are rendered in Red, and with handles or not, depending on the type of curve and the Tool selected (move, rotate, scale):

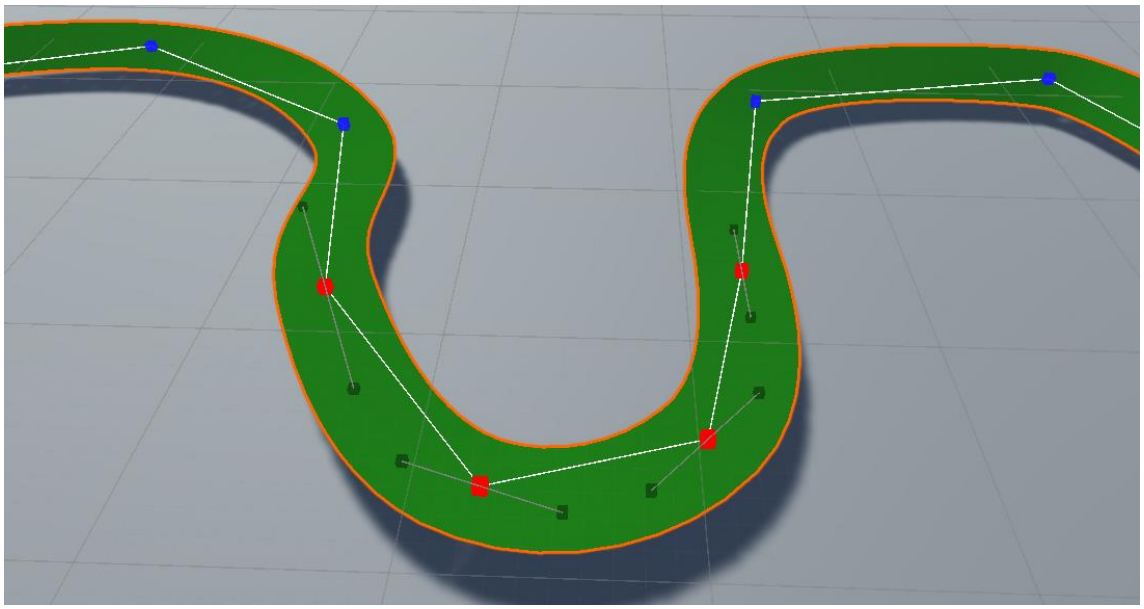


Figure 3: Selected Control Points in a Bézier curve

Once points are selected, use the regular Unity Tools to activate the move, rotate, scale mode:

Moving Control Points

When the Move Tool is selected, points will show a Move Handle to allow changing their position. If the type of curve used includes handles (like the Bézier Curve), points will also show green handles that allow modifying how the curve behaves when reaching-leaving the point.

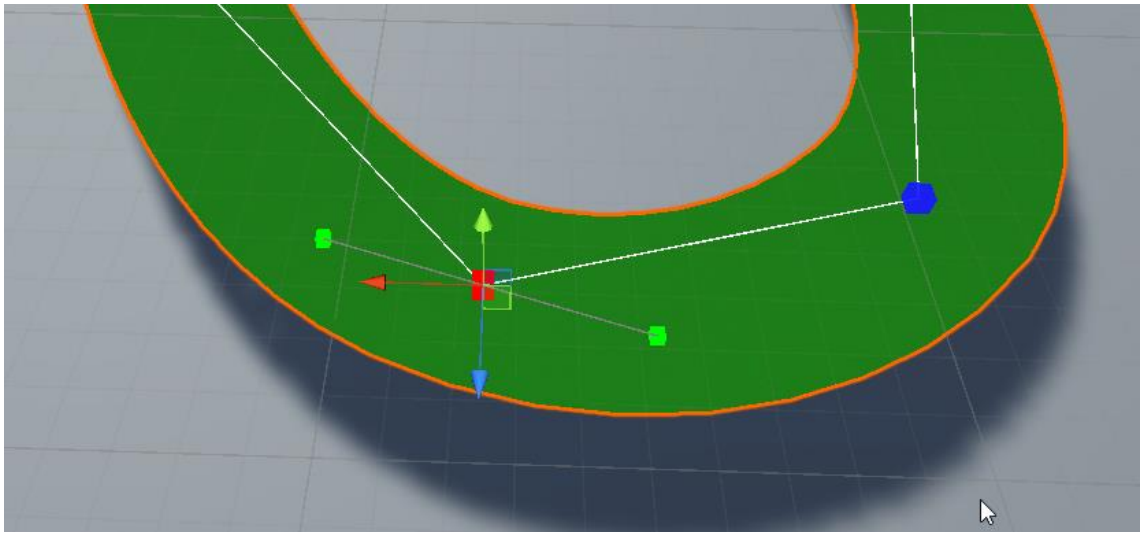


Figure 4: Moving a Bézier Control Point, with handles

Rotating Control Points

A very nice feature of Spline Studio is that it supports customizing **spline camber or tilt**. This is achieved by selecting the Rotation Tool while any control point is selected:

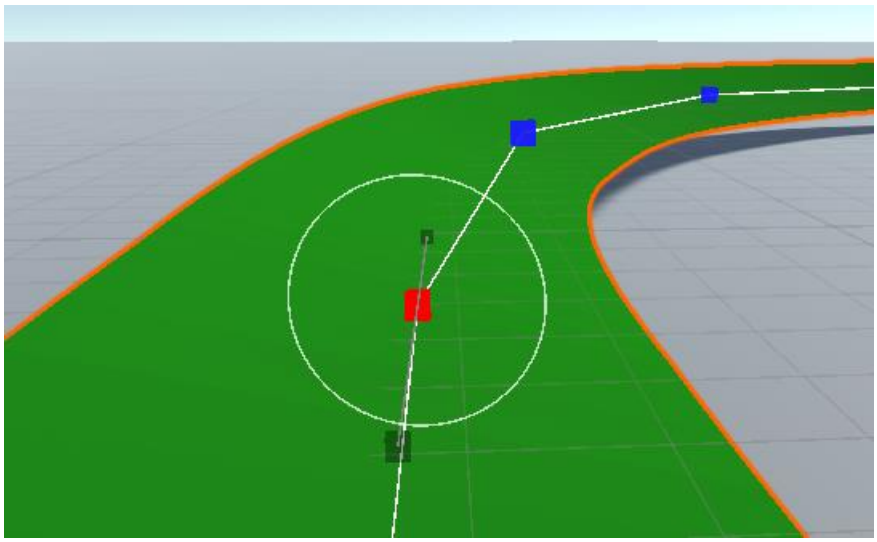


Figure 5: Adjusting Spline Camber with the Rotation Tool

***Please Note**: Unity's Line Renderer doesn't support this feature, so this will only have effect in the Scene or Game View if the render mode selected is set to Custom Mesh (see below for more info).*

Scaling Control Points

Scaling points will have only effect in those types of curves that include control handles (like the Bézier curve). This operation won't change the point itself, but the handles, making them bigger or smaller, respecting their direction and the size each handle had (which might be different depending on the handle mode selected)

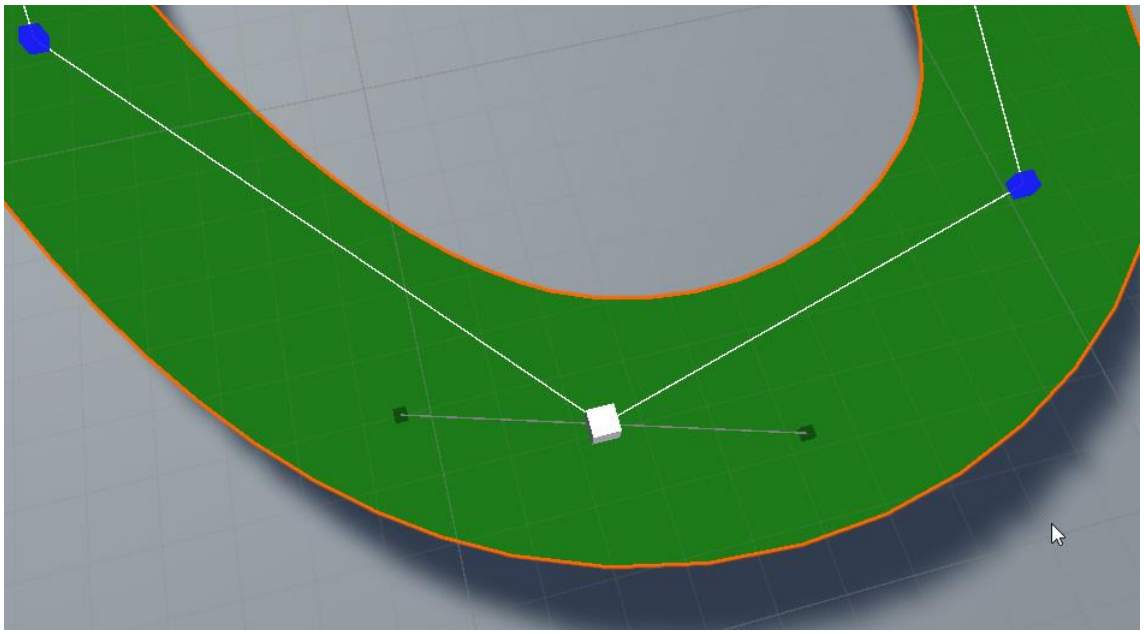


Figure 6: Scaling control handles

Manually Editing Control Points data

For your convenience, you can manually edit Control Point's data in the expandable section you will find in the bottom part of the component:

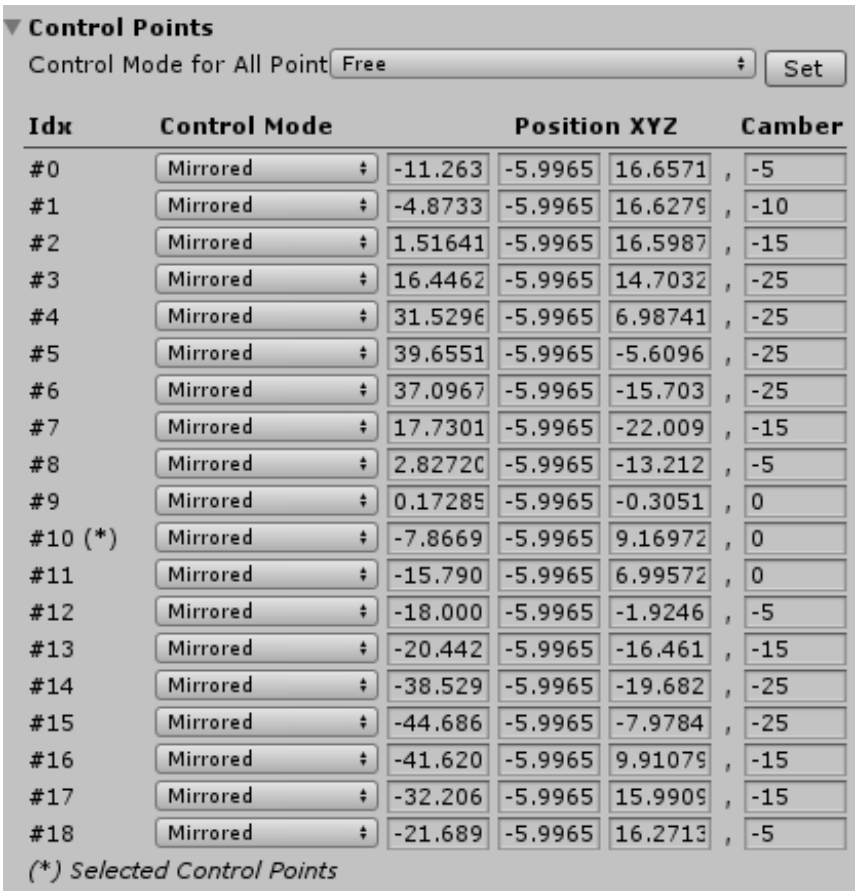
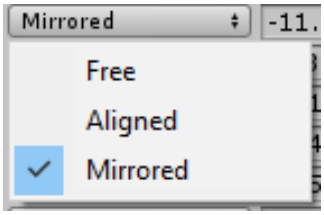


Figure 7: Manual Edition of control point's data

When the type of curve selected includes control handles, like the Bézier curve, this tool also allows you to change the Control Mode for all/individual points:



- **Free**: will allow moving each handle independently
- **Aligned**: handles will keep the same direction but can have different size
- **Mirrored**: both handles have the same direction and size

Deleting Control Points

By using the Delete button, you will be able to delete control points.

- If the Sub-Object mode is enabled, it will delete only those control points that are selected
- If the Sub-Object mode is disabled, it will delete ALL control points in the spline.

Refining Spline Segments

If you need more detail in a particular segment of a spline, you can use the Refine tool to add control points in the middle of a segment. Once the Refine mode is activated, a red dot will appear in refine point, calculated as the closest point to the mouse cursor:

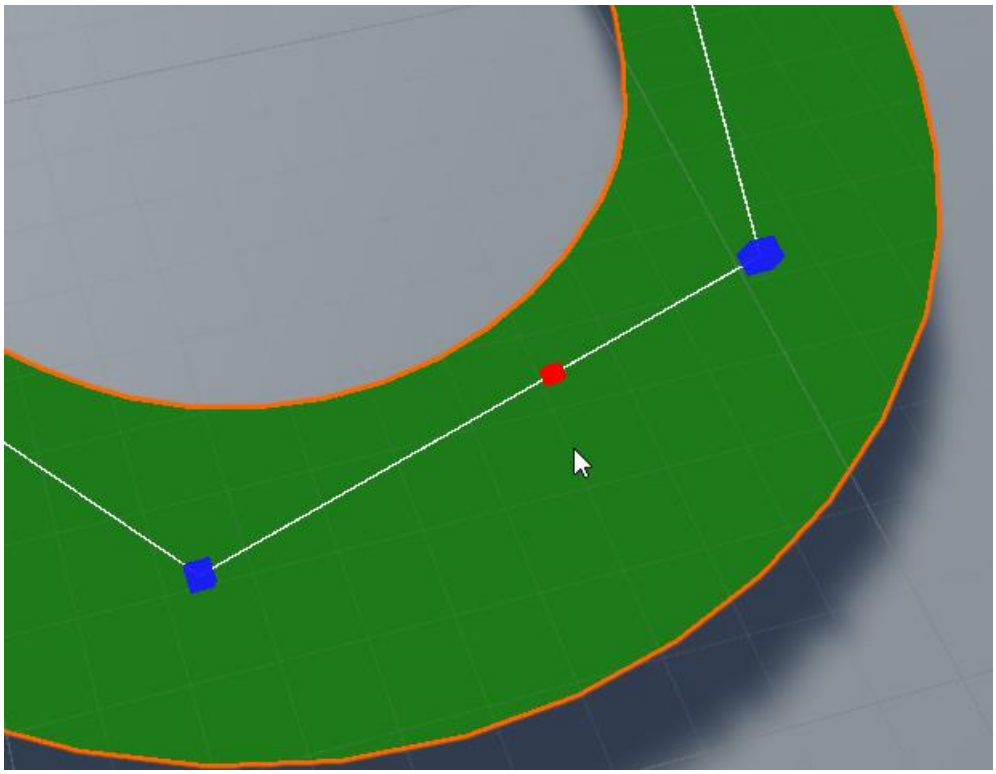


Figure 8: Refine point

Tessellating x2

If you need more overall detail in your whole spline, you can simply click in the X2 Tessellate button to create inner points in the middle of each segment. Each click will increase the number of Control Points x2.

Please note: Because this operation affects the whole spline, this option is only enabled when Sub-Object mode is off

Detaching Spline Segments

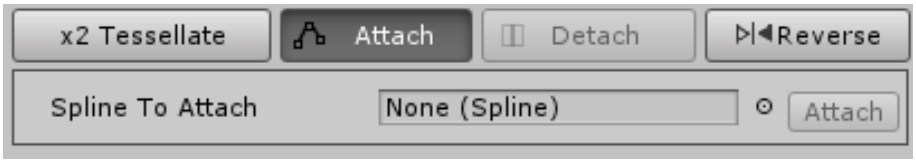
You can split a spline in two by enabling the Sub-object Mode, selecting two or more control points, and clicking in the Detach button:

It will remove those Control Points from current Spline, and create a new Game Object with a Spline Component already added, and filled with the control points detached.

Attaching Spline Segments

If you want to join two different splines in a single one, you can simply select the start Spline and click in the Attach button.

When the Attach mode is selected, a new field will appear requesting the second spline to attach. You can simply Drag&Drop any other spline GameObject there, and hit Attach to perform the attachment.



Please note: Because this operation affects the whole spline, this option is only enabled when Sub-Object mode is off

Reversing Splines

If you want to change the direction of a spline, you just need to hit the Reverse button.

You can tell the direction of a spline (and check if the reverse has been performed) by looking at the Control Point that is renderer in Yellow. That's the first point of the spline, and should swap from the first to the last point of it, each time you hit the Reverse button.

Please note: Because this operation affects the whole spline, this option is only enabled when Sub-Object mode is off

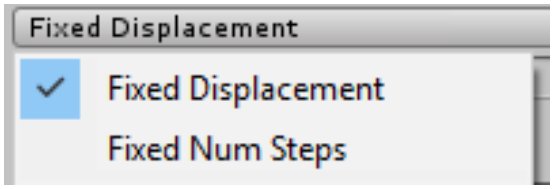
Open & Closed Splines

Splines can be open (they don't form a loop) or closed (the last and first points of the spline are joined with a segment). You can select one or the other by simply checking the Closed field:

Interpolation

Spline Studio interpolates the list of Control Points according to the parameters provided and the type of curve selected. The Interpolation parameters control how detailed the result is. The higher the detail, the more complex the resulting mesh will be (and the more resources it will require).

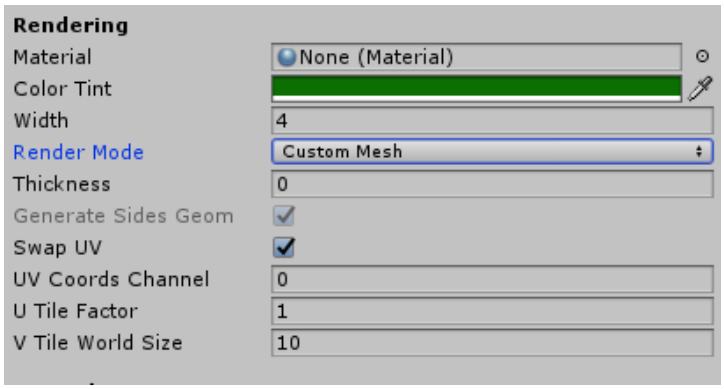
You can specify the level of detail in two flavors:



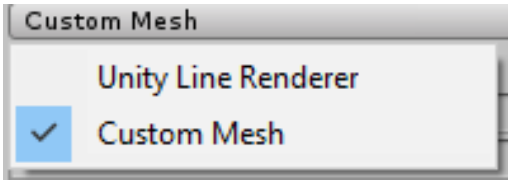
- **Fixed Num Steps**: you will specify a fixed number of steps in each segment (so the distance between each interpolated point will vary, but the number of them will remain as you say)
- **Fixed Displacement**: you specify the distance or displacement between interpolated points, so the mesh will look more regular, but then you won't know the total number of points that will be created.

Configuring Rendering & Visualization

This section configures the way Splines are drawn in the scenes:



Spline Studio supports two ways to actually draw them:



- **Using Unity's Line Renderer**: Spline Studio will automatically create a Line Renderer component for you, and will fill it with the correct data so the spline is properly drawn. Unity's Line Renderer has a really nice set of features, and might be the way to go in certain scenarios (for example if you want your splines to always face the camera, kind of a 2D-like feel), but it won't support Spline Editor's camber/tilt feature.
- **Using a Custom Mesh**: Spline Studio will automatically create the needed components (a Mesh Filter and a Mesh Renderer) for you, and fill them up with the correct data so the spline is properly draw. This might be the preferred way if you want your spline to be really 3D, and have full control on stuff like Control Points' Camber or Tilt, or UV Texture coordinates. Custom Mesh also allows setting **Spline's Thickness**, a really nice feature if you want your splines to appear a 3D, non-planar elements.

Some parameters, though, are common for both rendering modes:

- **Material**: set any Unity material to this field to be used as the rendering material of the spline
- **Color Tint**: this field will set a color tint over the material selected above (if any)
- **Width**: the actual width of the spline

Parameters only available when the **Custom Mesh** rendering mode is selected:

- **Thickness**: vertical thickness of the spline
- **Generate Sides**: if vertical thickness is set to anything greater than 0, sides triangles will also be generated if this option is checked.
- **Swap UV**: When selected UV coordinates are swapped (and therefore the texture is rotated 90º)
- **UV Coords Channel**: channel where UV coordinates will be generated
- **U Tile Factor**: number of repetitions of the texture in the U direction
- **V Tile World Size**: size (in world coordinates) of each V repetition
- **Mesh Offset**: you can set a X,Y,Z value to offset the mesh in a per-segment local coordinates basis. This allows to easily create complex structures like walls at the sides of a road (see picture below):

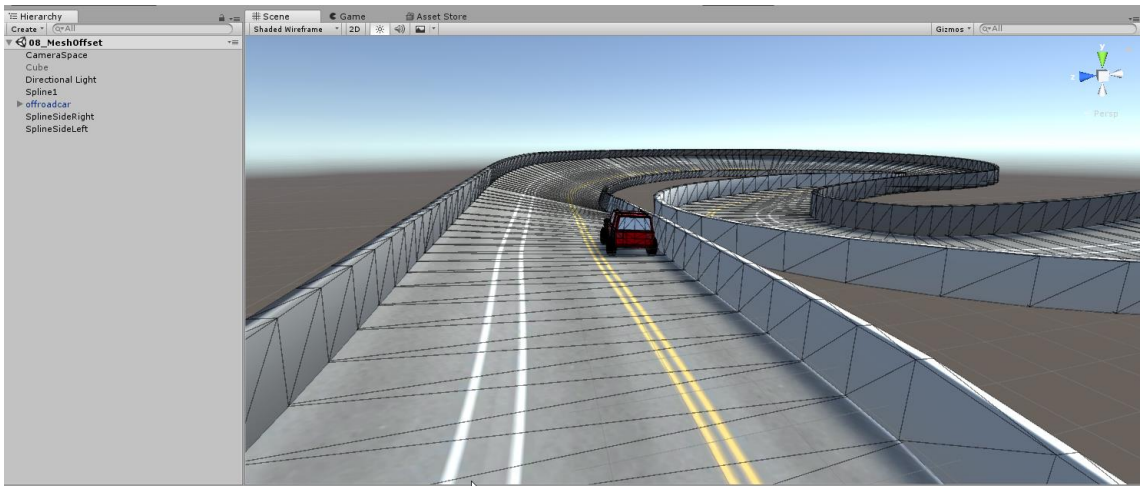


Figure 9: Using MeshOffset to create walls at the sides of a road

Spline Controller Component

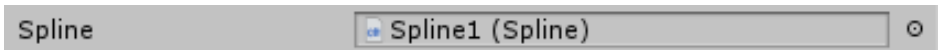
The Spline Controller component is the one responsible of moving GameObjects along splines. You can use it to manually place elements or to add animation controlled by the Unity's animation system, or automatically by the buit-in walk mode system included in Spline Editor.

Creating the component

The Spline Controller component should be added to the Game Object you want to animate. It will read any spline you select, calculate the appropriate position and orientation, and update the GameObject transform accordingly.

Assigning a Spline

First step is to assign a Spline to the controller. You can do so by simply Draggin&Dropping any spline element of your scene into this field:



Controlling the GameObject

The Spline Controller can affect position, rotation, or both. At each moment, new values are calculated according to the Curve Percent value selected:

If Curve Percent is zero, the position and orientation calculated will correspond to the beginning of the Spline. If it's one, it will correspond to the end of the Spline. Any value in between will interpolate correctly.

Controlling GameObject's Position

By checking the Affect Position field, you will activate the calculation of a new position on each frame.

If this option is not checked, position will not be affected. If it is, the proper position will be calculated, following the spline interpolated points and respecting Camber/Tilt (if any).

Position can be offset by using the Position Offset field:

Controlling GameObject's Rotation

As opposed to the position option, which is a yes/no option, orientation can be controlled in several ways:

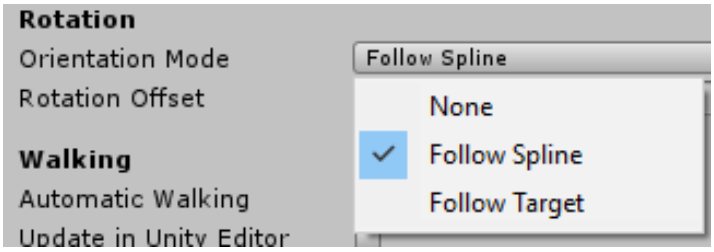


Figure 10: Orientation Modes

- **None**: this will disable controlling GameObject's rotation, so it will always remain the same.
- **Follow Spline**: at each frame, a new rotation of the GameObject will be calculated, making it follow the spline direction properly

- **Follow Target**: at each frame, a new rotation of the GameObject will be calculated to make it always look to a target object. This allows making an object move along a spline while looking to a different place, or to another moving object.

Rotation also supports offsets, by using the Rotation Offset field:

Animation

Animation of object during gameplay can be fully controlled using Unity's built-in animation system.

However, Spline Studio also offers an automatic walk mode for GameObjects that will make them travel through the splines at a speed you specify.

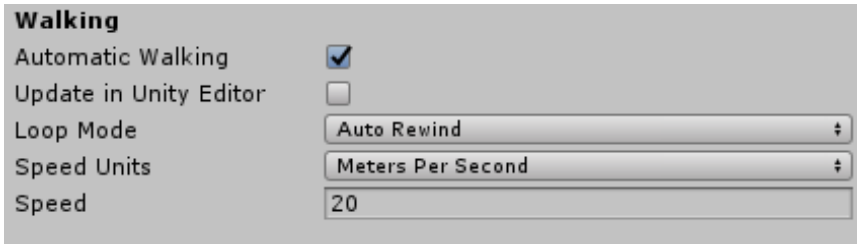


Figure 11: Automatic Walk Mode

- **Loop Mode**: let's you specify what happens when the walk controller reaches the end of the spline.
    - None: Will do nothing, and the object will stop
    - Auto Rewind: Automatically go to the beginning of the spline (if the spline is closed, this means continue looping forever)
    - Ping Pong: go back in the opposite direction
- **Speed Units**: Units of the speed field
- **Speed:** in the units specified above. Speed can be negative.

Please Note: *Speed can be controlled form a script to make the game object move faster, slower, or stop completely depending on other game situations or user input.*

Milestones

Spline Studio includes a Milestone system that detects when a game object passes through a Control Point (or an interpolated point). If configured, it will trigger an event to notify other scripts, so you can play a sound, show a visual effect, or trigger any other game condition.

Milestone events are configured like any other event in Unity:

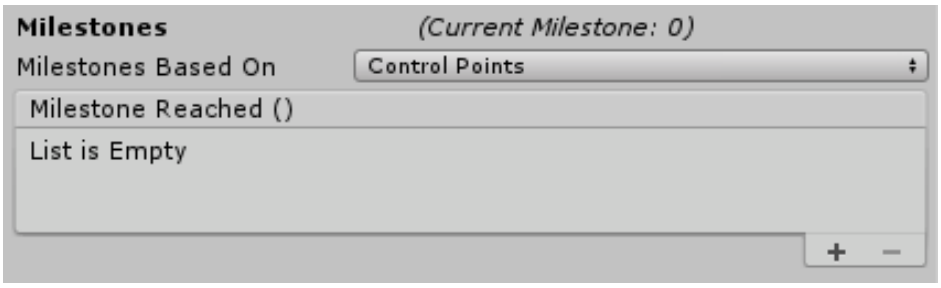


Figure 12: Milestone System Configuration

Contact

In case of doubts or any help needed, please contact: iayucar@simax.es