TR473677

Procedural and Automated Workflows in Alias for Automotive

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Learning Objectives

- Understand in which areas Dynamo and the Dynamo Player can be utilized
- Learn how to make a Dynamo Script work for the Dynamo Player

Description

In this class we will go over some of the new features in Alias software that can help in procedural modeling techniques, and tools that you can create with scripts to be driven through Dynamo software. Dynamo is a visual programming platform that you can use to create custom algorithms to process data and generate geometry. Since version 2019, we have had an integration of Dynamo in our Alias line of products (Concept, Surface, and AutoStudio). With the latest release of 2021, we have included Dynamo player, which enables anyone to run scripts and capitalize on the power of these tools to improve workflows and processes to save time and effort.

Speaker

While Michael Günther-Geffers achieved his diploma in mathematics and computers in 2006, he has already been in touch with CAD programs for the automotive industry since the year 2000.

He started as a quality assurance engineer for ICEM Surf, and later also tested its integration into Catia V5 (ICEM Shape Design at that time, later renamed to ICEM Catia).

In 2010 he joined Virtual Shape Research (VSR) as a QA, support and content creator for a rendering and class A plugin for Rhinoceros 3D.

Joining Autodesk with the acquisition of VSR in 2013, he then worked as a UX designer for SpeedForm and later Alias.

2018 he transitioned back to the QA role, becoming the technical lead for the testing of Alias. Since 2019 he is the QA manager for all automotive products (Alias, VRED, SketchBook, Shotgun), and became a free time enthusiast in using Dynamo and writing scripts to solve problems for Alias users.

Application areas for Dynamo

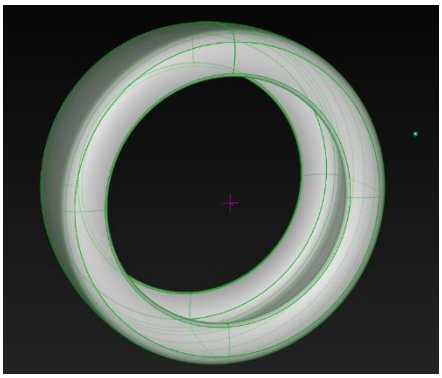
Dynamo and the Dynamo Player can be used in much more areas than probably most people are aware of. This class goes over several categories of possible appliances and shows you example scripts for each of them.
Alias 2021.2 comes with 14 Dynamo Player sample scripts, which demonstrate how Dynamo can be used to create your own tools. Each of these scripts could have been written by anyone who understands Dynamo. There is no dependency of them to the Autodesk development team. You can find those scripts on the What's New Shelf, which is accessible under "Help – What's New – What's New Shelf":

Templates

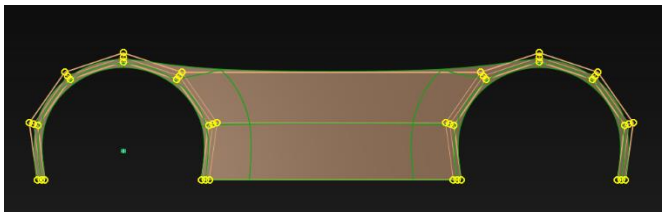
Whenever you have a reoccurring task of creating objects of a certain shape and/or structure, or modifying them in a way, chances are not too bad that this approach could be captured in a Dynamo script. If that is the case, you can create a Dynamo Player tool, which can then be saved onto your shelf in Alias. This allows you to easily skip over the reoccurring work, e.g. like creating a base shape of certain dimensions, as Dynamo does this for you. You simply start using your tailored tool in Alias. When doing so, you don't have to go to Dynamo, or even know that Dynamo is utilized in the background. This allows each user to optimize his or her workflow, saving precious time which can be used to create more and better models.

Nurbs Templates

A typical reoccurring shape in the automotive context is a tire. While it is true that the shape of a tire can be easily created by rotating a profile curve by 360 degrees, having a Dynamo Player tool available for this shape comes with several advantages. You can directly enter "real life" parameters like the rim size or the width of the tire. At the same time, you can just simply move sliders to adjust the global shape, to achieve the wanted result very quickly.
The tire script takes construction points as input, to then create the Nurbs tire(s) at the wanted position(s).



Subdiv Templates



Subdiv templates can be even more powerful than Nurbs, as Dynamo offers a lot of notes to create and modify subdiv geometry. A good example for this is the Wheel Arch tool. As a lot of car designers start with the wheel arches and the side shape of a car, the Wheel Arch tool provides an easy way to create two wheel arches with specified radius and amount of faces. Both wheel arches are bridged together, to form the side shape of a car, again with user defined values like distance and amount of faces. This template can save the first 10-15 minutes of modeling in the beginning of each new subdiv car design.
Similar tools could be created for other objects which have a defined shape every time, like steering wheels, seats, and such.

Templates using geometry input

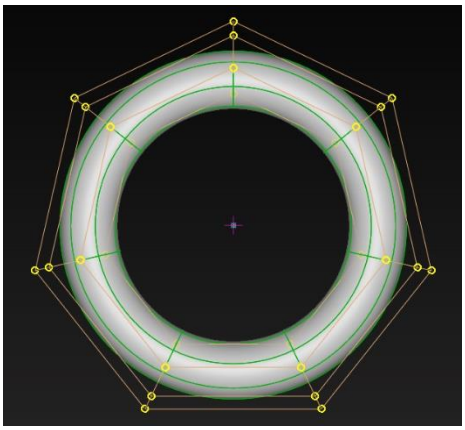
Probably most templates would take defined numerical values as input, e.g. the radius of the wheel arch, or the width of a tire. But you should also be aware that it sometimes might make sense to drive the geometry created by your templates by Alias geometry. This is for example the case when working visually, like when you want to create a 3D model from a 2D sketch. In this case, you don't have technical data like the length of the car. Instead you would like to drive your base shape by simply dragging your mouse. One way to achieve this is letting the user create the needed geometry, and then select it for the Dynamo Player script. Another way is to provide the user with a wire file, which already has the needed geometry input in place.
The wheel arch tool has a version which does exactly that. Instead of using the Dynamo Player, you can import a sample wire file. This file already has the template geometry created (in this case, the bridged wheel arches creating the side shape of a car). The dimension of this shape is controlled by Alias geometry, in this case Nurbs curves. By that, the user can simply move the curves to the needed positions, and move e.g. CVs as needed, looking at a displayed background canvas, to fit the wanted dimensions.
To check out this workflow, click on the "2021" tab of the What's New Shelf, and click on the icon all on the right. A file browser opens, pointing at the location "C:\Program Files\Autodesk\AliasAutoStudio2021.2\Dynamo\Sample Files". Navigate into the "Subdiv Wheel Arch" folder, and double click on the wire file Subdiv-Wheel-Arch-2021.2.4.wire to import it.
Similar as in this wire file, every user who wants to drive his template object by Alias geometry, can simply save a wire file, which has the wanted Dynamo script referenced. Since Alias 2021, dragging and dropping the "import wire file" tool onto a shelf remembers the last path being used. This way, with very few clicks, you can import a wire file to drive your template creation with geometry instead of numerical parameters.
You can see this workflow in the following video:

https://www.youtube.com/watch?v=nOXOC0qkO3k

Subdiv tools using the T-Spline library in Dynamo

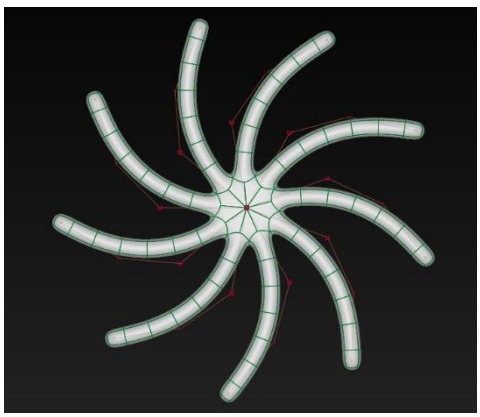
The T-Spline library is a library which is often used in the background for a lot of Alias subdiv operations. While the resulting object type of T-Spline nodes in Dynamo is a T-Spline, it will be converted to a subdiv when it is sent to Alias.
T-Spline is a more powerful type of geometry than a subdivision object. As this comes with a cost of performance, and as having two different types of subdivision objects would have been likely a confusing user experience, Alias introduced only subdivision surfaces 1.5 years ago. Nevertheless, the T-Spline library is very powerful. In Dynamo, a lot of nodes allow you to create and modify T-Spline objects, to then send them to Alias as subdivision objects.
In Dynamo, the T-Spline nodes can be found in the tree on the left under “Geometry – TSpline”. In the beginning, probably the nodes creating complete bodies are most useful to you. Those nodes can be found in the sub section “TSplineSurface”.

Primitive tools



Utilizing the T-Spline library in Dynamo, it was very easy to add the functionality to create subdiv cones, spheres, quad balls and torus as Dynamo Player tools in Alias. Depending on your needs and preferences, you might want to add different versions of those tools. For example, the current subdiv box creation tool in Alias only allows you to choose the spans for the X, Y and Z direction, the dimensions are controlled dynamically. If you prefer to define width, length and height of the box numerically instead, you could simply use the Dynamo node TSplineSurface.ByBoxLengths, and create a Dynamo Player tool from it. An example like this will be shown in the second section of this handout.

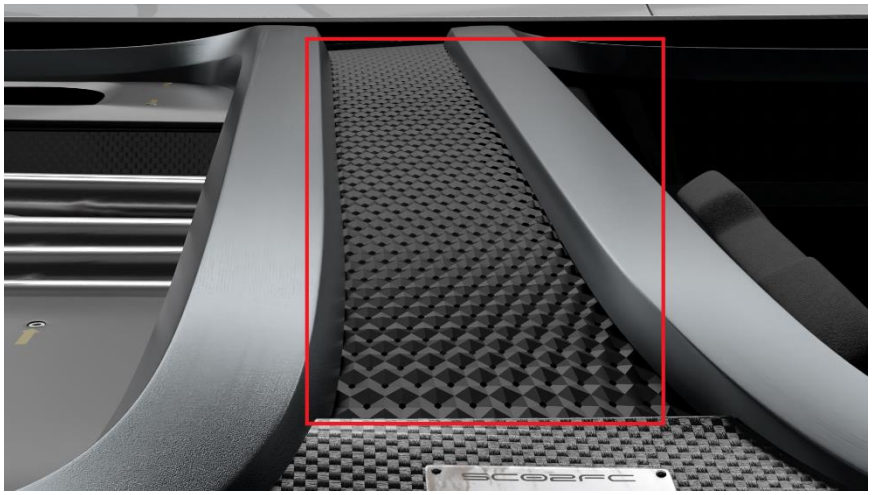
General tools



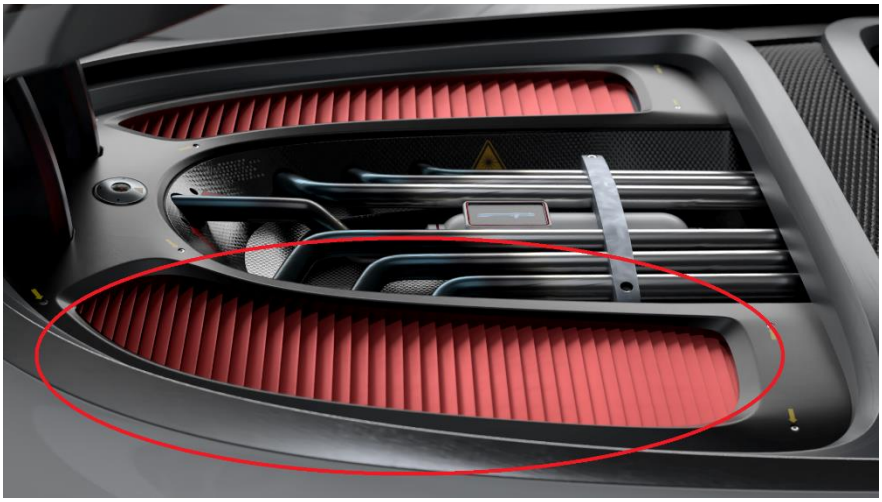
The T-Spline library in Dynamo also offers more complex subdiv generation nodes, like the Sweep, the Revolve and the Pipe tool. While the Sweep and Revolve tool work rather straight forward and can be seen as the subdiv pendants of the corresponding Nurbs tools, the pipe tool deserves a second look. When the input curves are disconnected, it will simply create a pipe for each curve, as expected. But if the curves are connected, it will take care of the subdiv topology at the meeting points, creating one closed subdiv body out of all connected curves.

Creating distributed geometry

Of course, Dynamo can also be used in its well-known area of creating and placing a lot of objects in an easy fashion. With the “Nurbs-Hexagon-Pattern” sample script, people can try different versions of a hexagonal pattern, which will be distributed over the input surface the user chooses:



It is worth pointing out that you can also apply easier, self-written scripts with great visual effects. The following script has been created after 2021.2 was shipped, so it’s not part of the sample scripts of this release. It simply distributes a closed subdiv body along a curve, in a controllable nonlinear way. It also allows a staggered rotation of that body along the guide curve. This creates a nice visual effect, and saved a good amount of modeling time, while the script itself was written in about an hour:



Ease of use

The Dynamo Player allows you to tailor your tools, as you are now in control about which parameters to expose, how to name them, and what the default parameter range is. E.g. you can now create your own circle tool, which takes the radius of the circle as a numerical input value. This way, you don't have to create the circle, and then afterwards scale it in the information window, to achieve the wanted size. You can directly enter the wanted value.

Modifying existing geometry

Another area of applying Dynamo scripts which might be easily overlooked is the ability to write your own "modification" tools. The quotation marks must be used, because Dynamo can't directly work on the input geometry. But you can take the input, create a copy, and modify the copy in the needed way. When the original input is then deleted afterwards, you have effectively (in a way) modified your input.
It is e.g. possible to write a script to align subdiv geometry perpendicularly to reference geometry, as you can see in this video:

https://youtu.be/Ge5PInMRHs8?t=26

Another way to use this is the sample morph script "Subdiv-Morph-between-2-Objects", which is part of the What's New Shelf. It takes two differently shaped subdiv's as an input, and then creates a third copy in between them, which is an intermediate shape of the two input bodies. With one single slider, you can then control if the new object shall be closer to the shape of the first, or the second input body, as you can see here:

https://youtu.be/Jx531XHWFAg?t=76

Be aware that both input bodies must have the same number of CVs, to allow the script to work. Ideally, they should be created via copy and paste, before they received their different shape.

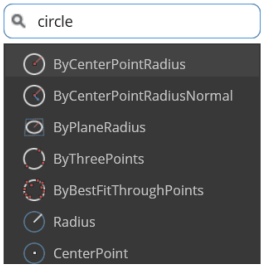
Import and Export operations

Dynamo is also able to import and export several types of file formats, such as images, excel files, T-Spline formats (.tss and .tsm), text and CSV files. A Dynamo Player sample script which utilizes this is the "Export-to-tsm" tool. It allows the user to select a subdiv body, and then write it to disk, with a user given file path and file name. This is useful if you want to send Alias subdiv geometry to Fusion (Fusion can import the .tsm file format).
Alias does not support the .tsm export functionality natively yet. In fact, this script has been written for an Autodesk employee, who needed a quick support of this data exchange. This is therefore a good example on how it is now possible to solve issues directly, without having to wait for a next Alias release.

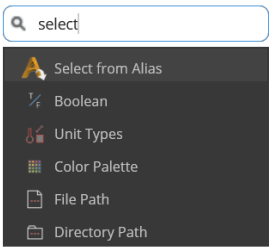
Making a Dynamo script work for the Dynamo Player

In general, each Dynamo script can become a Dynamo Player script, and therefore utilized as being a tool in Alias. Let's create a new one from scratch. Start Alias and start the "normal" Dynamo tool. It can be found in the Palette, in the bottom right of the "Transform" tab. Keep the left mouse button pressed to expand the tools, and choose the "Dynamo" tool on the right:

After Dynamo has come up, click on "New". We want to create a Dynamo Player tool for a circle, which allows the user to specify the radius directly on creation. So, the first thing we need to do, is to add a "Circle" node. Right click into the graphics area of Dynamo, and type "circle" into the upcoming search window:



Choose the option ByCenterPointRadius. A node named Circle.ByCenterPointRadius appears. The needed inputs for this node are displayed on the left and named *centerPoint* and *radius*. The output of this node on the right is named *Circle*.
Next thing we need are the nodes we want to gather the needed input from Alias. Right click in the graphics area of Dynamo, and type in "select":



Pick the “Select from Alias” option on the top of the list. A node named “Select from Alias” appears. To connect this node with the Circle node we created before, left mouse button click on the text *Geometry*, and then left mouse button click on the text *centerPoint* of the “Circle” node. As only points are suitable inputs for a center point of the circle to be created, let’s limit the Alias selection to that object type. To do so, click on *Unspecified* in the “Select from Alias” note, and select the entry *Point*. This will set the selection filter of the Dynamo Player tool accordingly, when this script is used.

Our last remaining needed input is a value for the radius. Right click again into the graphics area of Dynamo, and type in “slider”. Pick the “Number Slider” entry of the upcoming list. To connect this node with our “Circle” node, left click on the > symbol on the right of the “Number Slider” node, then left click on the text *radius* of the “Circle” node.

As we want this slider to show up in the Dynamo Player tool, we need to mark it accordingly. For that, right click on the “Number Slider”, and activate the option *Is Input*.

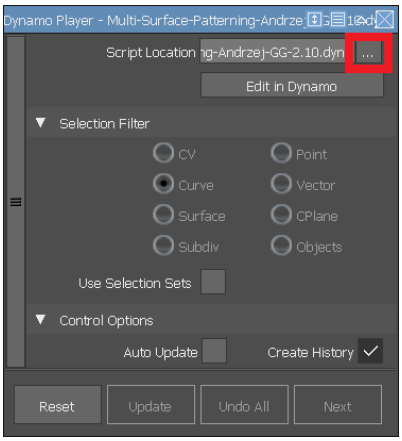
Note that this option is set by default for the “Select from Alias” node, as the solely purpose of this node is to select something from Alias, so it always will be an input.

Once the circle creation is complete, we want to send the geometry back to Alias. For this, right click into the graphics area from Dynamo, and type in “send”. Pick the “Send to Alias” entry. Left click on the text *Circle* of the “Circle” node, then left click on the > icon on the left of the “Send to Alias” node.

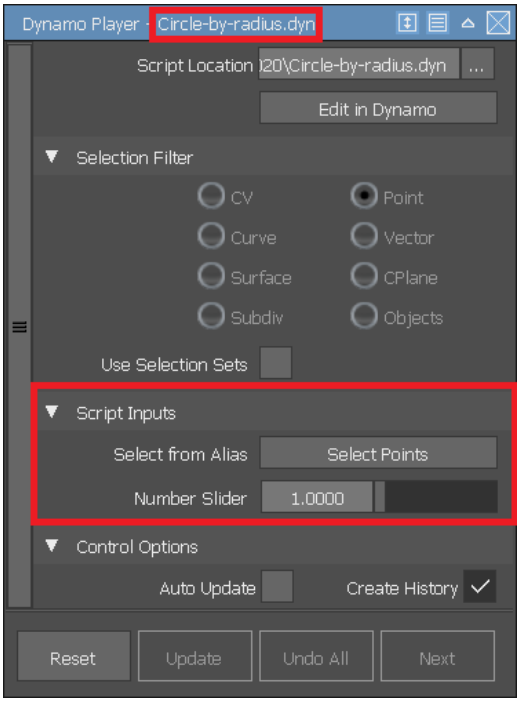
A Dynamo script which sends geometry to Alias needs to be saved on disk before it can work. Reason for that is, that the Alias model needs to store the path to the Dynamo script. This can only happen, if the script exists somewhere on disk.

Once you have saved your file, you can use it in the Dynamo Player. To do so, open the Dynamo Player in Alias. It’s also in the Transform tab of the Palette, in the bottom right, called dynply.

Browse to your script which you have just saved, using the “…” icon in the Dynamo Player tool window:



Once you have done that, you will notice that your Dynamo Player window has changed. It now shows the name of your saved script in the title, as well as the needed inputs (a point to select, and a radius to be given) in the lower section of the window:



Let's do some fine tuning, before saving this new tool to a shelf. Click on the "Edit in Dynamo" button, to edit the currently loaded script. We want the text "Select from Alias" to be "Select Center Point" instead. For this, in Dynamo, right mouse button click on the "Select from Alias" node, and pick "Rename node…". In the upcoming window, change the name to "Select Center Point".
In addition to that, we want to change the text "Number Slider", too. Right mouse button click on the number slider in Dynamo, pick "Rename node…", and change the title to "Radius".
Save the script, and you will immediately see that the Dynamo Player tool window has adapted the texts.
If you now drag and drop the Dynamo Player icon onto your own user defined shelf, you have created your own circle tool, which directly allows you to enter a radius open circle creation.
For a more detailed description, and sample videos, check out the Alias online help on this topic:

https://help.autodesk.com/view/ALIAS/2021/ENU/?guid=GUID-1E1BBB04-060B-4AC4-AD06-0CA8B539FE16