

TR501092

Using the Dynamo Player in Alias to Solve Problems and Automate Processes

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Learning Objectives

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- **Learning Objective 1**
 - Learn about the variety of application areas of Dynamo and the Dynamo Player inside Alias.
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- **Learning Objective 2**
 - Discover how to address the problem of multisurface patterning.
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- **Learning Objective 3**
 - Learn how to create your own Alias tools using Dynamo and the Dynamo Player.
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- **Learning Objective 4**
 - Discover sample workflows that can save time and accelerate workflows.

Description

Dynamo is capable of much more than patterning. In this class, we'll demonstrate the latest improvements to the Dynamo Player. We'll show you the broad variety of possible applications for Dynamo and the Dynamo Player, including the generation and modification of NURBS, subdivision, and construction elements. Dynamo Player can help you create highly customized tools and increase the efficiency of the way you handle daily routine tasks in all kinds of different areas. Since the introduction of Dynamo Player in Alias 2021.2, each Alias release has come with a variety of new Dynamo and Dynamo Player tools. We'll also share examples of how to use Dynamo and the Dynamo Player to create your own tools inside Alias. In those examples, we'll also address the common problem of working across multiple surfaces.

AUTODESK UNIVERSITY

Speakers

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 the automotive products Alias and ShotGrid, and became a free time enthusiast in using Dynamo and writing scripts to solve problems for Alias users.



Andrzej Samsonowicz graduated in architecture from the Roma Tre University in Rome, Italy. After that he returned to Warsaw, Poland, and joined Autodesk, Inc., as the engineer responsible for Building Information Modeling (BIM) and Revit software. He's fascinated by the computational and generative design and he has been exploring its potential for some years already.



Dynamos evolution in Alias

This session gives you an overview over what feature of Dynamo or the Dynamo Player has been added to which Alias release. This allows you to understand what features you can use in the Alias version you are currently using.

Alias 2019

In Alias 2019.0, Dynamo was added for Alias Autostudio, Surface and Concept, so it is available in all flavors of Alias.

It was made available in the Transform tab of the Palette.

Alias 2021.2

Dynamo's potential in Alias grew a lot in version 2021.2, when the Dynamo Player was added.

Since then, two different tool icons now define the two possible entry points for Alias users:

The Dynamo Player for „normal“ Alias users, who just want to use Dynamo Player tools like any other Alias tool, and the regular Dynamo icon, for people who write the Dynamo scripts.

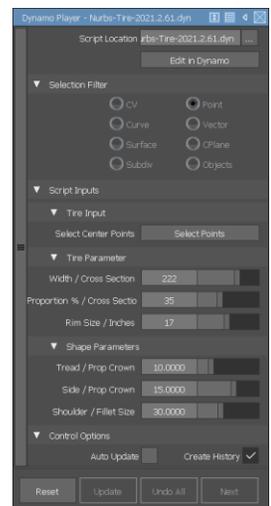
The Dynamo Player allows you to browse for a Dynamo Player script.

Once selected, the Dynamo Player tool window changes its layout and options according to the input of this script.

This way, you can create your own Alias tools using Dynamo, and the people using them have no need at all to know anything about Dynamo.

This tool window can then be dragged and dropped onto a shelf, like any other tool in Alias.

You can even create and use your own icons for it, to improve its recognizability.



Alias 2022.2

Over the last years, we kept adding Dynamo Player sample scripts to our Alias releases.

As those new tools disappeared from the What's New shelf after a year, we needed a way to permanently display these tools in the Alias UI.

That's why we added the Dynamo Toolbox to Alias 2022.2.

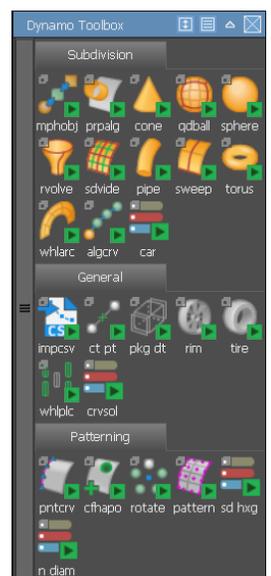
It is accessible via the „Dynamo Toolbox“ button in the Dynamo Player tool window, as well as from the „Help“ menu, under „Dynamo Resources“.

It provides you a visual overview over each Dynamo Player sample script which ships with Alias.

Similar to the Alias Palette, this shelf cannot be edited by the user.

It is important for users to know that these additional tools exist in Alias.

So for example, they shouldn't just focus on the subdivision tab in the Palette when they are looking for a subdivision tool!



Alias 2023.0

In Alias 2023.0, we added the option to create Drop Down Menus and Radio Buttons in the Dynamo Player tool window.

These options allow your tools to be much more understandable than before. In older versions, number sliders or check boxes had to be used to fulfill this functionality.

In addition to that, the „Keep Original“ option has been added.

Before, when you only wanted to modify a certain object instead of creating a new one (for example like in the subdivision Perpendicular Align tool), the user had to manually delete the original input after being done with the Dynamo Player tool.

With this option, you can now do that automatically, so it behaves much more like a normal Alias tool.

Also an option to send text from Dynamo to Alias has been added. This allows Dynamo script authors to provide warning or error messages to the Alias users when they are using their scripts.

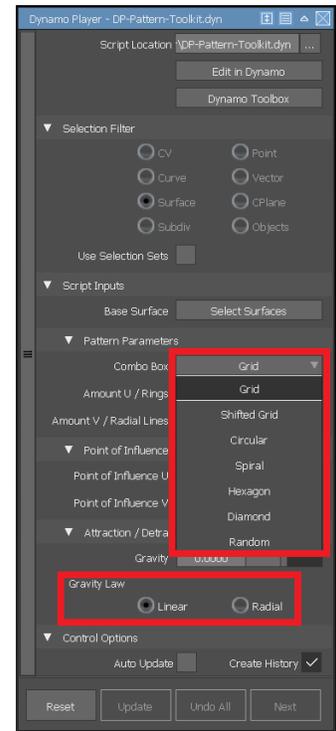
The Dynamo update inside Alias 2023.0 is especially worth noting, because it not only came with bugfixes and new features, such as the „allow groups in groups“ on the Dynamo side.

It also came with a UI refresh.

It is a known issue that the new nodes are bigger than the old ones, so if you have legacy scripts, those might be hard to read inside the new UI, because the nodes might overlap.

We do have an automatic solution for that available on the forum, so if you suffer from this problem, and need a solution, please reach out to us.

We will also ship this solution script with a future version of Alias.



Dynamos Potential in Alias

First, it cannot be stressed enough that anyone could create Dynamo Player tools and a shelf like the Dynamo toolbox.

The scripts and icons provided here can come from everybody with the according skill set, there is nothing needed from the Alias side for this.

It could be you, a colleague, or a Dynamo expert hired by your company.

Templates (Re-occurring shapes, structures, processes)

The first class of tools you can create with the Dynamo Player are the ones for a basic, re-occurring shape or setup in your daily routine.

Nurbs Templates

A tire is a great example for a Nurbs template. While all of them are different, the basic shape is always similar, and follows certain parameters.

The Dynamo Player script which ships with Alias creates a Nurbs tire, based on several numerical input values.

The latest version even allows you to create a 3D tread shape, where amount, depth, angle and distances of the tread can be controlled by the user.

In a future version, individual, user created curves can serve as a basis for this tread to be generated.



Another Nurbs template allows you to take closed input curves, for example like the one created by the Alias Text tool, and creates a solid out of the curves.

The extrude direction of this solid can be controlled by the user, as well as the depth, and if it shall be bevelled and/or filleted.



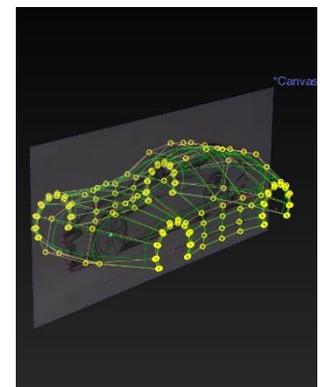
Subdiv templates

In a similar way, you can write Dynamo Player scripts which create re-occurring subdivision shapes.

Alias provides you with a tool, which creates a subdivision car body for you.

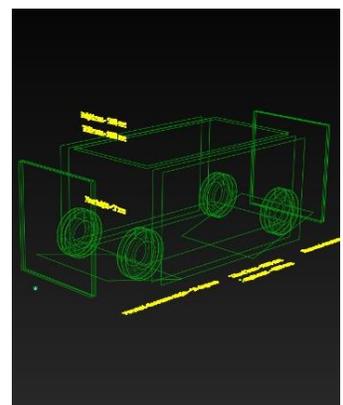
Input can be either purely numerical values like width, length, wheel arch radius and such, or, optionally, two guide curves can provide most of these parameters.

The number of subdivision faces to be created for this topology is also user controlled.



General Templates

Obviously, you can also choose to create any mixture of curves, Nurbs and subdivision surfaces, as well as construction entities for your template script. One example for this is the package data script, which has been added as a Dynamo Player tool in Alias 2022.0. It creates 4 base wheels, as well as limiting minimum and maximum planes inside which your design has to stay. It also provides the technical data information as text out of curves. Please be aware that for the last feature to work, you need to have the package "Text" installed for Dynamo. To do so, in Dynamo, please use "Packages – Search for a Package". Since Alias 2023.0, the user is informed by a warning message in case he tries to use this script without the needed Text package being installed.



T-Spline Library

The T-Spline library is the backbone for most of the subdivision operations in both, Alias and Dynamo. Be aware that on the Dynamo side, the term “T-Spline” will be used for everything in regard to subdivision operations. This is due to the fact that Dynamo is also integrated in other Autodesk products, which use T-Splines, instead of (like Alias) subdivision surfaces.

The T-Spline functionality in Dynamo can be used in several ways to deliver value for the subdivision workflow in Alias.

T-Spline Primitives

It is worth mentioning that, as the primitive tools for a Cone, Quadball and Sphere are not available in native Alias yet, they do exist as Dynamo Player scripts. You can specify the default values to be used by saving the Dynamo Player script with the corresponding values. Note though, that for data integrity and security reasons, you cannot save an existing script back into the installation directory.

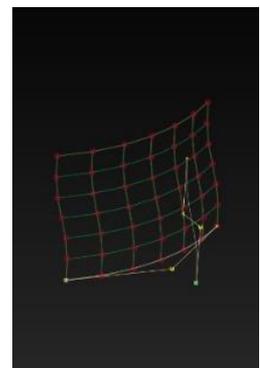
General T-Spline Tools

Beside primitive tools, the T-Spline library also offers regular subdivision tools, as the subdivide functionality, the Revolve, the Pipe and the Sweep tool. All four tools are available as Dynamo Player scripts, and the latter two have been improved in Alias 2022.1.

In the Pipe tool, now the caps at the end of the pipes are optional.

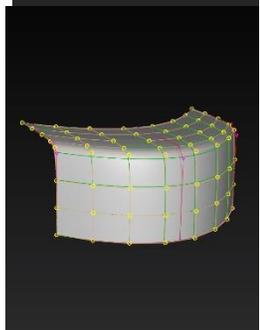


The Sweep tool now creates the sweep by default at the path curve, not the profile curve position (the latter one is still possible by switching on the according option).



Also, the „Subdiv from Nurbs“ tool has been created from such a T-Spline library functionality.

It allows you to re-approximate any kind of single surface Nurbs result, which can be multi-span, though, in Alias, with a choosable amount of subdiv faces, like the Skin result in the image on the right.



Modification Tools

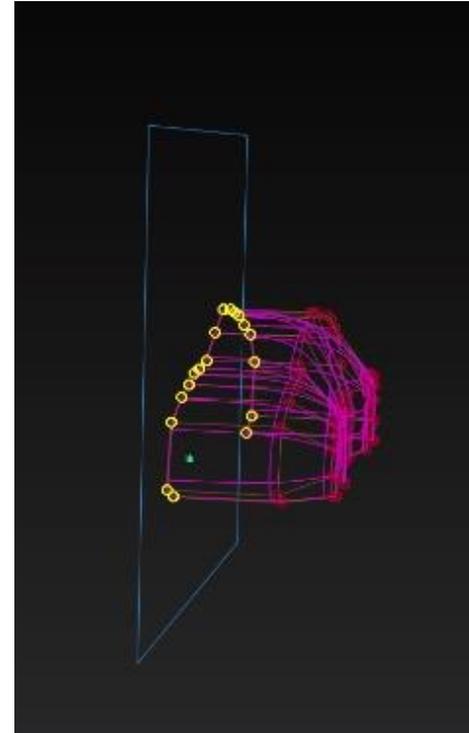
With the new “Keep Originals” feature, available since Alias 2023.0, the input of a Dynamo Player script can be optionally deleted. This makes sense for tools which are supposed to modify a certain input, instead of creating a new object.

One example of such a „modification“ tool is the perpendicular Align tool for subdivision surfaces. It takes points of open edges of a subdiv as input, and then drags them onto a reference plane or surface.

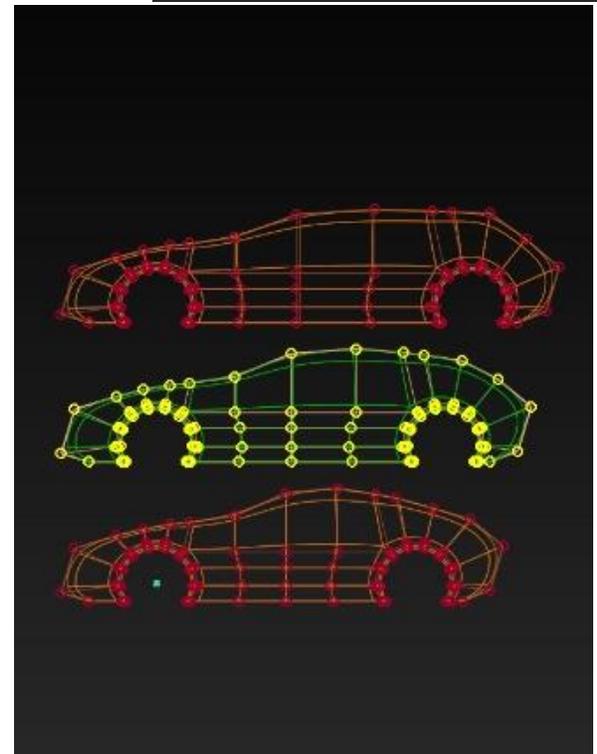
Then next row of CVs is then oriented in a perpendicular way to that reference.

This allows to build only half of a subdivision object, and then applying symmetry of that object to the reference plane by using this tool.

This tool will soon be enhanced to be a “complete” subdivision Align tool.



Another, only kind of modificational script is the “DP-Subdiv-Morph-between-2-Objects.dyn” script. It creates an intermediate shape of two subdivision bodies (must have originated from the same body), where the amount of shape being taken into account from input body 1 and 2 can be changed by a slider. The resulting new body can optionally be created in place of the first selected object. Otherwise, the position will depend on the slider value, which controls how much percent of each input body shape shall be taken into account to generate the new shape.

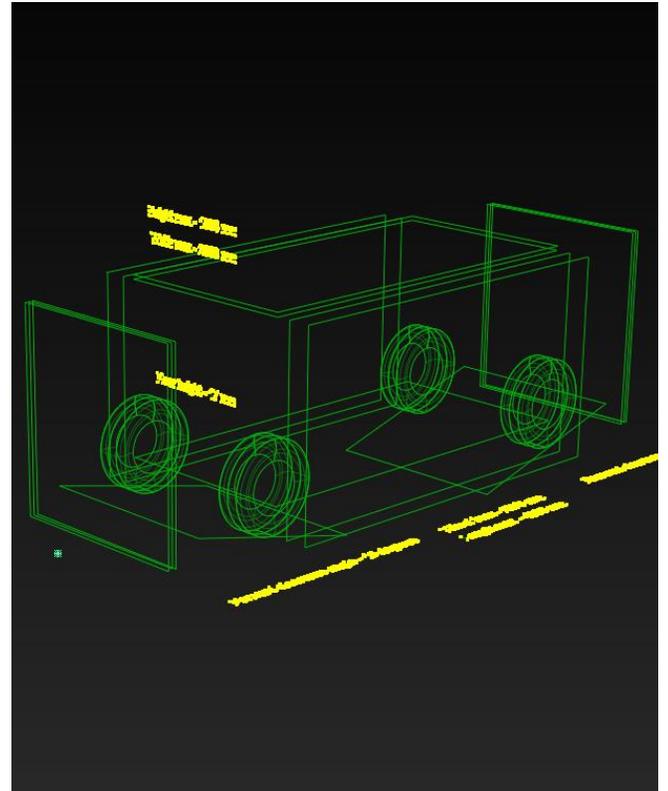


Dynamo File Import / Export

It is also worth noting that Dynamo has its own capability to import and export data. This can be used to read geometry into Alias or export it from there, as well as to drive Dynamo scripts by the ability to read from various possible file formats.

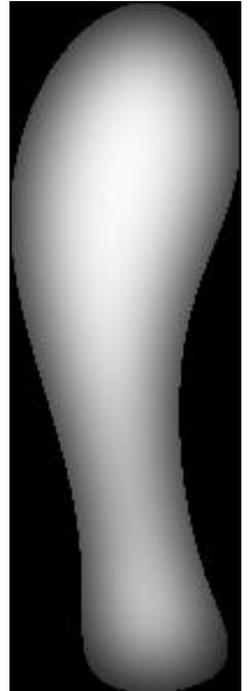
Text based formats

Dynamo can read text files, Excel sheets and comma separated value files (.csv). You can e.g., use such files to drive the dimensions of the package data script, which has been mentioned earlier in this handout.



Images

Dynamo can also read images. You could e.g., use grey scale images to drive parameters of a script. In the shown data model on the bottom, the image on the right has been used to drive the scaling of the spikes on the shoe sole. By that, a designer can use image programs like SketchBook or Photoshop to drive the geometry creation in Alias.



TSpline format

Dynamo can also read and write .tsm and .tss files. This e.g., allows you to write scripts for the direct data exchange of subdivision surfaces between Alias and Fusion.



Workflow Improvements

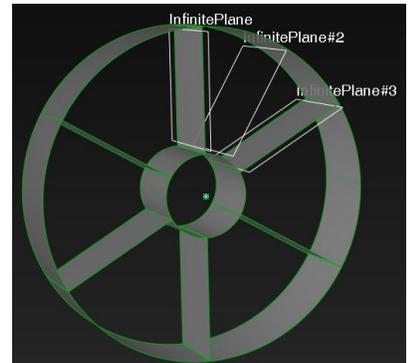
Already in the AU session of 2021, we presented the ability of Dynamo to compute center points of geometry, based on geometry extension instead CV positions (useful for Center Pivot Point operations).

We also demonstrated Dynamos ability to filter duplicate points.

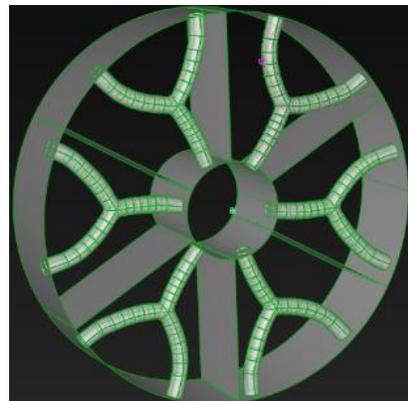
This year, we would like to present two other tools for workflow improvements.

Rim Support and Radial Scaling

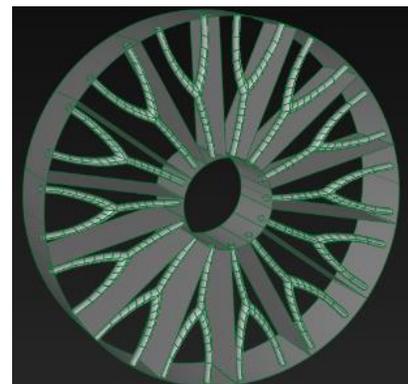
This script (to be found in the Dynamo Toolbox) is meant to assist for symmetrical spoke design. In a first step, it creates your „bounding box“ geometry, where you can choose the size of the sector in which area you want to design a subdivision spoke. The script also allows you to optionally create construction planes at the right places, in case you want to be symmetrical to neighbor sectors, or inside of your sector.



Once you created your subdivision spoke, the script takes care to create the rotated copies.



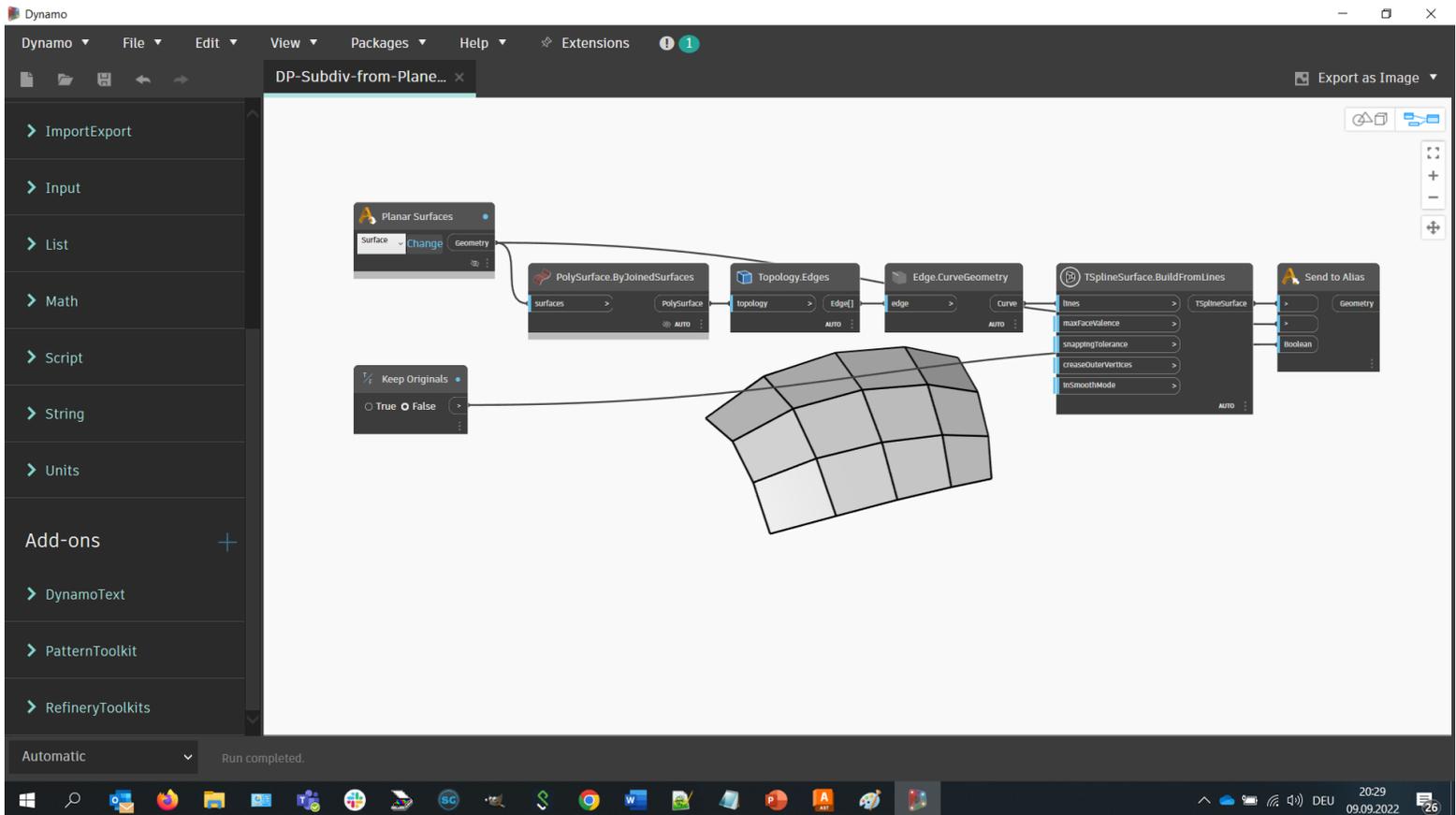
This all still has history, so if you change the spoke design, or want more or less spokes, the script takes care of the updates, and ensures that the subdivision body is scaled accordingly, so that it does not interfere with its neighbours.



Subdiv from Planes

Another creative use of Dynamo is the script displayed on the image below. A user really loved the concept of subdivision objects, but was struggling with the according tools in Alias. He was using Nurbs tools for 20 years, and much faster using them than using the subdiv tools. Also, he was missing the amount of control from the classical Nurbs tools when using the subdiv ones. As he was able to easily create box-mode like Nurbs results, using “Explicit Control” with a max degree of 1, and multiple spans, he was asking if there was a way to translate such box Nurbs results into subdivs. Understanding the task, evaluating possible implementations, and finally creating the script took less than an hour. The script is only able to translate a topology of single planar Nurbs surfaces into a subdiv body so far, but that one can easily be achieved when selecting a linear multi span Nurbs surface for the “Nurbs to Bezier” tool.

Within less than a working day, a Dynamo script has been created to speed up his workflow significantly, and he was directly able to use it.



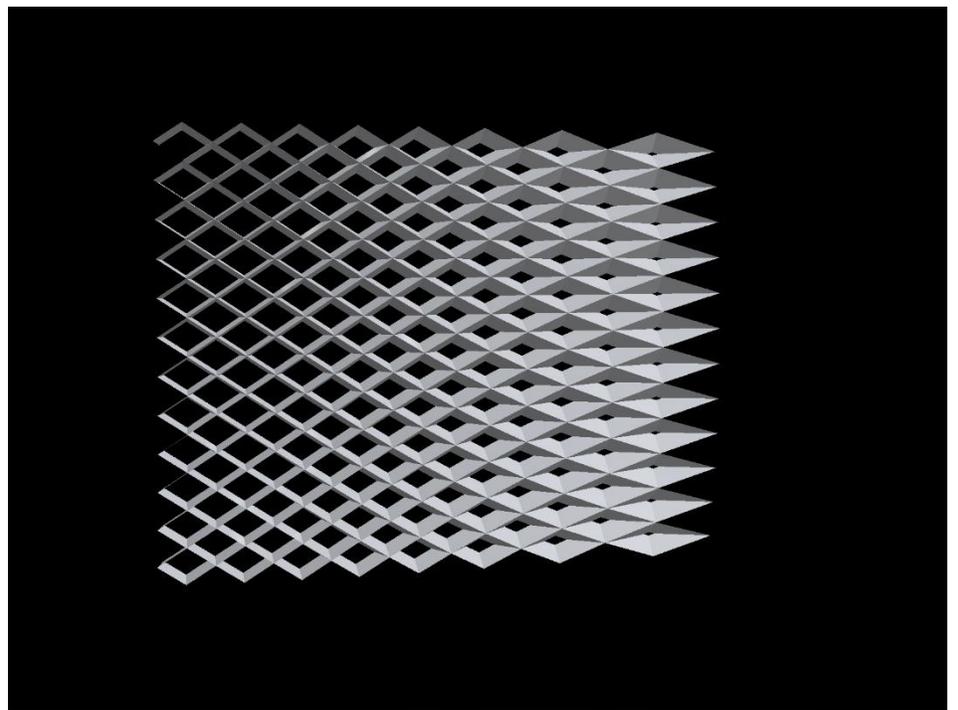
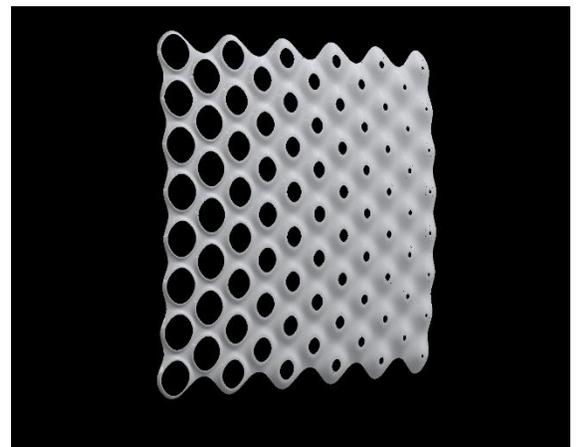
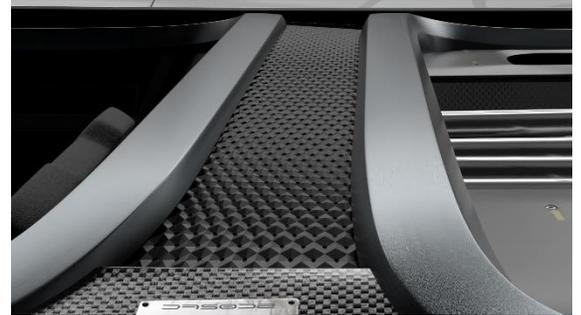
Generative Modeling

A classical application area of Dynamo is generating a lot of objects and shapes in a parametric way. Alias ships with two sample scripts to demonstrate possible use of this.

The first one is the subdiv hexagon pattern script. It takes a single, untrimmed surface as input, and creates the wanted amount of hexagonal subdivision bodies on it. Depending on whether you want to create the bodies or not, the result can look quite different. The script also supports a point or a curve to control an alteration of shape.

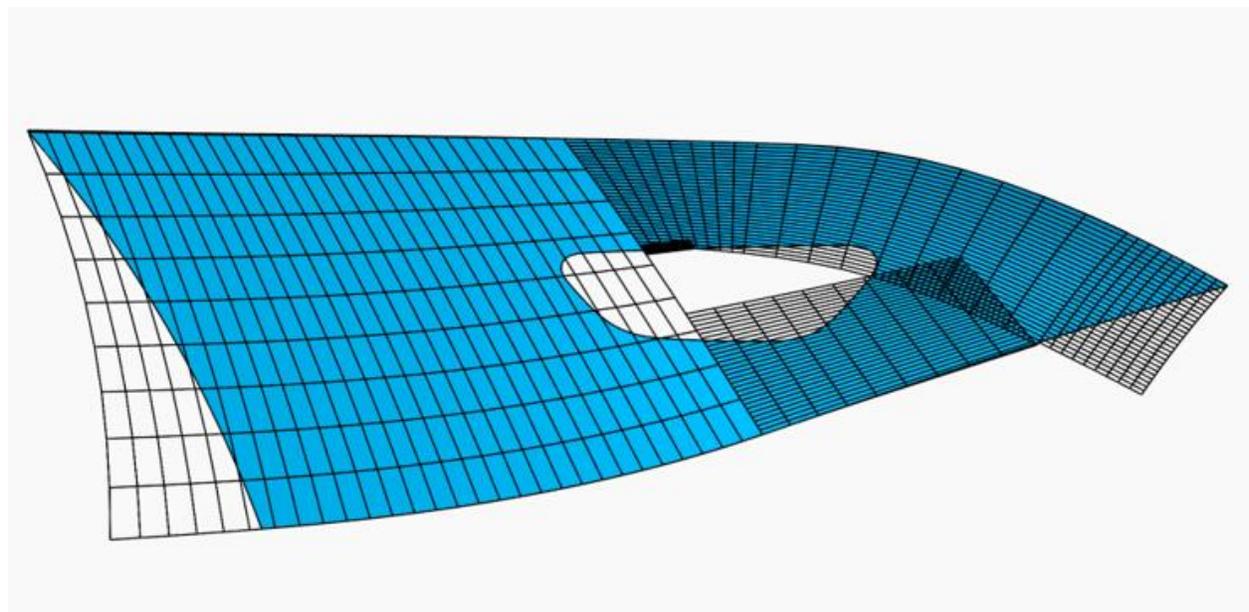
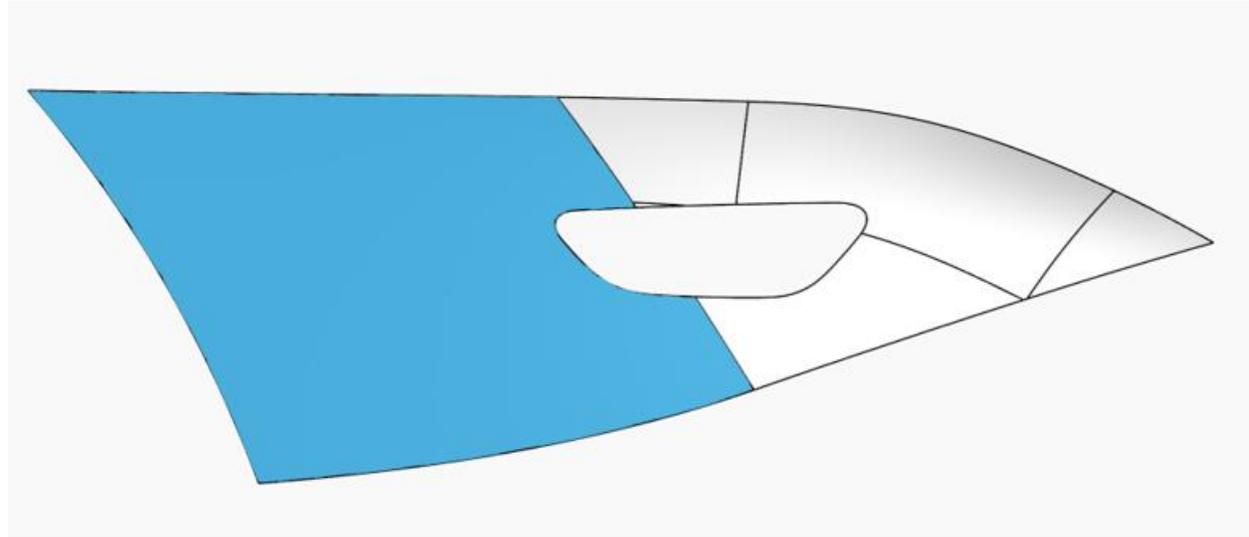
The second script also takes an untrimmed surface as input, to then create Nurbs surfaces with a diamond pattern onto it. This script also allows to use an attractor point or curve to control the shape of the output.

Of course, working only on a single, untrimmed surface is quite a limitation. Most of the patterns require to be distributed over a topology consisting of multiple surfaces. This case will be handled in the following section.



Multi Surface Patterning

The problem of patterning across multiple surfaces is the fact, that those surfaces usually don't share a common parameter space:



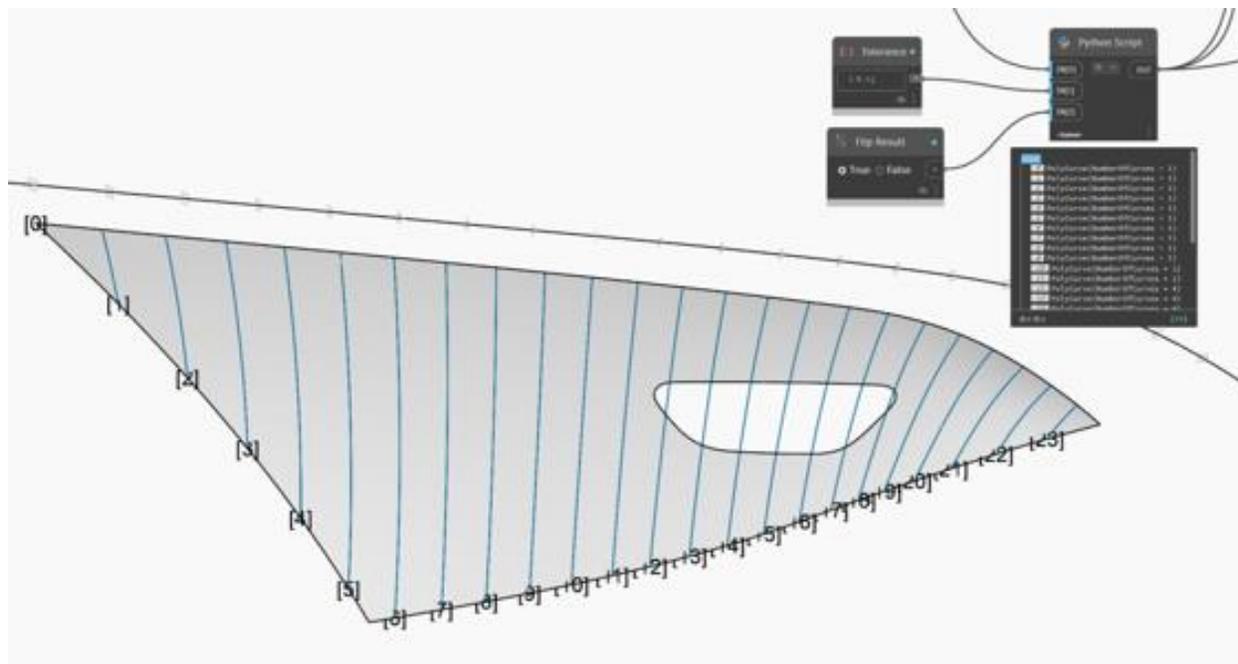
We have developed an algorithm, which solves the issue in the following way: usually, a pattern is created from points. These points either serve as a base position for placing an object, or a collection of points is used to create any kind of object, like a pyramid, a diamond or such. The task is to be able to place these points on multiple surfaces, with minimal effort, but still with a "natural" distribution.

For this, you need to note the following: for a pattern to be created, each point can be defined

as a (U,V) pair on a planar surface. Each (U,V) point from the planar surface must be placed accordingly onto the surfaces to be patterned, to recreate the pattern there.

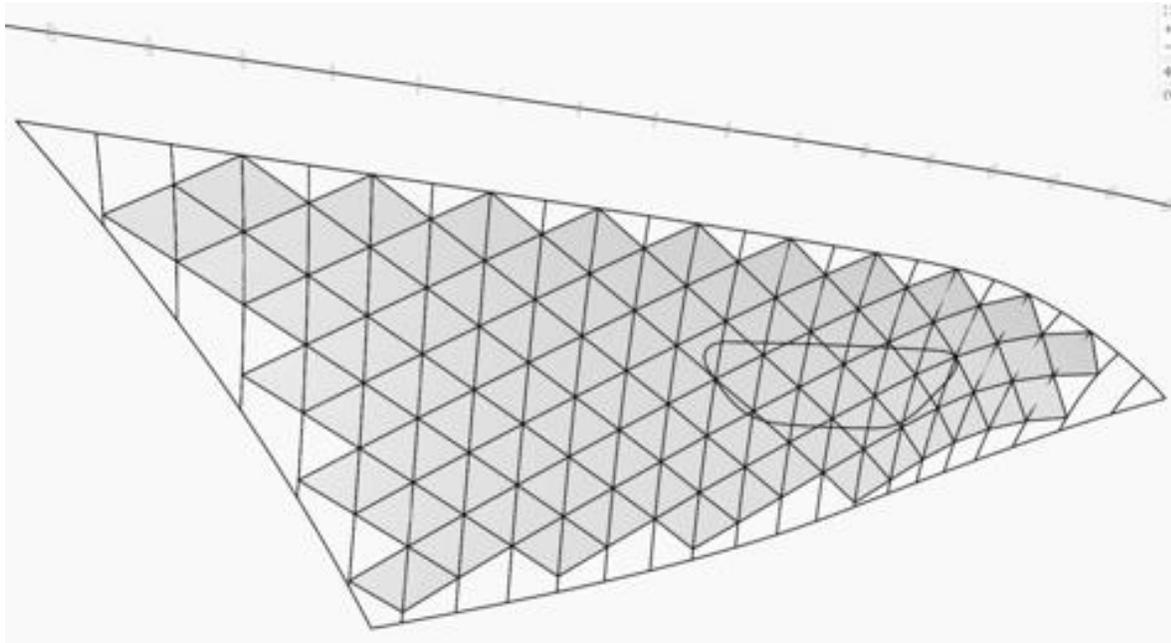
Our algorithm works as follows: the user creates a single guide curve in Alias. This curve is handed over to Dynamo, and then used to create section planes perpendicular to that curve. Each U value of a point can be placed along this guide curve, using its parameter space. At each such point, a section plane is generated, which intersects the surfaces to be patterned. The resulting section curves are sorted, and connected (in case of gaps) by an algorithm we wrote. They can also be extrapolated tangentially, if wanted.

As each intersection plane has now created a continuous curve, that one can be used to place the point using its V parameter as an arc length parameter on the section curve:

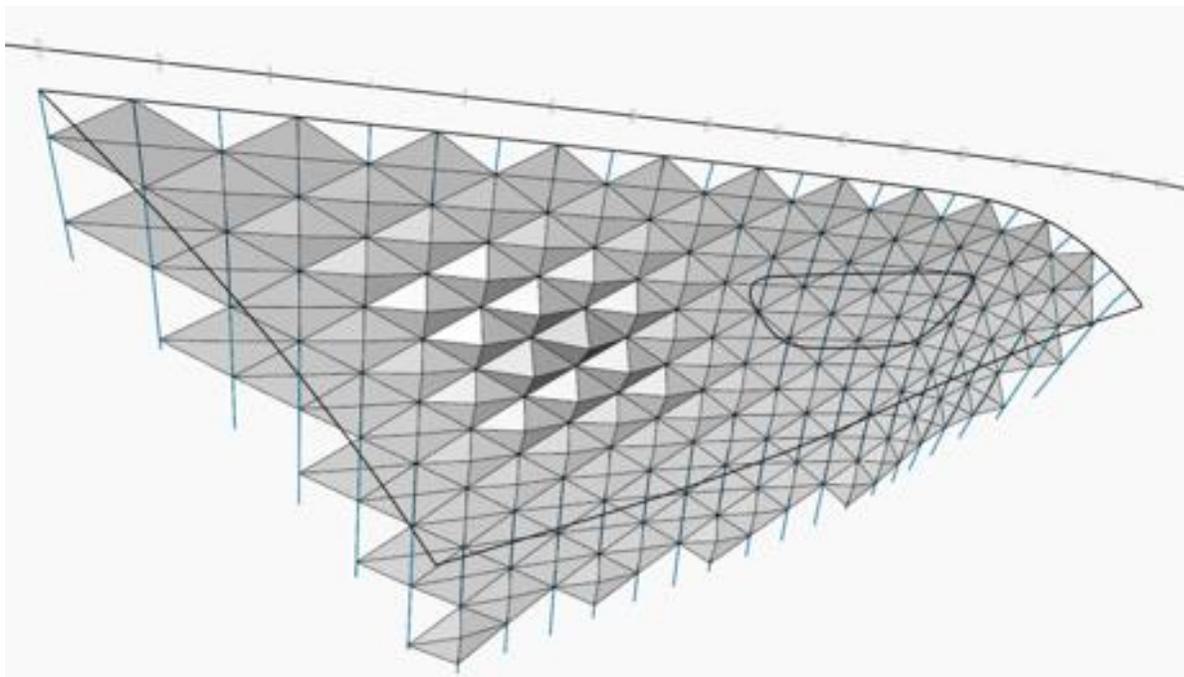


In summary: each U value of a pattern point creates a section plane on the guide curve, which was given by the user. Each according point is then placed on its section, using the V value of each point as an arc length parameter on the according section.

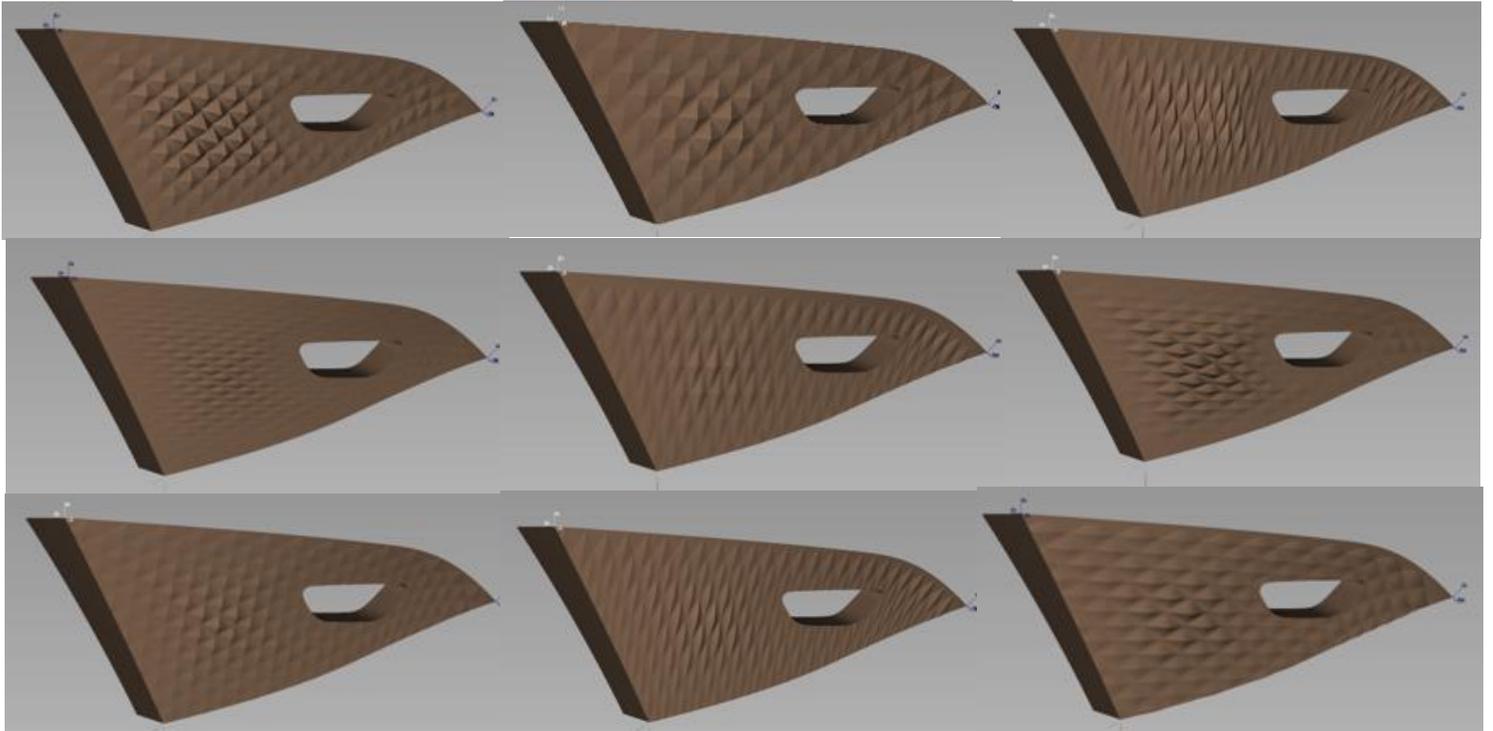
With this, you can e.g. create a diamond pattern like this across multiple surfaces:



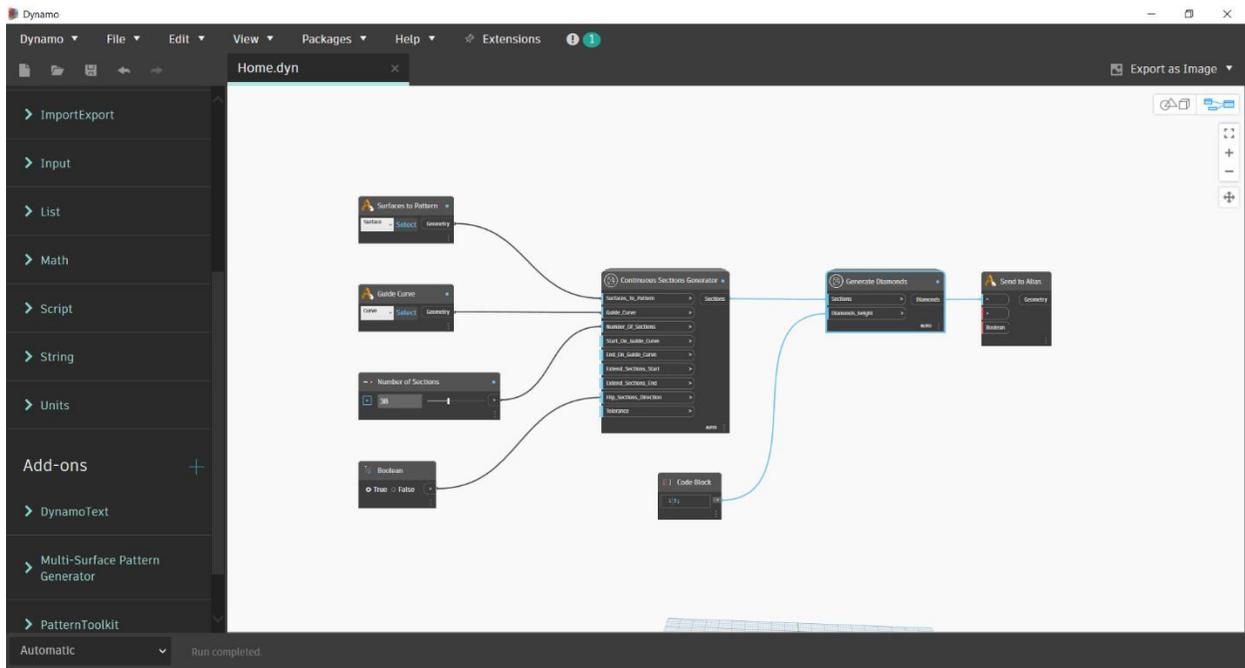
From these points, linear lines can be created, which can then define a subdivision body in Dynamo. Using the extended sections, and an attractor point for the height of the diamonds, the following result can be achieved:



Using the edges of the surfaces as trimming objects on the Dynamo side, it is possible to quickly generate different designs of this pattern:



Using our algorithm on the Dynamo side, the script looks simple like this:



The “Generate Diamonds” node in this image is the part where each user could define her or his own pattern.

Creating a Dynamo Player tool from Scratch

Please note that Alias provides a lot of general information about Dynamo and the Dynamo player in [this part of the online help](#).

In Alias, open the “Transform” tab in the palette, and keep the left mouse button pressed on the “dynply” icon in the bottom right corner, to expand the tool group. Then left mouse button click on the “dynamo” icon to start Dynamo. When starting a new script, or doing major edits to an existing one, it is usually better to start Dynamo instead of the Dynamo Player. The “normal” Dynamo icon maintains the connection to Alias, which is needed to transfer selected items from Alias to Dynamo. This is necessary if you want to see if your script works as expected with Alias input geometry while editing the script.

In Dynamo, click on “New” to start a new script. As mentioned before, we would like to write a script which only returns unique copies of given points back to Alias. The first thing we need is the node to select the points from Alias, to send them to Dynamo. For this, right mouse button click in the canvas to open a search window, and type “sel” into it. The first resulting hit in the list is the node we need, which is “Select from Alias”. Left mouse button (LMB) click on it, to add the node to the canvas. Most of the time it makes sense to also specify what kind of elements you expect to come from Alias. This way, the according selection filter will be set on the Alias side, making it easier for the user to pick only the intended entities. To do so, LMB click on the “Unspecified” drop down in the “Select from Alias” node, and select “Point”, as that is the type we want to work with.

Next thing we need is the node which shall get rid of possibly duplicate points. RMB click in the canvas to open the search again. Type in “pru”, and LMB click on the PruneDuplicates entry to add the corresponding node to the canvas.

We now need to feed the points coming from the Alias selection into the PruneDuplicates node. To do so, LMB click on the “Geometry” text on the right of the “Select from Alias” node, and then LMB click on the “points” entry on the left of the PruneDuplicates node. The two nodes are now connected. You will mostly likely see a yellow warning popping up. This is only because the current selection from Alias is empty and can therefore be ignored.

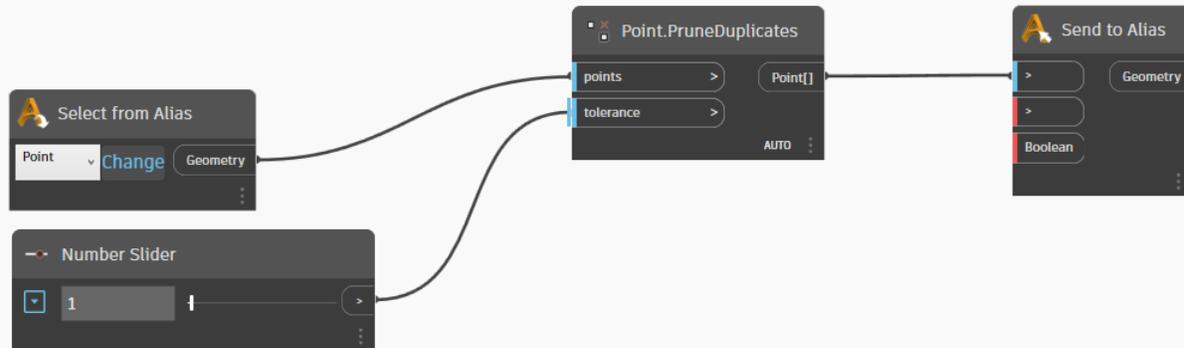
As you can see, the PruneDuplicates node also offers a tolerance parameter. If not explicitly set, it defaults to 0.001. You can see that by hovering the mouse pointer over the “tolerance” text of the node. We would like to give the Alias user the option to set this explicitly.

For that, we need a slider. Click RMB in the canvas to open the search, type in “sli”, and click on the Number Slider entry in the list. Good tolerance values probably range from 0.001 to 1. To only allow the user to set values in this range, LMB click on the little downward pointing arrow on the left of the number slider. Type in 0.001 as Min value, and 1 as Max value. You can also set the wanted step size, but be aware that this value does not control the slider sensitivity on the Alias side yet, it only works on the Dynamo side so far. Now connect the number slider to the PruneDuplicates node, by first LMB clicking on the little arrow on the right of the number slider node, and then on the “tolerance” entry on the left of the PruneDuplicates node.

To make the number slider show up in the Alias tool window later, we must let Dynamo know that this slider shall be an input parameter coming from Alias (this is already set by default for all “Select from Alias” nodes). To do so, RMB click on the number slider node, and in the upcoming list, activate the check mark before the “Is Input” entry.

Now we need to send our unique copy of points back to Alias. For that, RMB click in the canvas, and type “send” into the search window. LMB click on the “Send to Alias” entry, to add the node to the canvas. Now LMB click on the “Point[]” entry on the right of the PruneDuplicates node,

and then LMB click onto the little arrow on the left of the “Send to Alias” node. The two nodes are then connected, and our script is complete.



Go to “File – Save As”, and save the Dynamo script somewhere, e.g., as Filter-Points.dyn. Now go back to Alias, and double LMB click on the “dynply” icon, to bring up the Dynamo Player tool window. In that window, click on the “...” button on the top right, and browse to the location where you saved your script. Once there, in the file browser double LMB click on your script to load it. The Dynamo Player tool window should now update its UI to reflect the loaded Dynamo Player script.

Now the Dynamo Player has loaded your script, you can create an instance of your script on your shelf. For that, keep the LMB pressed again on the tool group of the Dynamo tool icons in the Transform tab, to display both icons. Now use the MMB to drag the Dynamo Player icon onto your shelf. Note that it is important to only drag and drop the Dynamo Player icon, and not the complete group, otherwise you won’t be able to rename your shelf entry in the next step. We want to rename this icon now, to distinguish it from possible other Dynamo Player instances on our shelf. For that, press the ctrl key on your keyboard, and then double LMB click on the icon. You can rename your tool icon in the upcoming window.

Creating an icon for your Dynamo Player script

In the location where you saved your script, you need to create a folder, named depending on the icon sizes you are using for Alias. A folder named “small” is needed for small icons, a folder named “medium” for medium ones. The icon you want to use needs to be saved in the tif file format, and the name of the icon needs to be the same as the name of your Dynamo Player script. Please save the icon in the size of 32x32 pixels into the “small” folder” in case you are using small icons, and as 48x48 pixels into the “medium” folder in case you are using medium sized icons.

Alias checks for these possible icons when the script is loaded, and in case an icon is found, it immediately replaces the standard Dynamo Player icon in Alias by the one being found.

Dynamos Limitations

Dynamo geometry typically not Class A

The math kernel of Dynamo does typically not provide class A quality. Its strength is in the area of solid modeling and boolean operations. It achieves accuracy by inserting spans with a degree of 3.

No Alias Tools inside of Dynamo

There is currently no access to the Alias tools inside from Dynamo. This is a difficult thing to achieve, due to the way the Alias modeling kernel is set up.

No Access to Alias Data Model

Dynamo has no access to the Alias data model yet. While geometry can be sent, Dynamo can't transfer or create layers, shaders, colors or similar entities yet.