

Dynamo: Generative Modeling with T-Splines

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Mode Lab

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Hi, I'm Ronnie



- Global design and strategy to iterate and create in new and unimagined ways. www.modelab.is



- Open-source guide to share the fundamentals of visual programming in Autodesk Dynamo. www.dynamoprimer.com



- Open-source searchable database for Dynamo functionality. <http://dictionary.dynamobim.com/>



Key learning objectives

Learn quick and efficient workflows, using Dynamo and T-Splines, to generate structures, textures, and forms for rapid prototyping.

At the end of this class, you will be able to:

- Create a parametric Dynamo Graph with T-Splines Nodes
- Extend Dynamo Functionality using the Package Manager
- Export a Dynamo T-Splines file for use in an External Application
- Create and Export a Dynamo T-Spline file for Rapid Prototyping

Lab Handout(s)

Lab handouts and datasets can be downloaded at:

www.modelab.box.com/v/au2016

- Main class handout contains key information and workflows.
 - Compiled from multiple chapters of the Dynamo Primer
- Datasets (Annotated for in-context learning)
 - 00.Getting Started
 - 01.Advanced
 - 02.Going Further

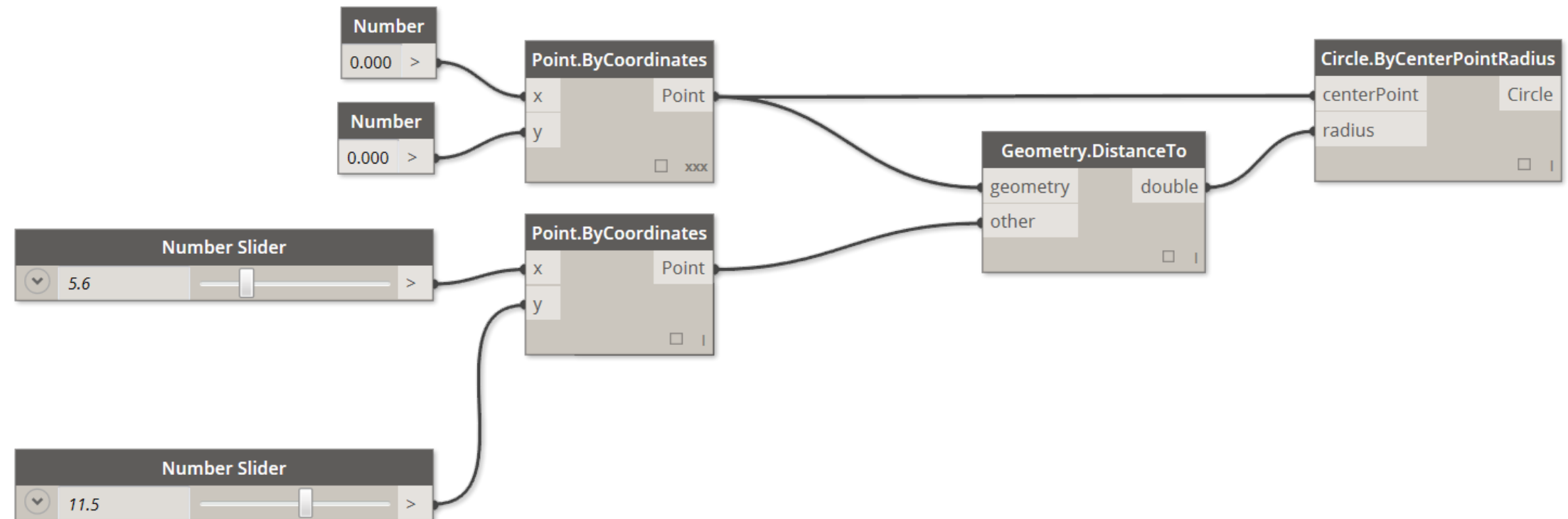


Dynamo: Open, Connected, Creative



What is Dynamo?

- Visual Programming Platform
- Compose Custom Algorithms
- Process Data and Generate Geometry



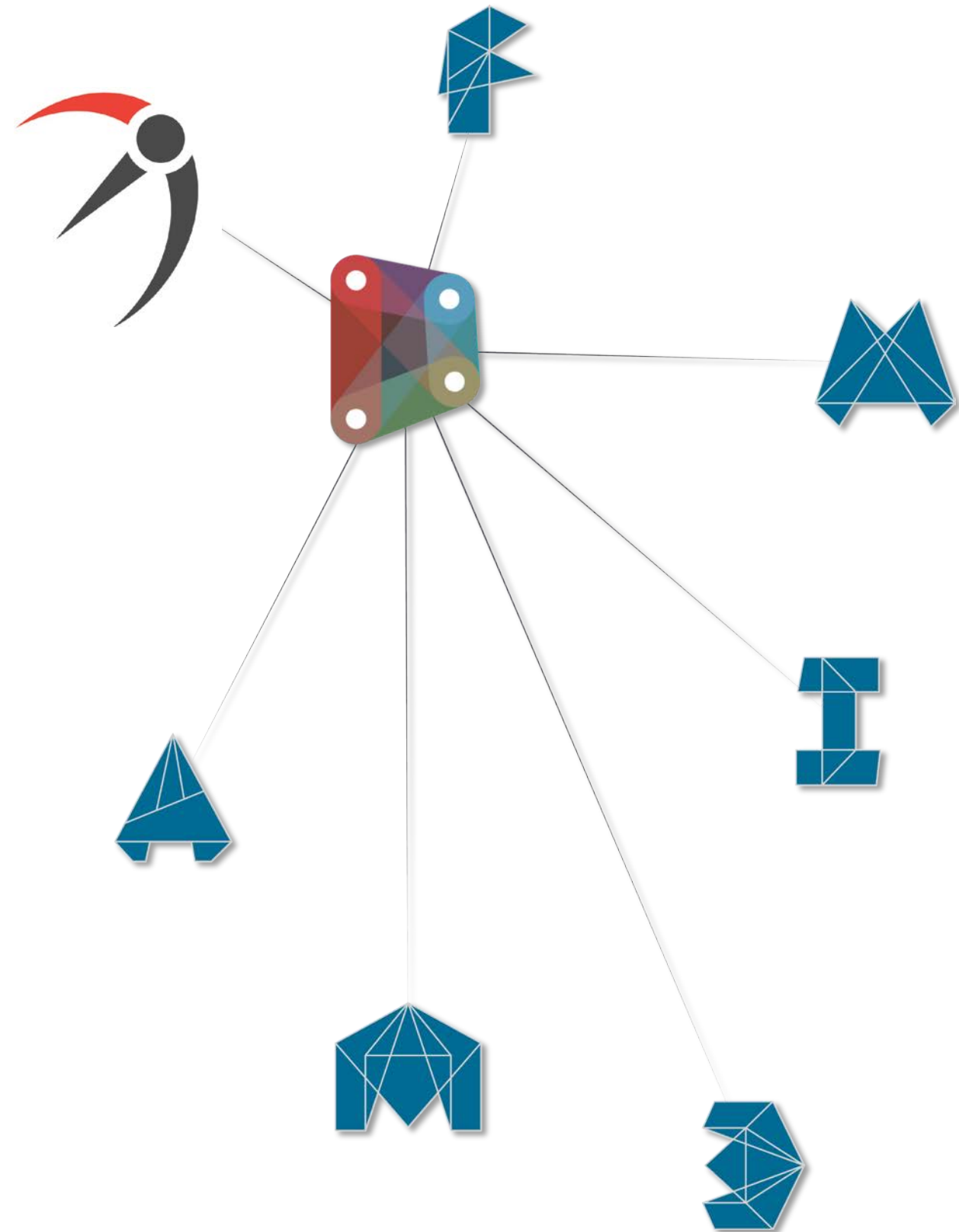
What is a T-Spline?

- Special kind of Geometry
- Combine many Surfaces as a Single Surface
- Mathematically Watertight
- Minimal Amounts of Control Points



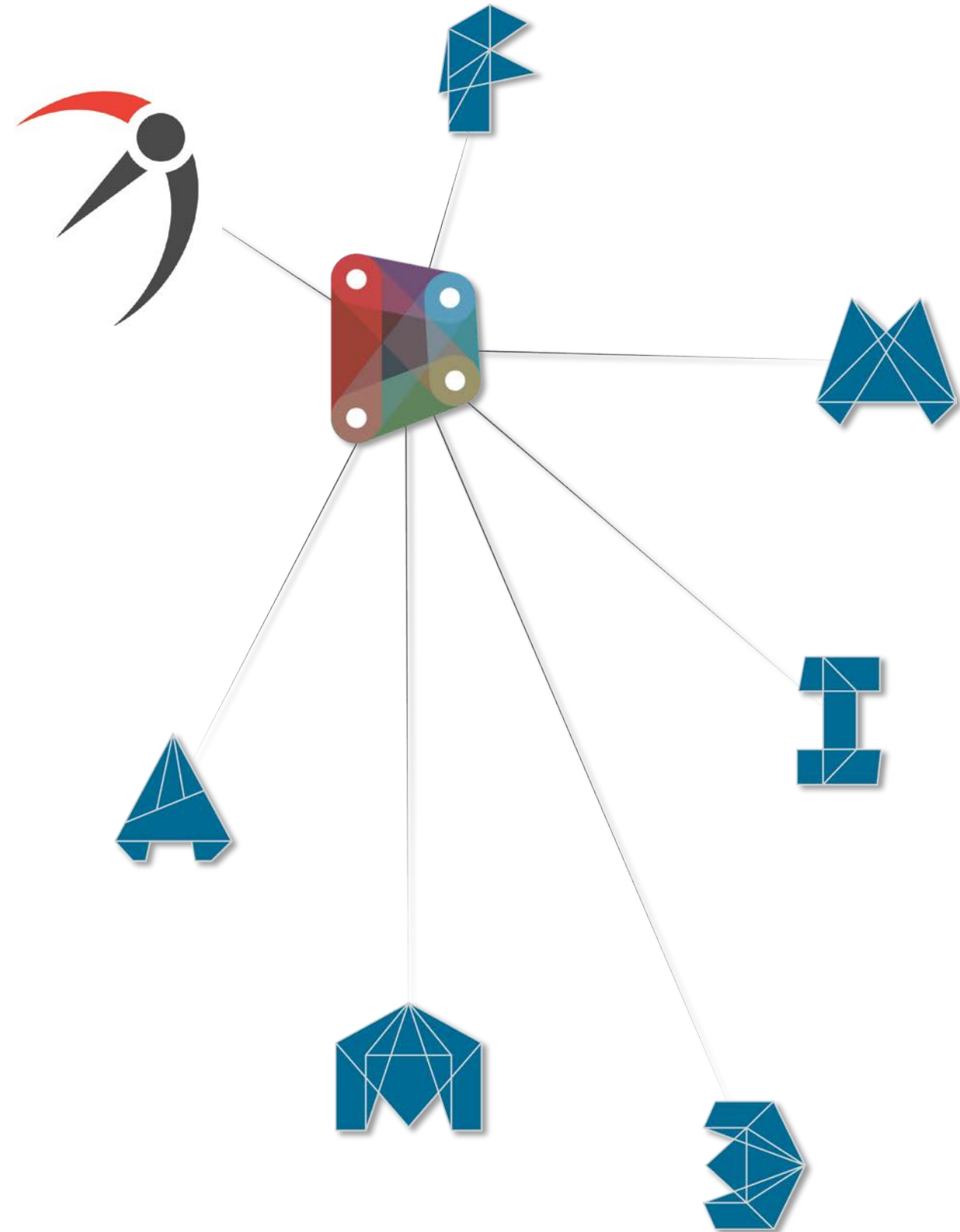
Why Dynamo and TSplines?

- Open
 - Open-source design Tool



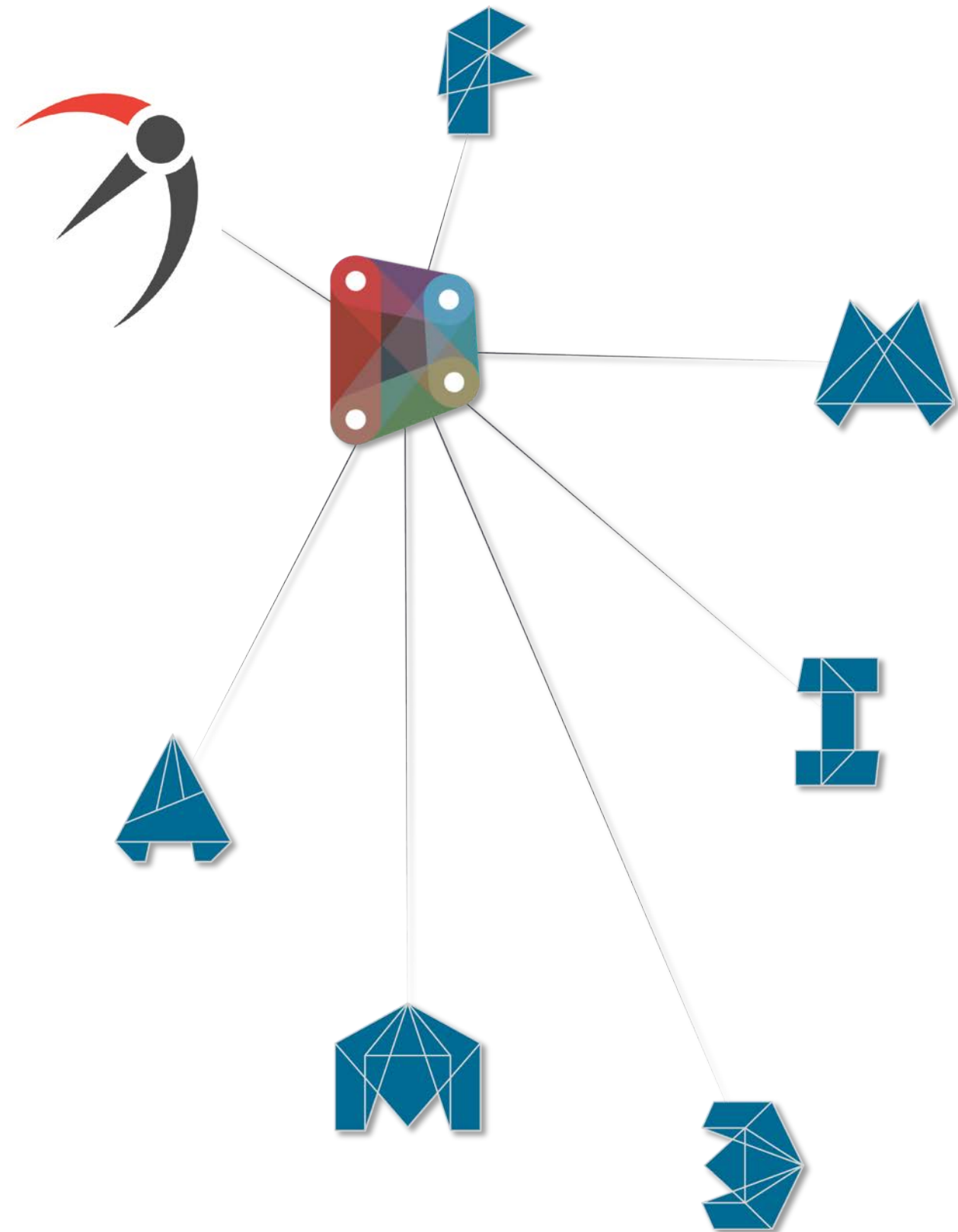
Why Dynamo and TSplines?

- Open
 - Open-source design Tool
- Connected
 - Stand-alone or Add-on



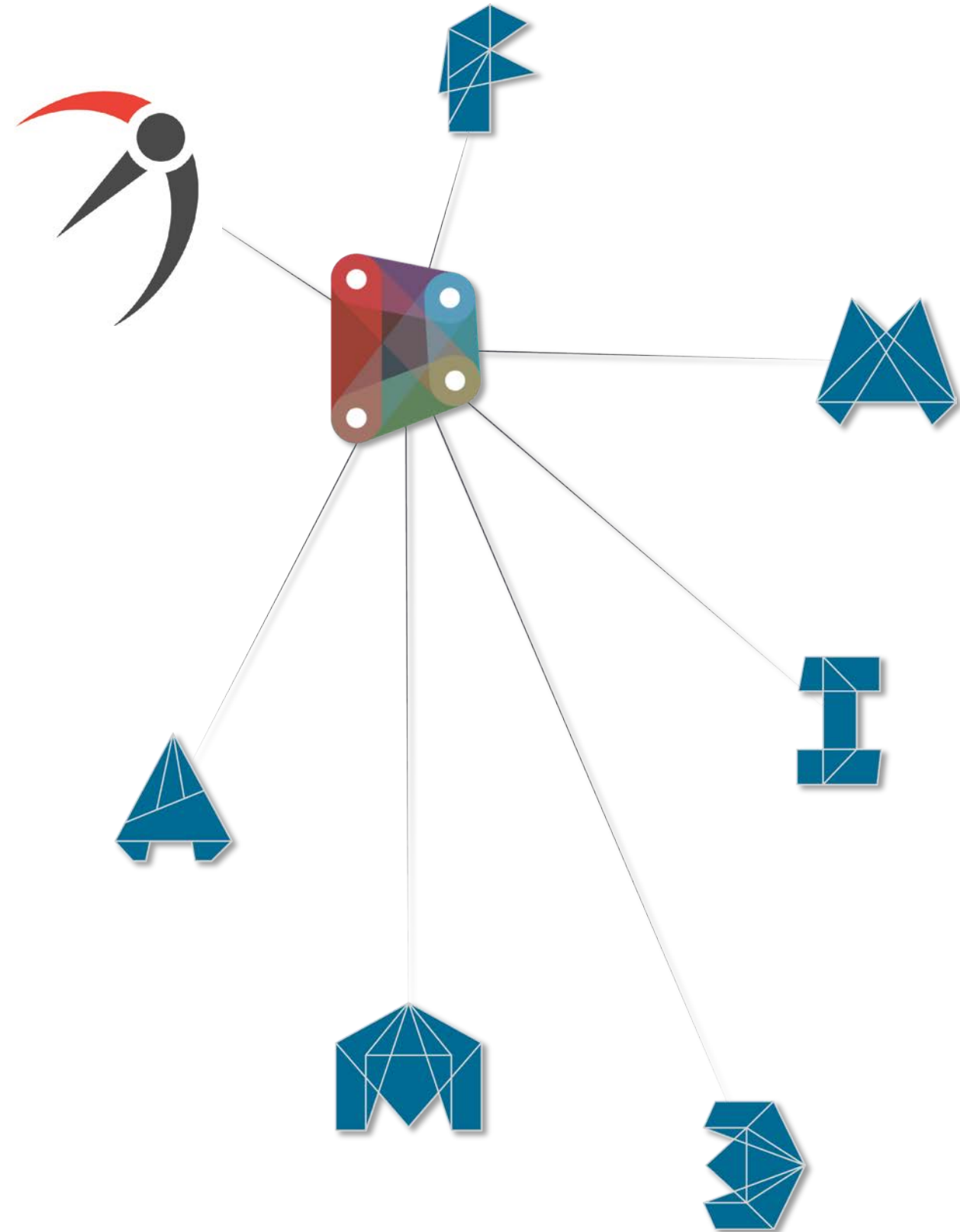
Why Dynamo and TSplines?

- Open
 - Open-source design Tool
- Connected
 - Stand-alone or Add-on
- Creative
 - Visual Programming
 - Low-Poly Modeling
 - NURBS Compatability



Why Dynamo and TSplines?

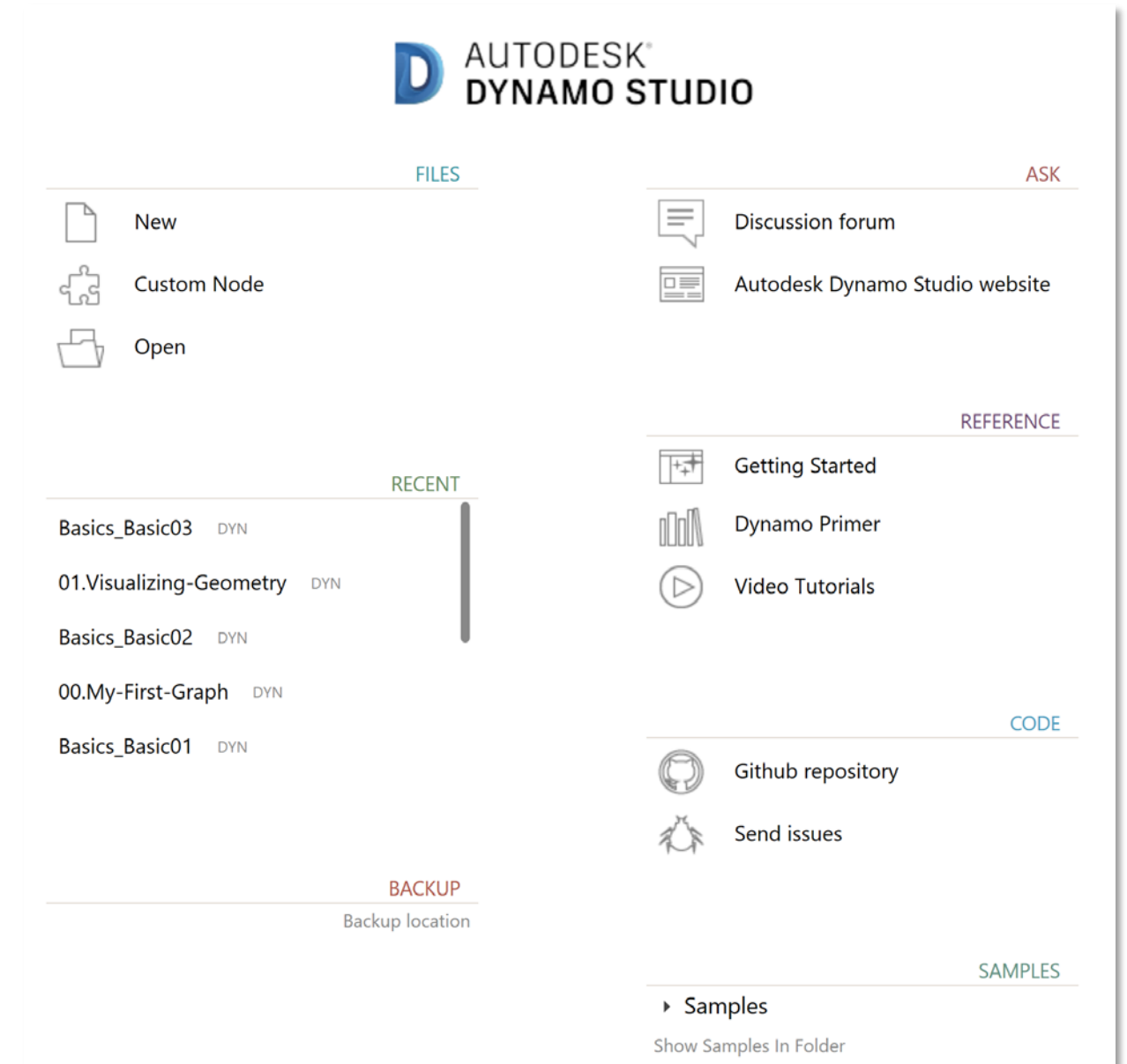
- Open
- Connected
- Creative
- **Generative**
 - Inspire Creativity
 - Support Imagination



Getting Started with Dynamo

Launching Dynamo

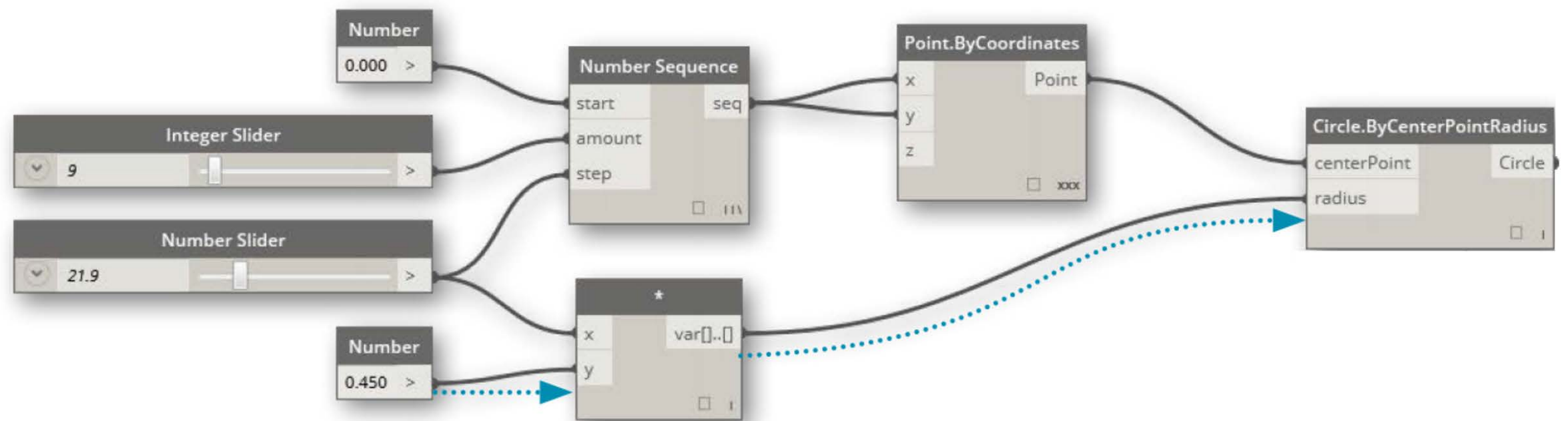
- Ask
 - Reference
 - Code
 - Samples
-
- **Files > New**



Dynamo Start Page

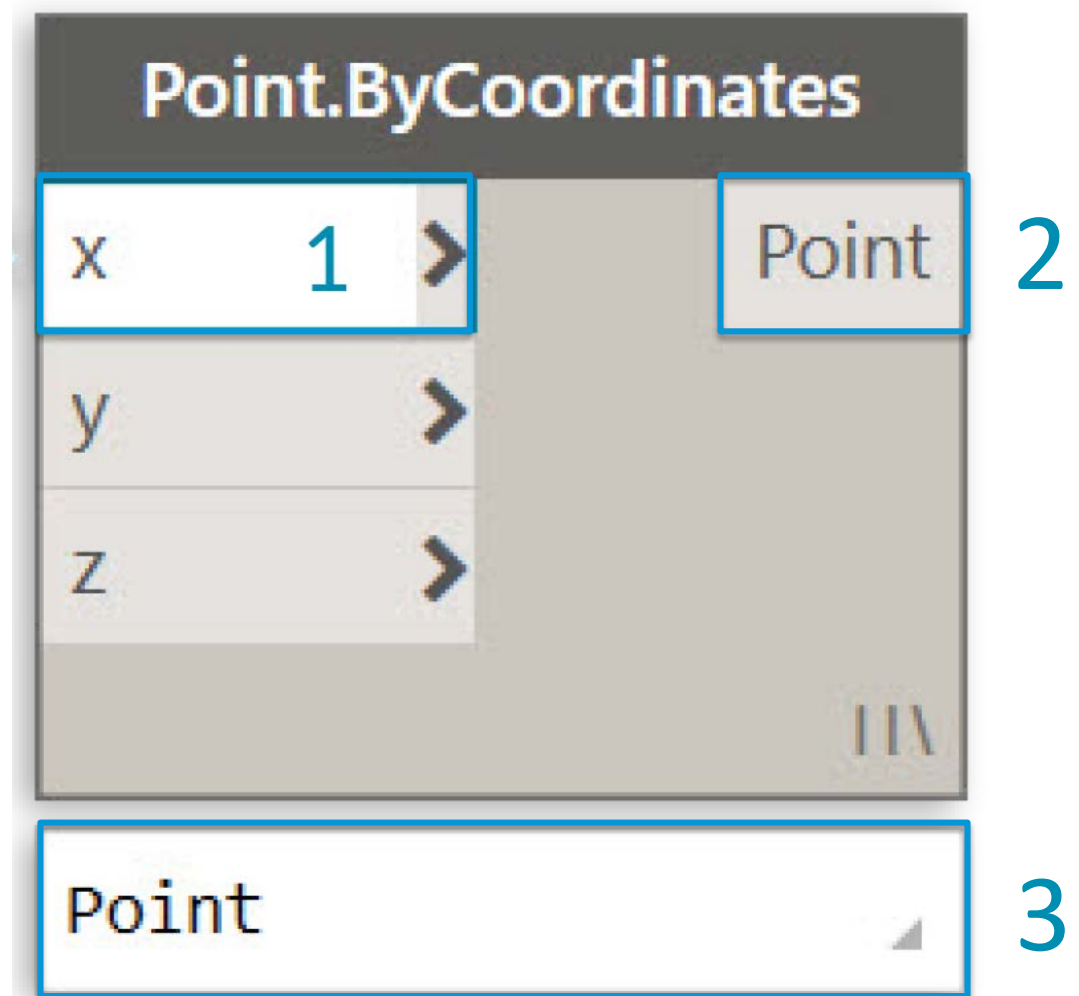
What's in a Dynamo Program?

- Collection of Nodes
- Wired Together
- to Define Modeling Instructions



Anatomy of a Node

1. Input Port
2. Output Port
3. Preview Bubble



Finding and Placing Nodes

1. Search “Point”

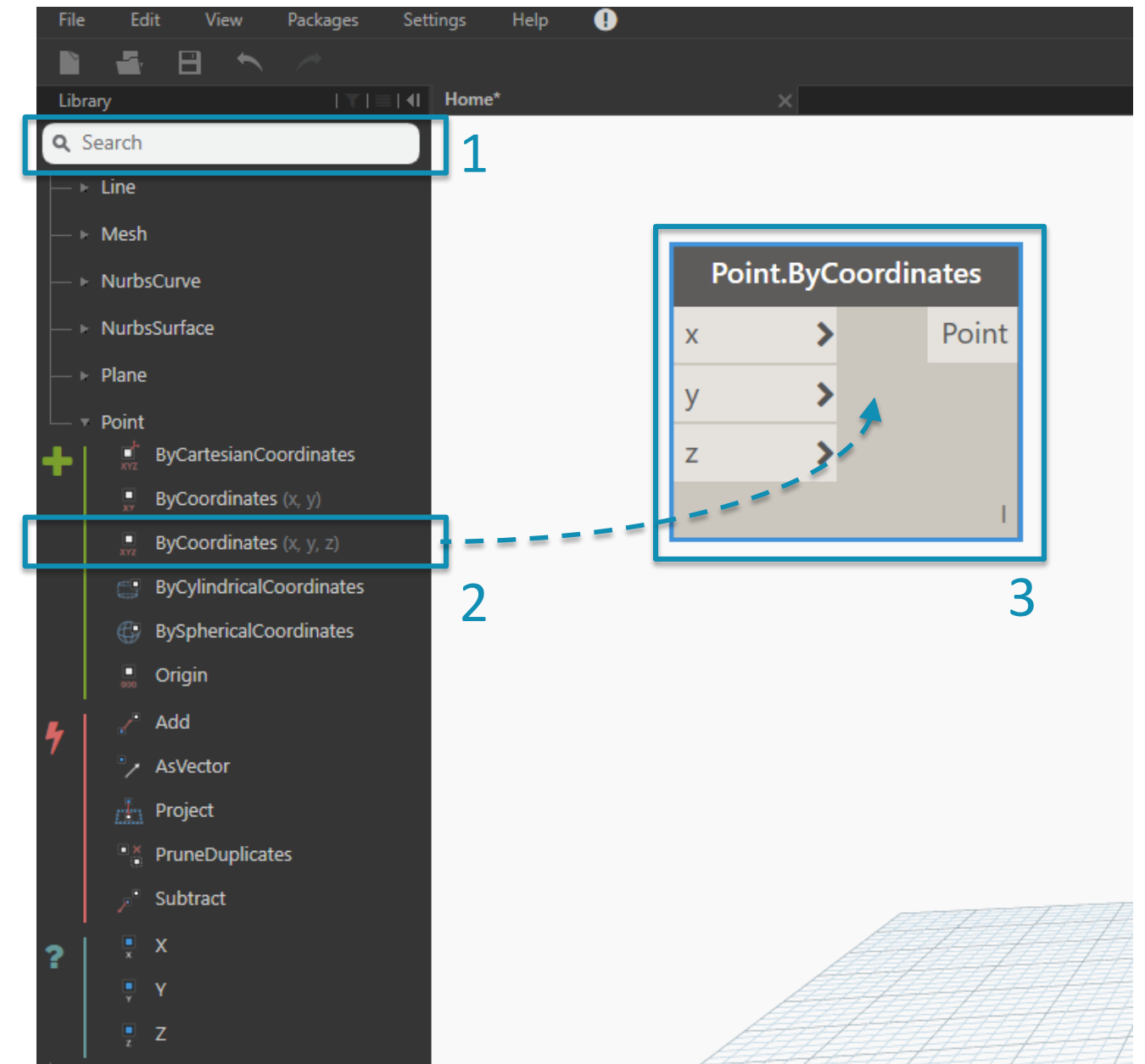
- Use the Library Search to find nodes

2. Browse for “Point”

- Discover nodes in the Library Categories

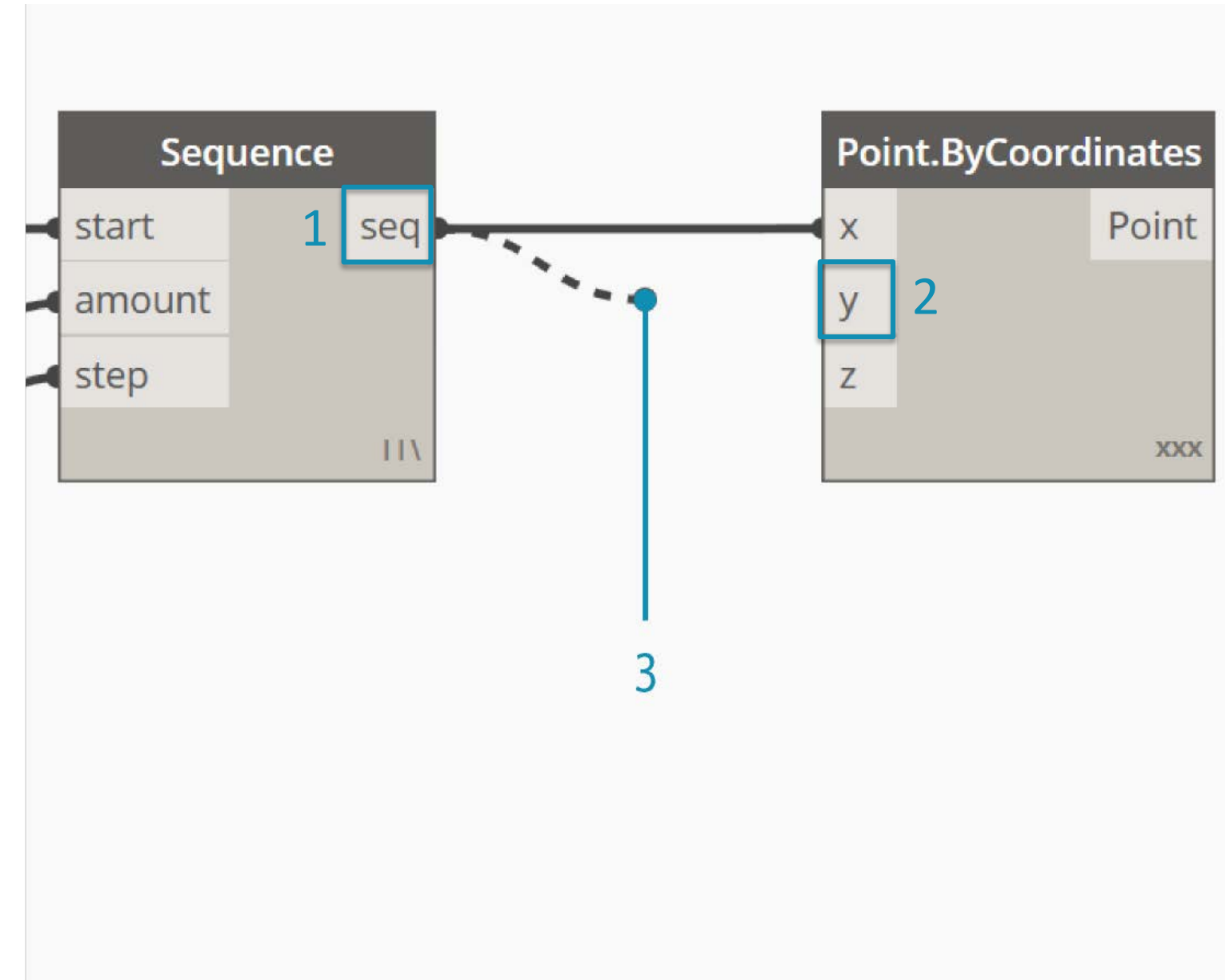
3. Add **Point.ByCoordinates**

- Click + Drag node to the Workspace



Wiring Nodes to Build an Algorithm

1. Click on Output Port
 - Node A
2. Drag Wire to Input Port
 - Node B
3. Deleting Wires
 - Click on Port and Drag Wire Away



Graph View VS Background 3D Preview

1. Switch Views

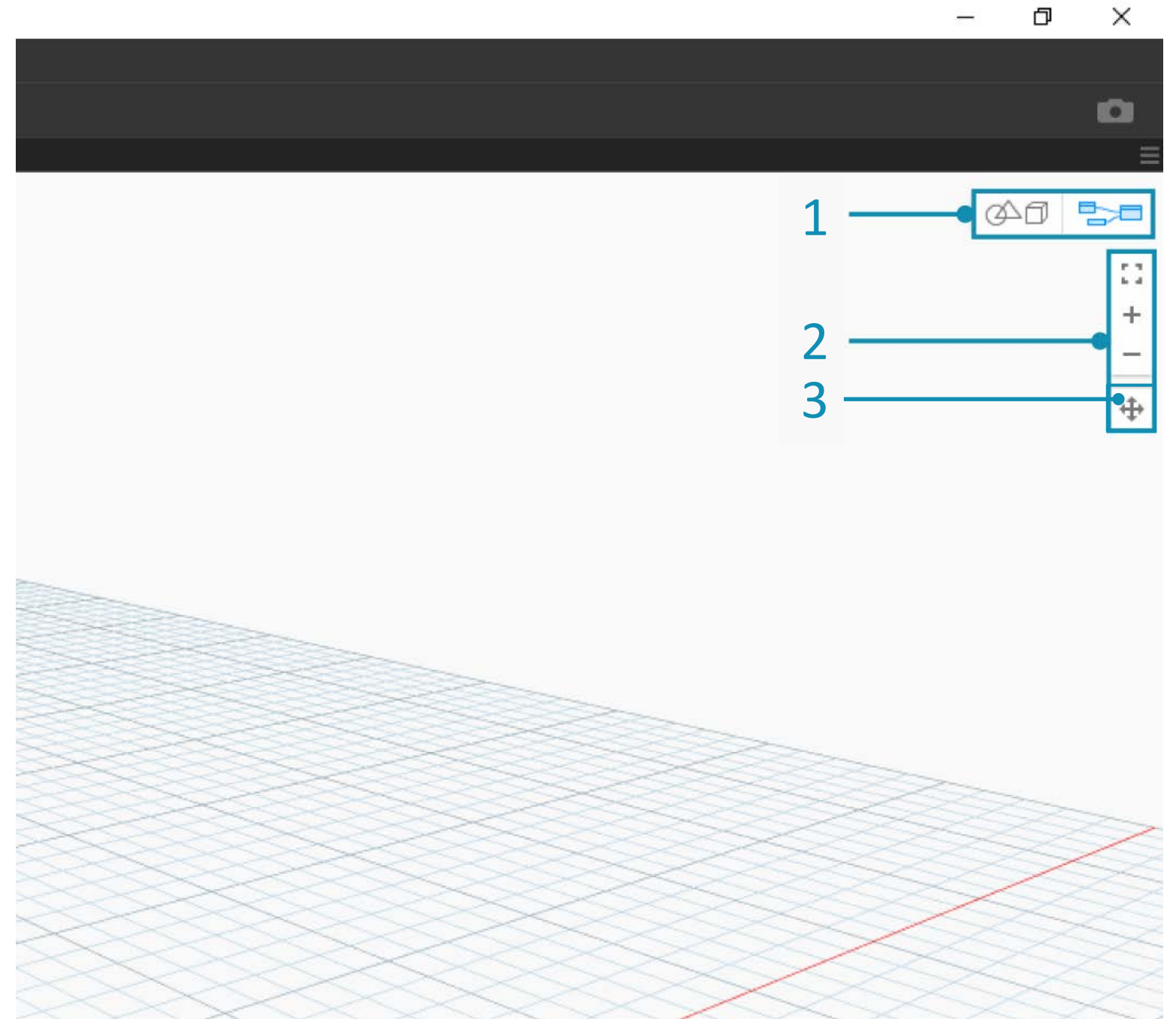
- Graph View
- Background 3D Preview

2. Zoom Controls

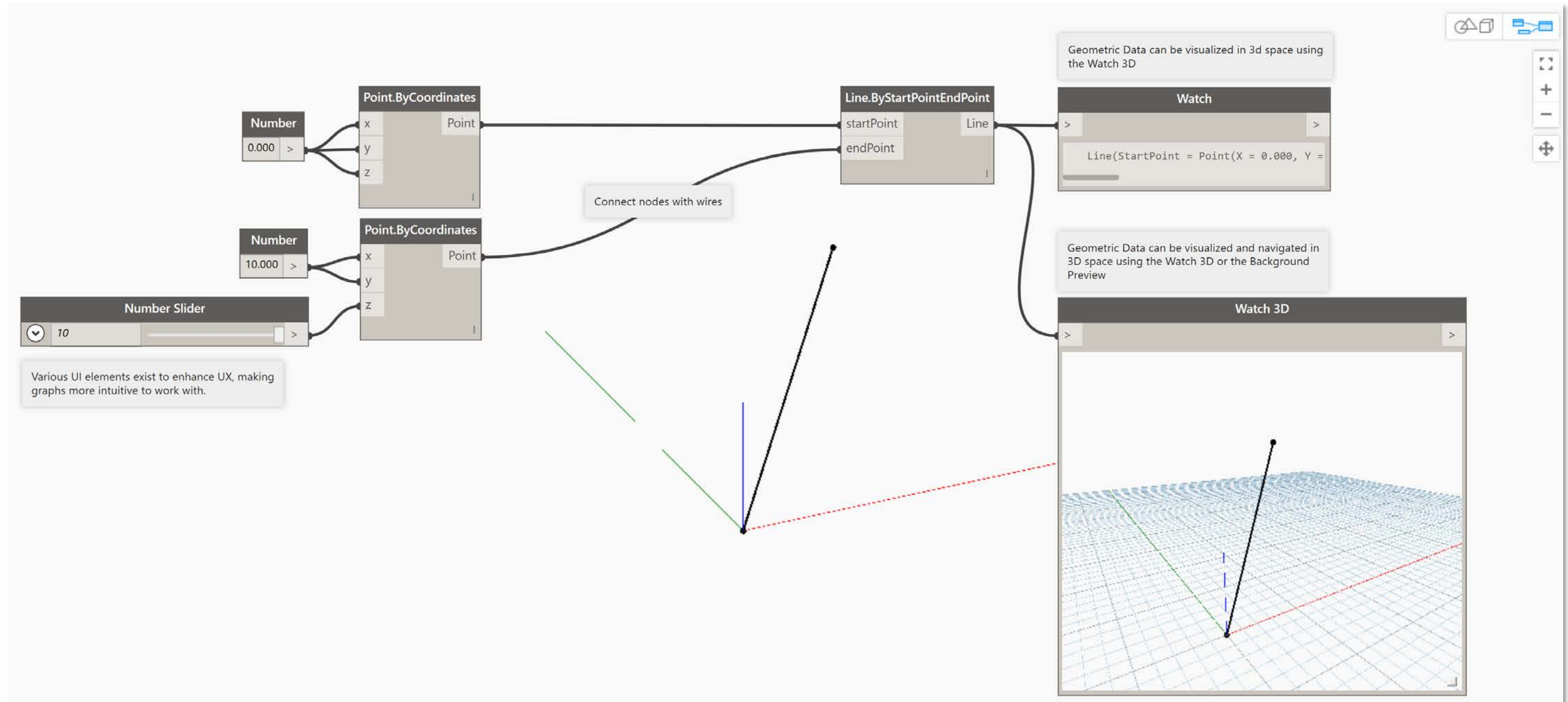
- Independent Zoom Control

3. Pan View

- Click + Drag the Mouse

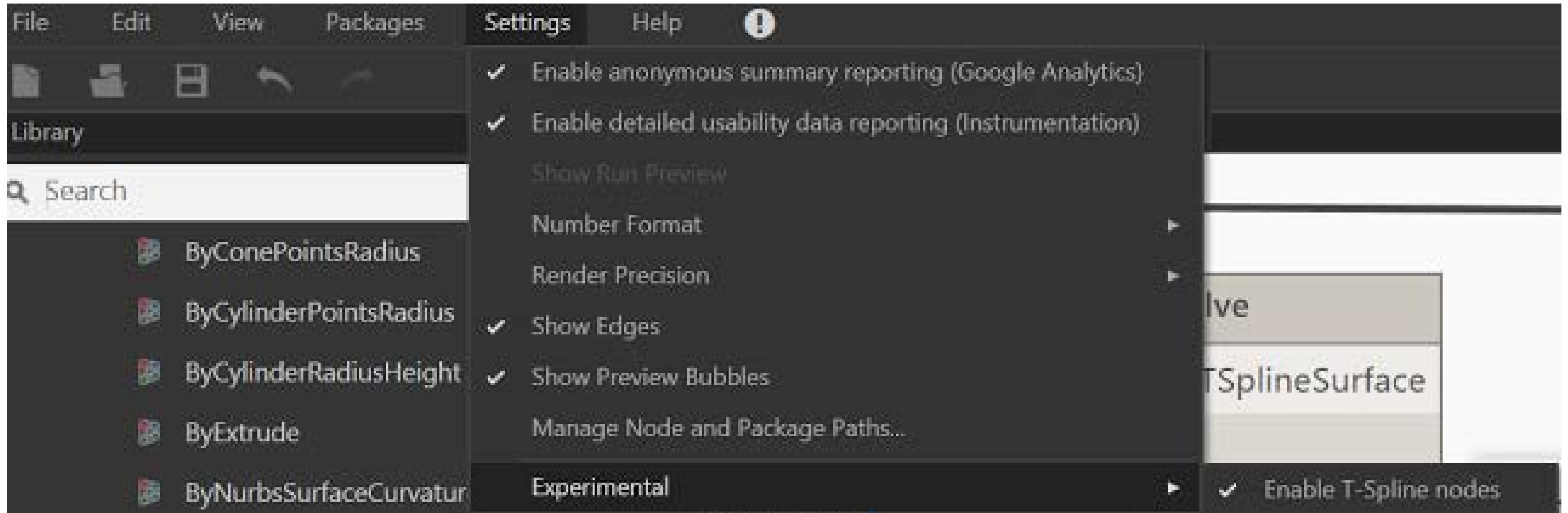


00.Introduction-To-Dynamo



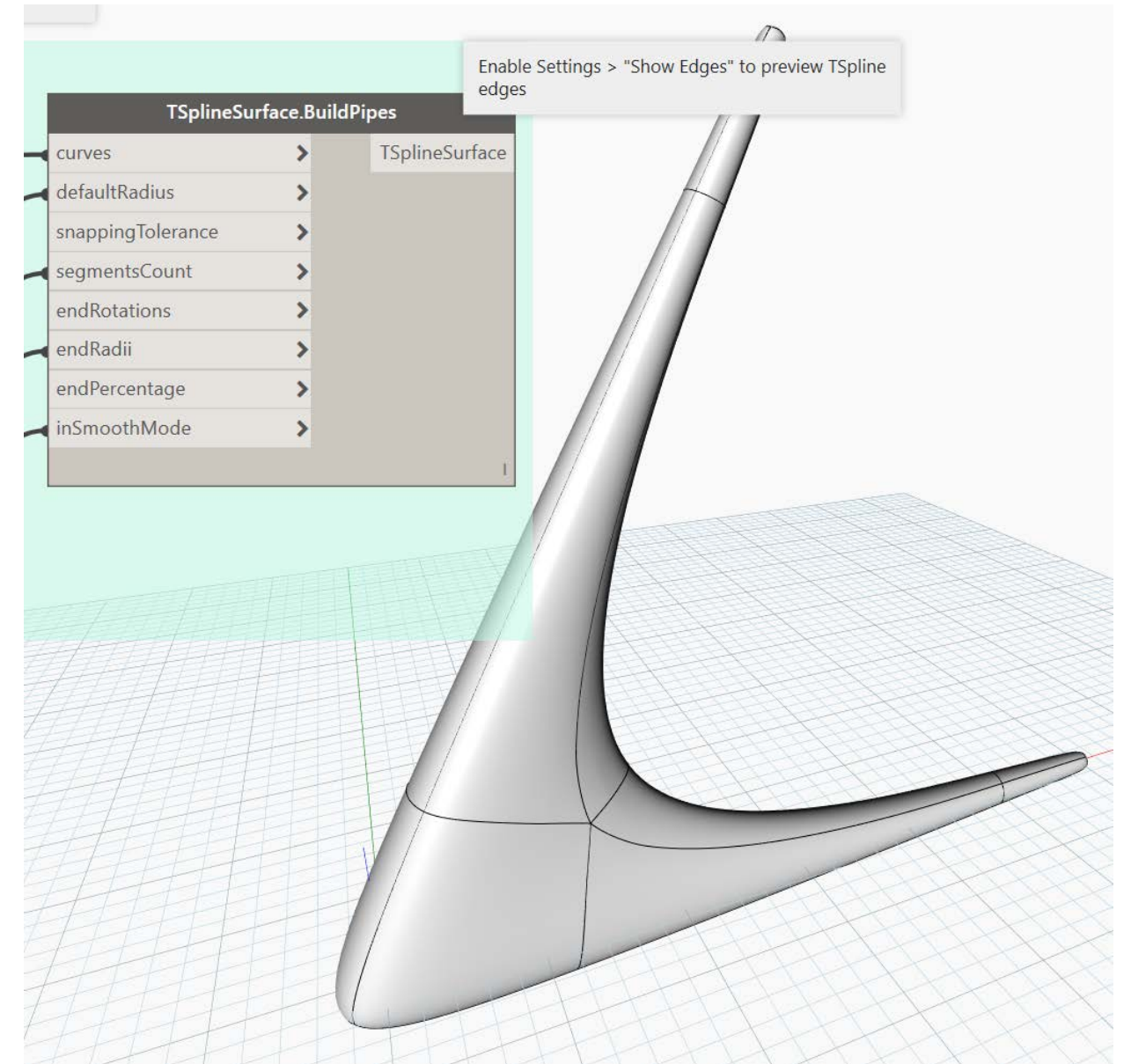
Building Dynamo Graphs with T-Splines

Why “Experimental” in Dynamo?



01.TSpline-Pipe-From-Lines

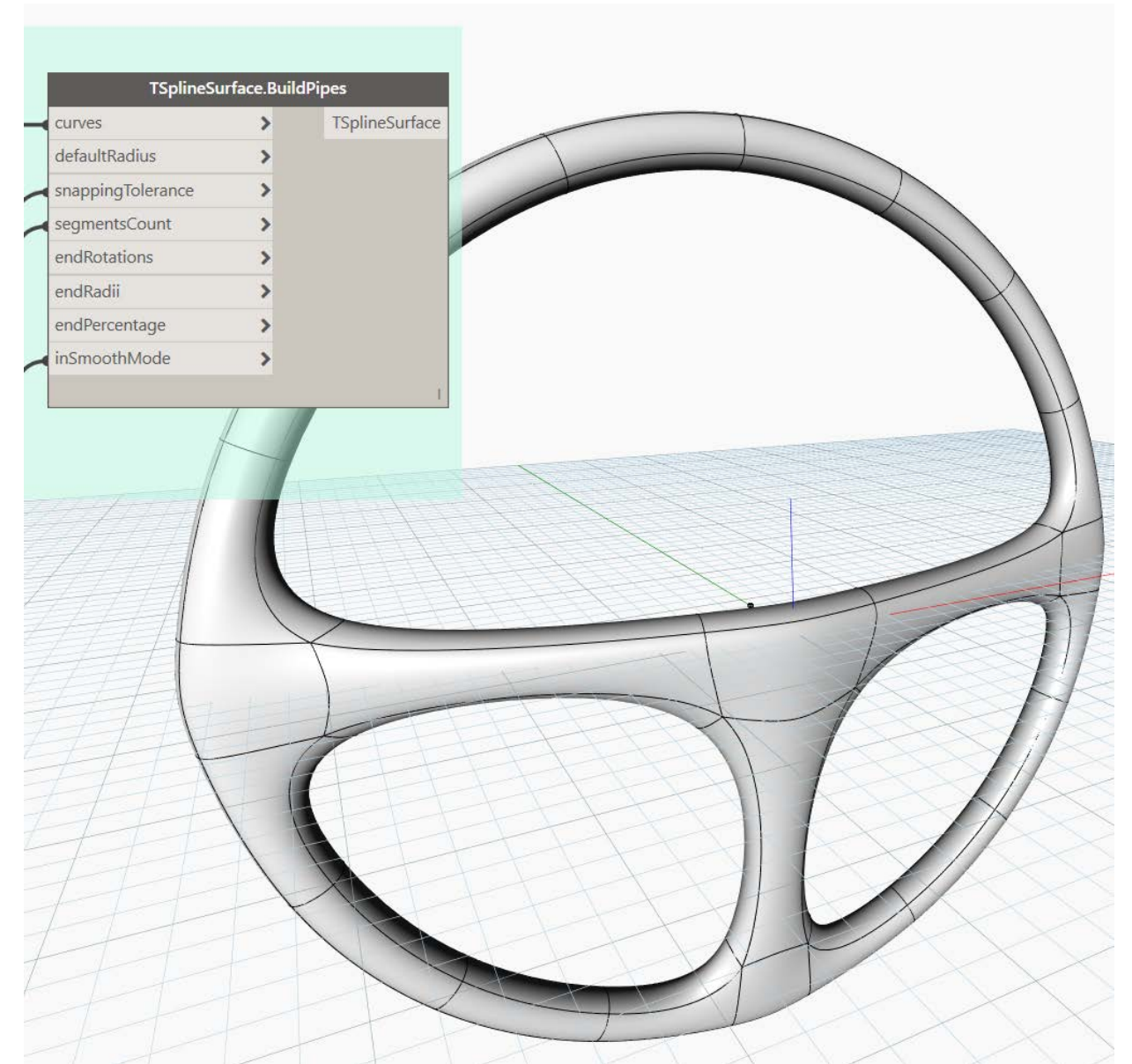
1. Create Two Lines
2. Build a TSpline Surface
 - TSplineSurface.BuildPipe



BuildPipes from lines

02.TSpline-Pipe-From-List

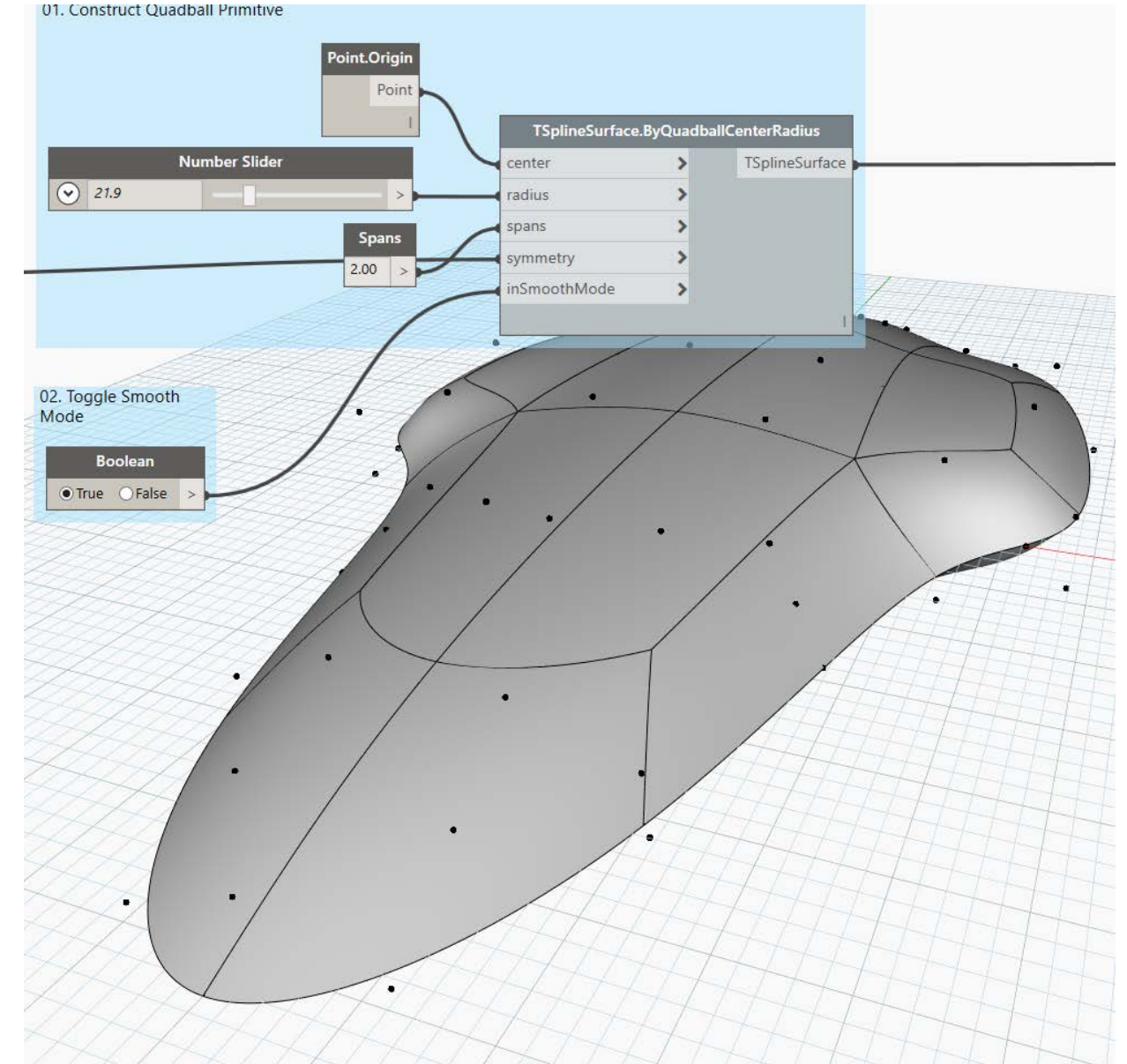
1. Create Three Lines
2. Create One Circle
3. Build a TSpline Surface
 - TSplineSurface.BuildPipe
- Convert to BRep
- Export Surface
 - TSM
 - SAT



BuildPipes from a list

03.TSpline-Primitive-Speedform

- Create Quadball
- Scale Quadball
- Display Topology Data
- Create Symmetry Axes
- Extrude Quadball Faces
- Crease Edges



Scaled Quadball with Extrusions and Creased Edges

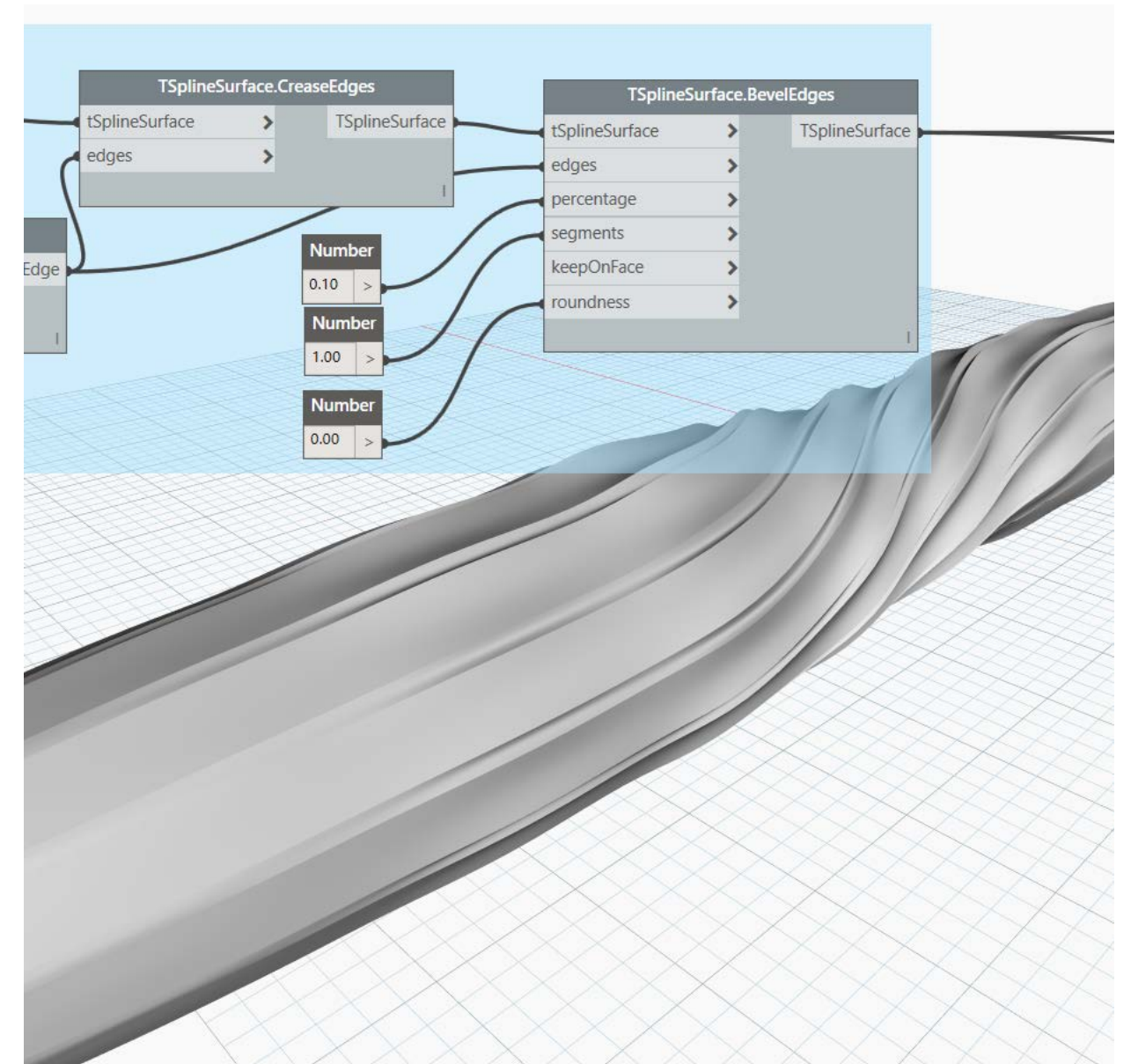
Advanced Workflows

Attractors, Image Sampling



04.TSpline-Crease-Bevel-Edges

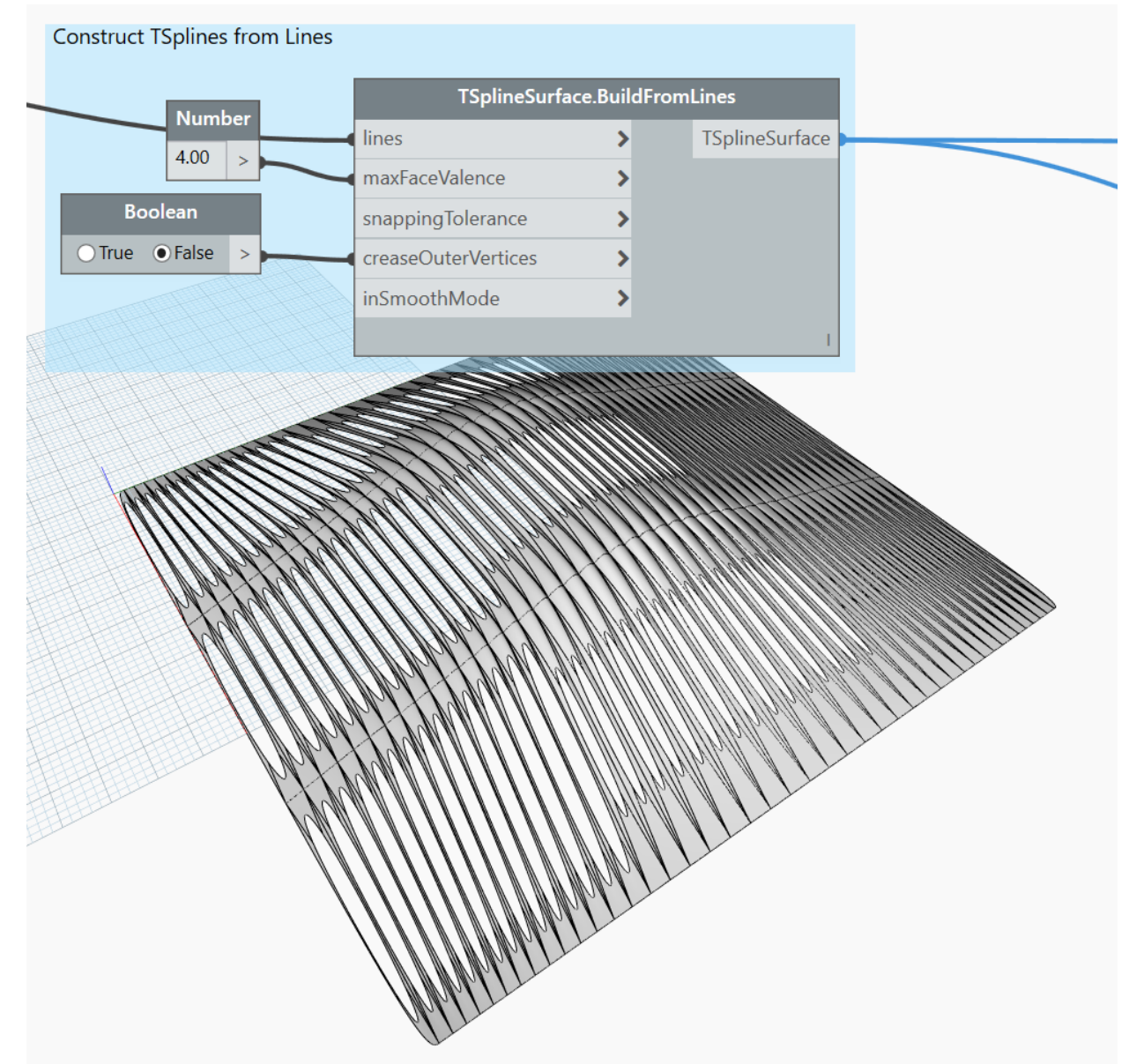
- Import SAT
- Convert NURBS to TSpline
- Crease Edges
- Bevel Edges
- Translate Vertices by Attractor



Creased and Beveled edges in one direction.

05.TSpline-Surface-From-Lines

- Import SAT Surface
- Import Image File
 - Use Brightness to Offset
- Create Quads on Surface
 - Scale Quads
 - Based on an Attractor
- Create Lines Between
- TSpline from Lines

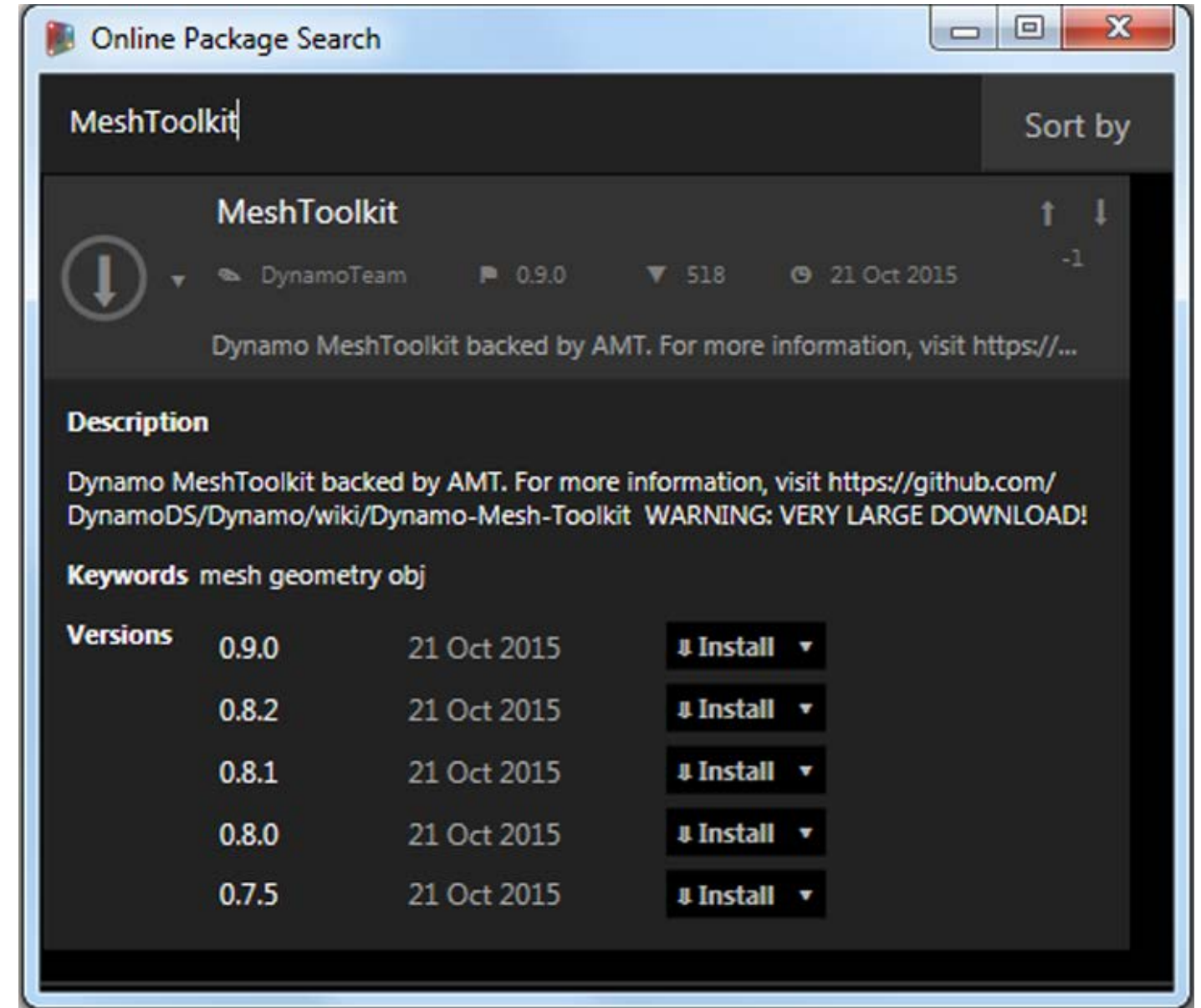


Build Tsplines from Lines

Extending Dynamo with Packages

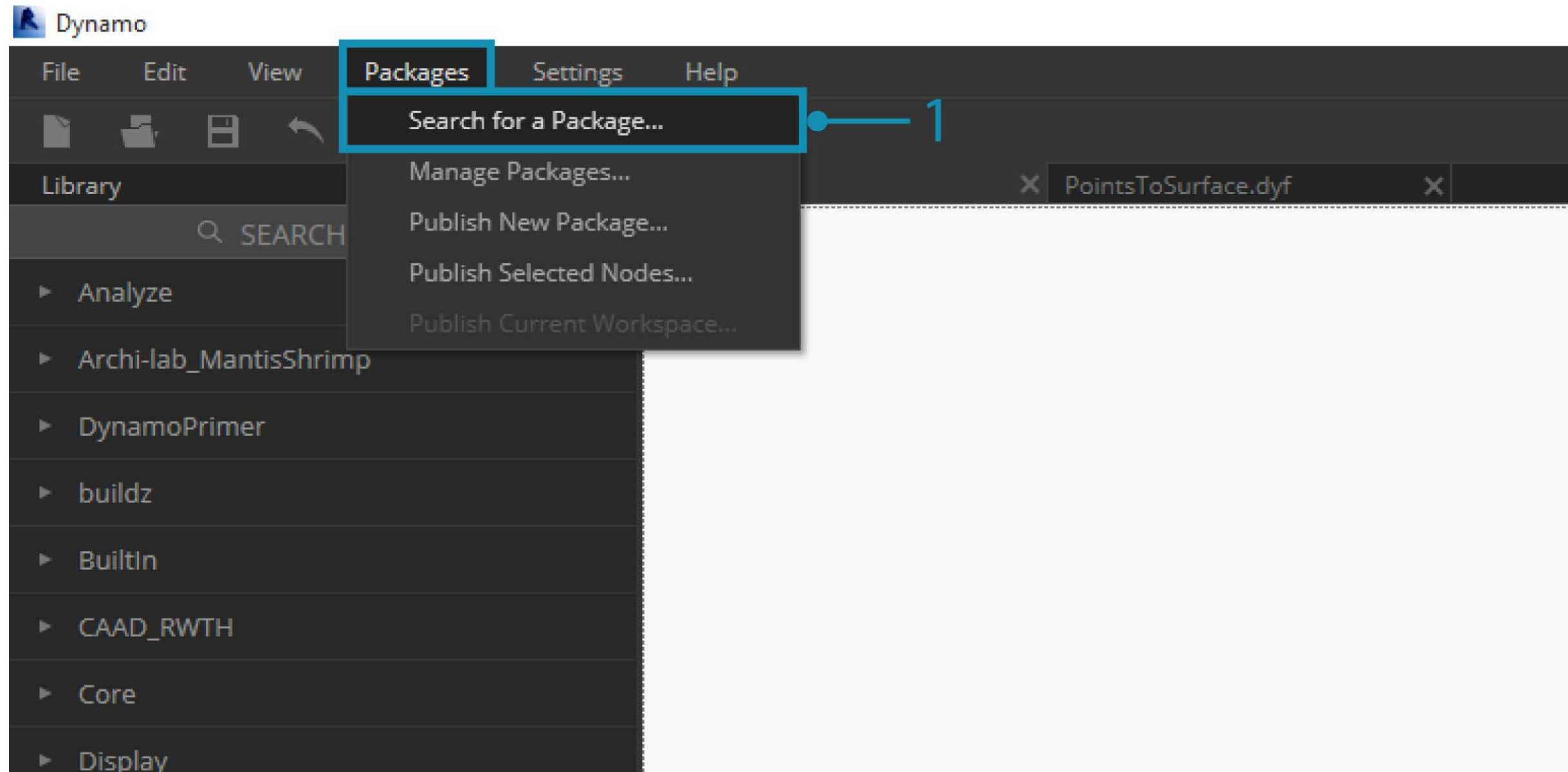
Dynamo Packages

- Search for a Package
- “MeshToolkit”
- “MapToSurface”
- Install Current Version



Online Package Search Window

Dynamo Packages



Search for a Package...

Dynamo Packages

Online Package Search

maptosurface Sort by

MapToSurface ↑ ↓
ekatzenstein 0.0.4 ▼ 291 18 Sep 2015 -1
A library for mapping geometry to surfaces based on UV coordinates.

Description
A library for mapping geometry to surfaces based on UV coordinates.

Keywords svg import

Versions

0.0.4	18 Sep 2015	Install ▼
0.0.3	11 Sep 2015	Install ▼
0.0.2	9 Sep 2015	Install ▼
0.0.1	9 Sep 2015	Install ▼

Visit package website

DEPRECATED

MapToSurfaceTest ↑ ↓
a0119383 0.0.1 ▼ 1 27 May 2016 0
Smoke test for publishing package

DEPRECATED

MapToSurfaceTesting ↑ ↓
DynamoTeam 0.0.1 ▼ 7 17 Mar 2016 0
Testing publish online functionality

Online Package Search

meshtool Sort by

MeshToolkit ↑ ↓
DynamoTeam 1.2.0 ▼ 2635 18 Oct 2016 1
Dynamo MeshToolkit backed by AMT. For more information visit github link...

Description
Dynamo MeshToolkit backed by AMT. For more information visit github link WARNING: VERY LARGE DOWNLOAD!

Keywords mesh geometry obj

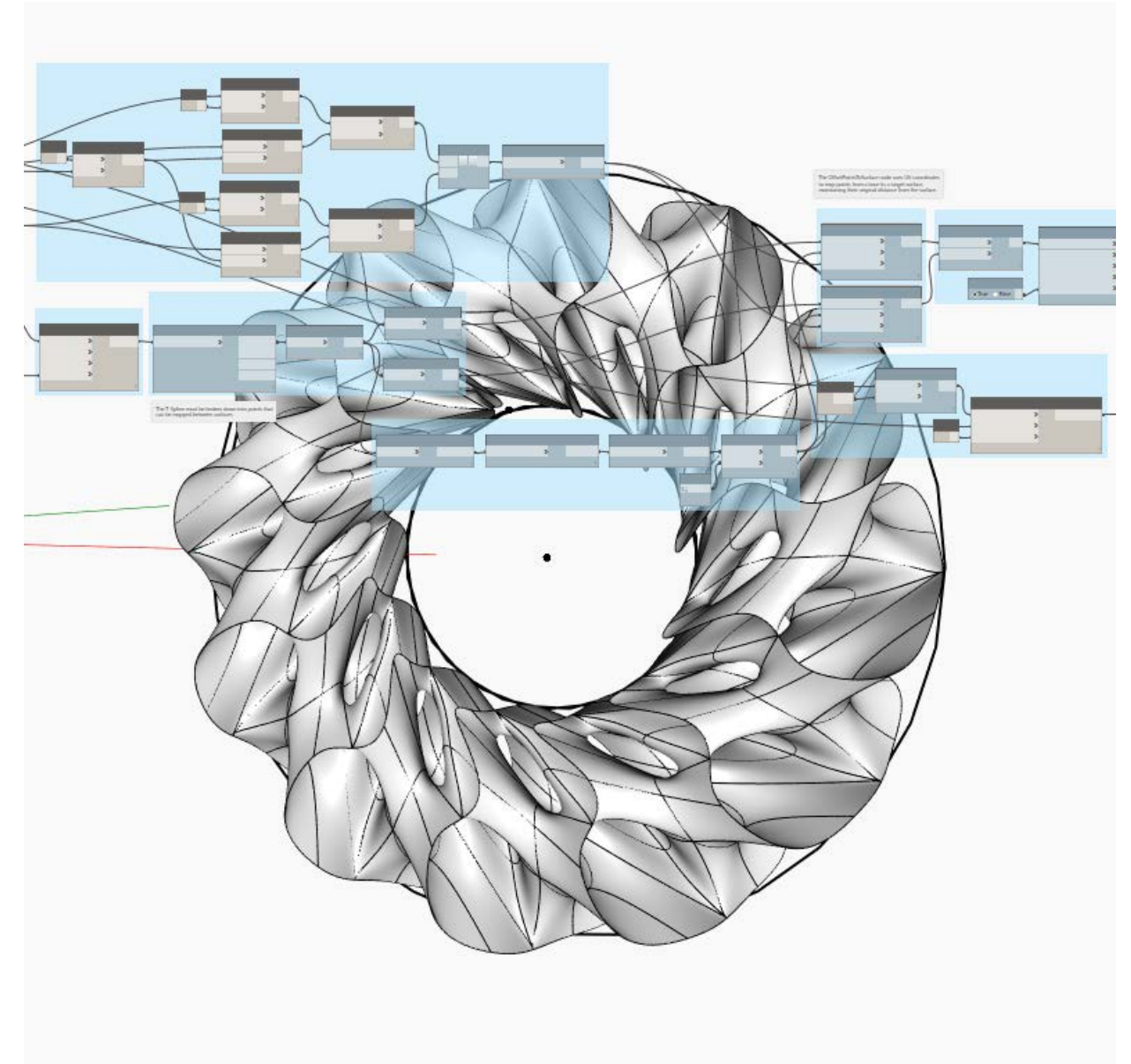
Versions

1.2.0	18 Oct 2016	Install ▼
1.1.0	19 Jul 2016	Install ▼
1.0.0	18 Apr 2016	Install ▼
0.9.0	21 Oct 2015	Install ▼
0.8.2	21 Oct 2015	Install ▼
0.8.1	21 Oct 2015	Install ▼
0.8.0	21 Oct 2015	Install ▼
0.7.5	21 Oct 2015	Install ▼

Visit package repository

07.TSpline-Geometry-Replicator-Mapping

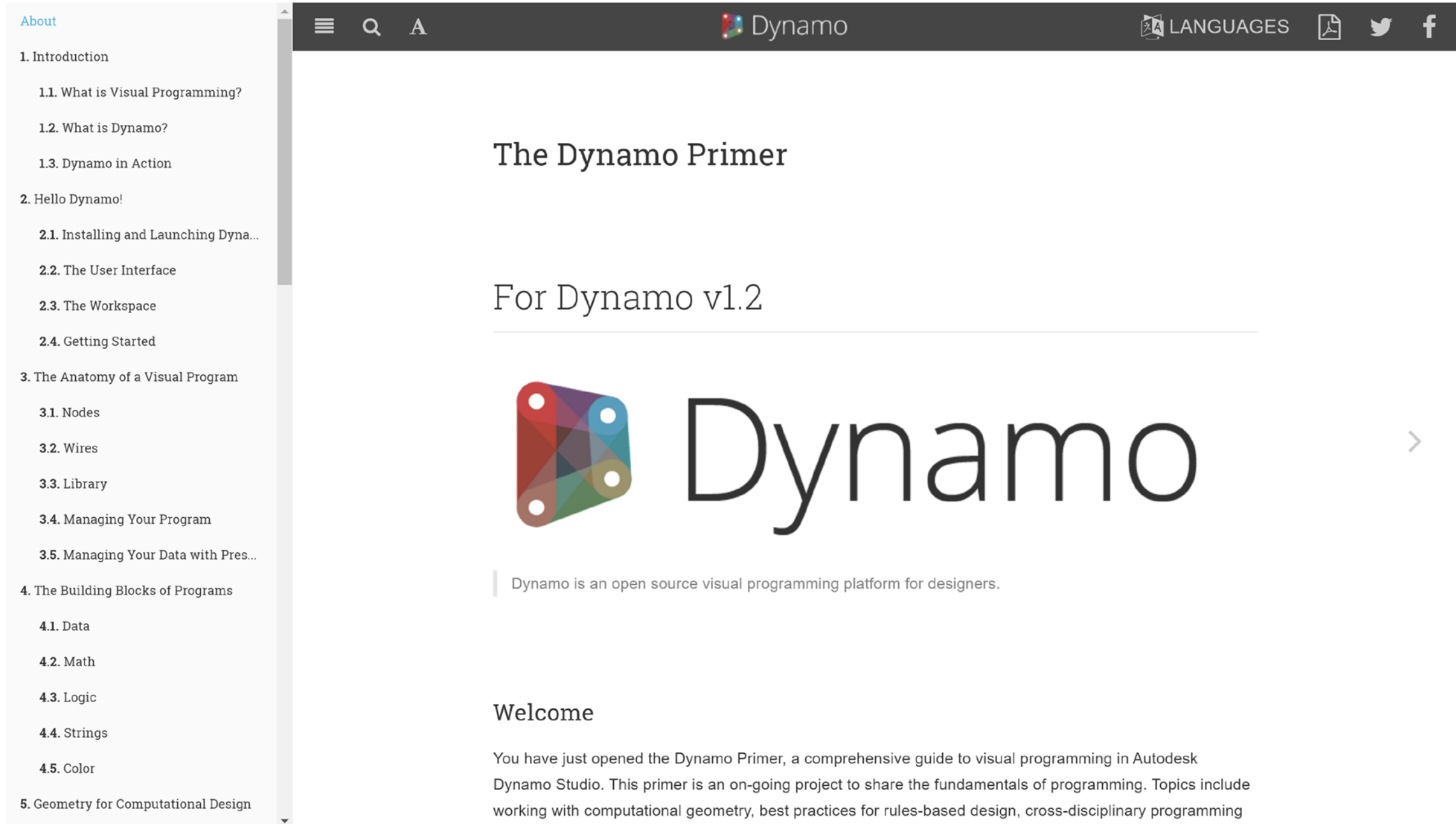
- Dynamo Packages
 - MapToSurface
 - MeshToolkit
- Exporting TSpline Files
 - TSM (Mesh File)
 - Single TSpline Object



Next Steps

The Dynamo Primer

<http://dynamoprimer.com>



The screenshot displays the Dynamo Primer website. On the left is a sidebar with a table of contents. The main content area features a dark header with navigation icons, the 'Dynamo' logo, and social media links. The main heading reads 'The Dynamo Primer For Dynamo v1.2'. Below this is a large image of the Dynamo logo with a right-pointing arrow. A descriptive sentence follows: 'Dynamo is an open source visual programming platform for designers.' The 'Welcome' section begins with the text: 'You have just opened the Dynamo Primer, a comprehensive guide to visual programming in Autodesk Dynamo Studio. This primer is an on-going project to share the fundamentals of programming. Topics include working with computational geometry, best practices for rules-based design, cross-disciplinary programming'.

Table of Contents (Left Sidebar):

- About
- 1. Introduction
 - 1.1. What is Visual Programming?
 - 1.2. What is Dynamo?
 - 1.3. Dynamo in Action
- 2. Hello Dynamo!
 - 2.1. Installing and Launching Dyna...
 - 2.2. The User Interface
 - 2.3. The Workspace
 - 2.4. Getting Started
- 3. The Anatomy of a Visual Program
 - 3.1. Nodes
 - 3.2. Wires
 - 3.3. Library
 - 3.4. Managing Your Program
 - 3.5. Managing Your Data with Pres...
- 4. The Building Blocks of Programs
 - 4.1. Data
 - 4.2. Math
 - 4.3. Logic
 - 4.4. Strings
 - 4.5. Color
- 5. Geometry for Computational Design

Dynamo Dictionary

<http://dictionary.dynamobim.com>

The screenshot shows the Dynamo Dictionary website. At the top, there is a search bar with the text "search..." and two tabs: "list" and "matrix". The title "Dynamo Dictionary" is displayed on the right. On the left side, there is a vertical navigation menu with the following categories: Analyze, BuiltIn, Core, Display, Geometry, Office, and Operators. The main content area has a dark background. It starts with a heading "Welcome to the Dynamo Dictionary!" followed by a paragraph: "Welcome to the Dynamo Dictionary, a searchable database for Dynamo functionality. Here you can find explanations for nodes, sample files, and links to more information on associated workflows. This site is constantly evolving as the community continues to add more information. Like the **Dynamo Primer**, this dictionary is open-source - check it out on our **Github page** and contribute!". Below this is another heading "Editing this Dictionary" followed by a paragraph: "Not only is the Dynamo Dictionary open-sourced, you can also edit the repository straight from this webpage! Click on edit icons on node pages and add your own **in-depth description**, update **examples files and images**, or **add your own!**". There is a bulleted list of instructions:

- After making your updates, remember to click the "Submit Pull Request" icon in the top right of the page. This will allow you to open a pull request on Github without having to login.
- The **Pull Request** will be opened on the Github repo. After we've reviewed it and are ready to accept the changes, we'll **merge** the new content onto the live site!
- Because of the review period, you may have to wait a few days for the Pull request to go through. If you have any **issues**, please don't hesitate to log them **here**.

At the bottom, there are four featured images with labels: "Community" (showing a book cover titled "Open source graph programming for"), "Product" (showing a blue geometric structure), "Learning" (showing a grid of blue geometric shapes), and "Development" (showing a screenshot of a GitHub repository for "DynamoDS / Dynamo" with 26,451 commits).

How did I do?

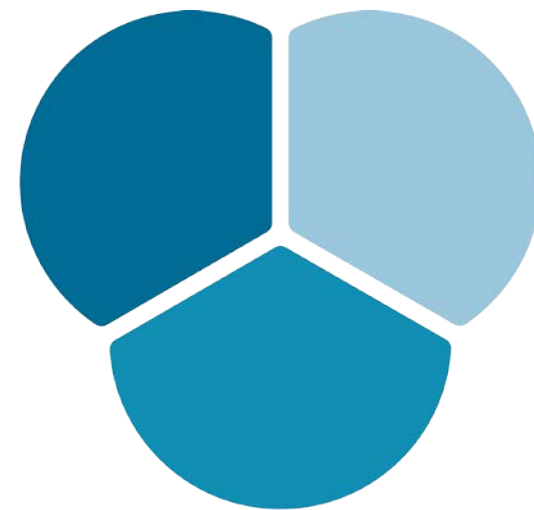
- Your class feedback is critical. Fill out a **class survey** now.
- Use the AU mobile app or fill out a class survey online.
- Give feedback after each session.
- AU speakers will get feedback in real-time.
- **Your feedback results in better classes and a better AU experience.**



In case you missed them

Lab handouts and datasets can be downloaded at:

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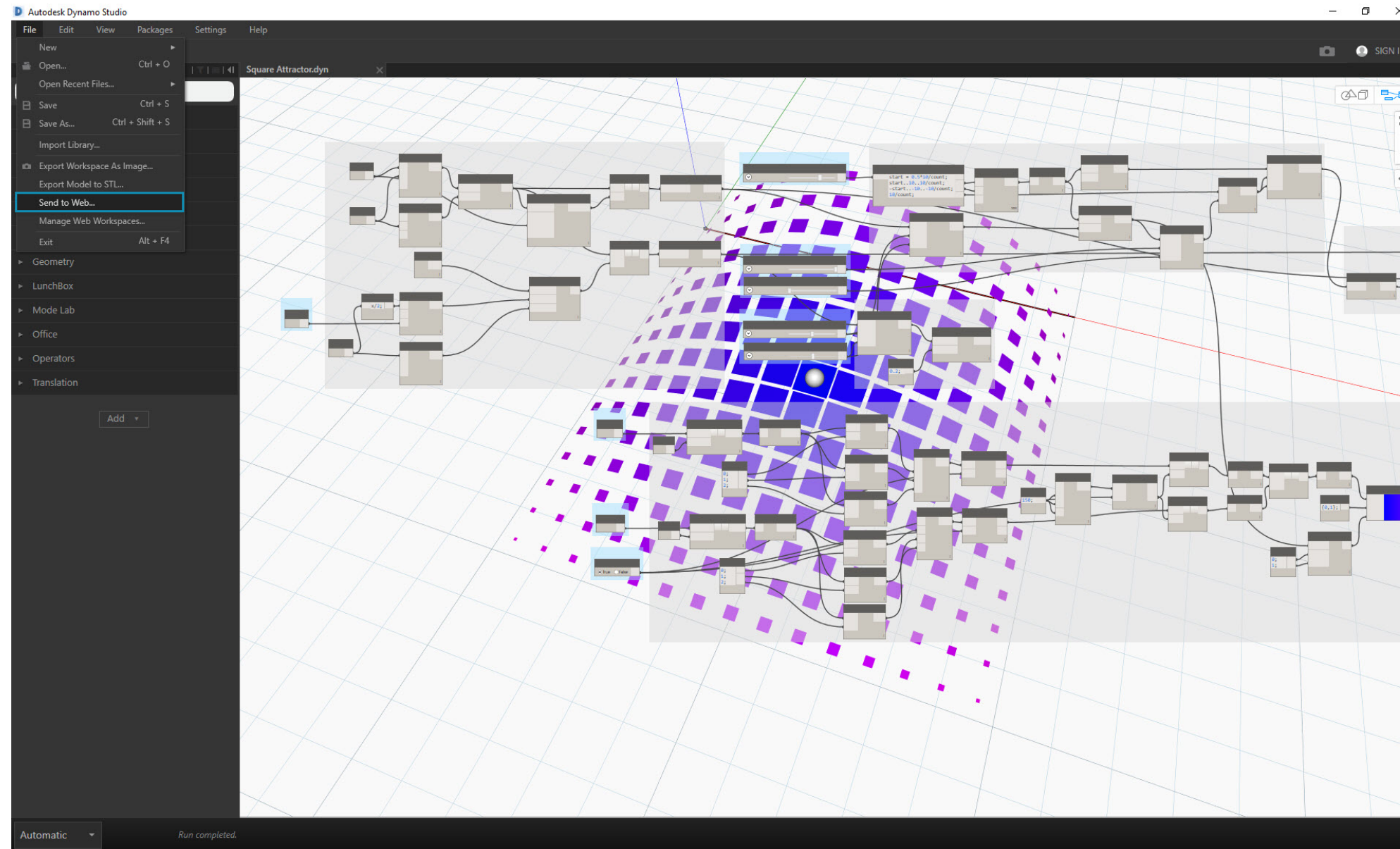
MODELAB

<http://modelab.is/>



Dynamo Web Experience

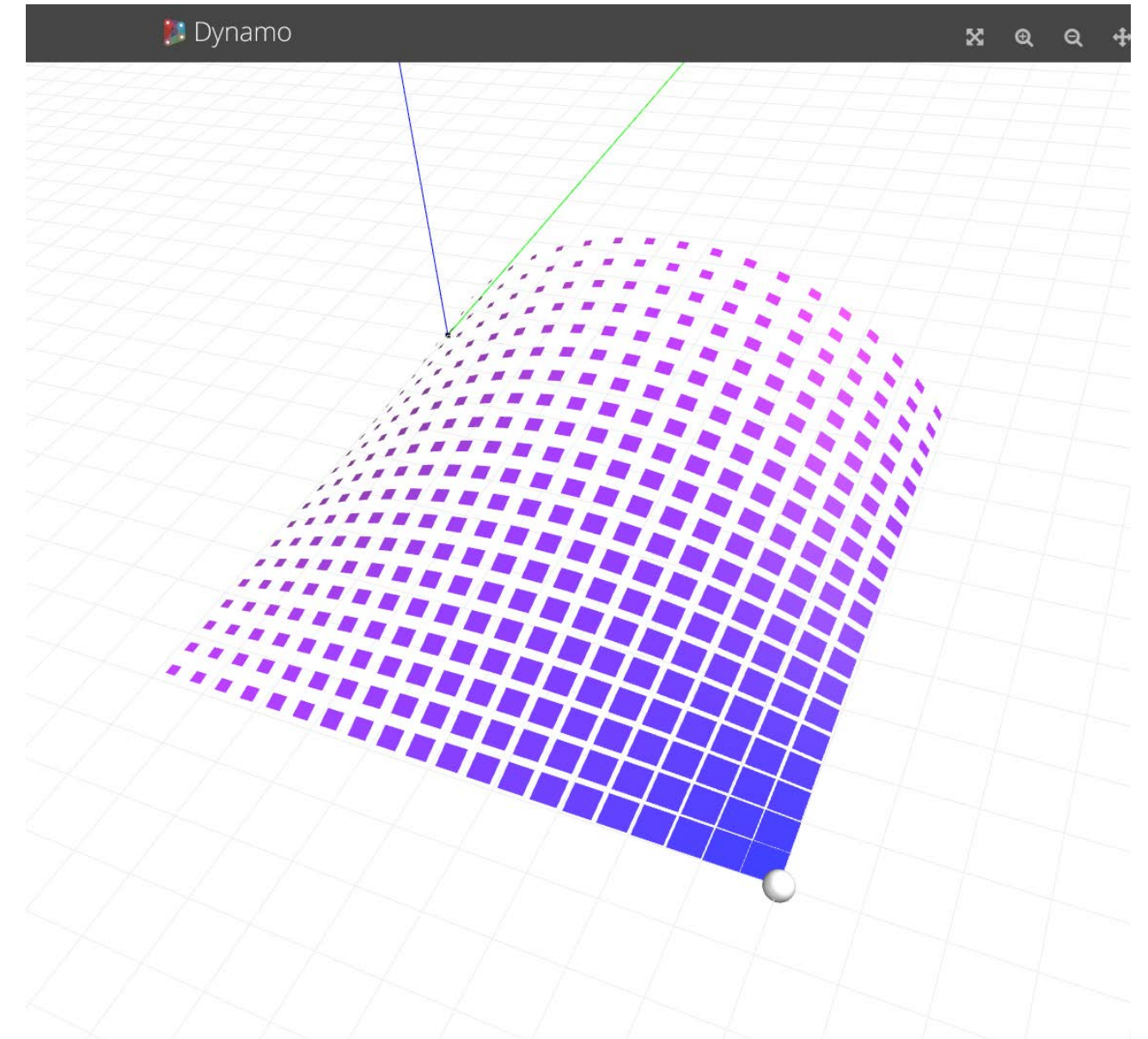
Send to Web (Dynamo Studio)



Dynamo Graph, formatted for “Send to Web”

Send to Web (Dynamo Studio)

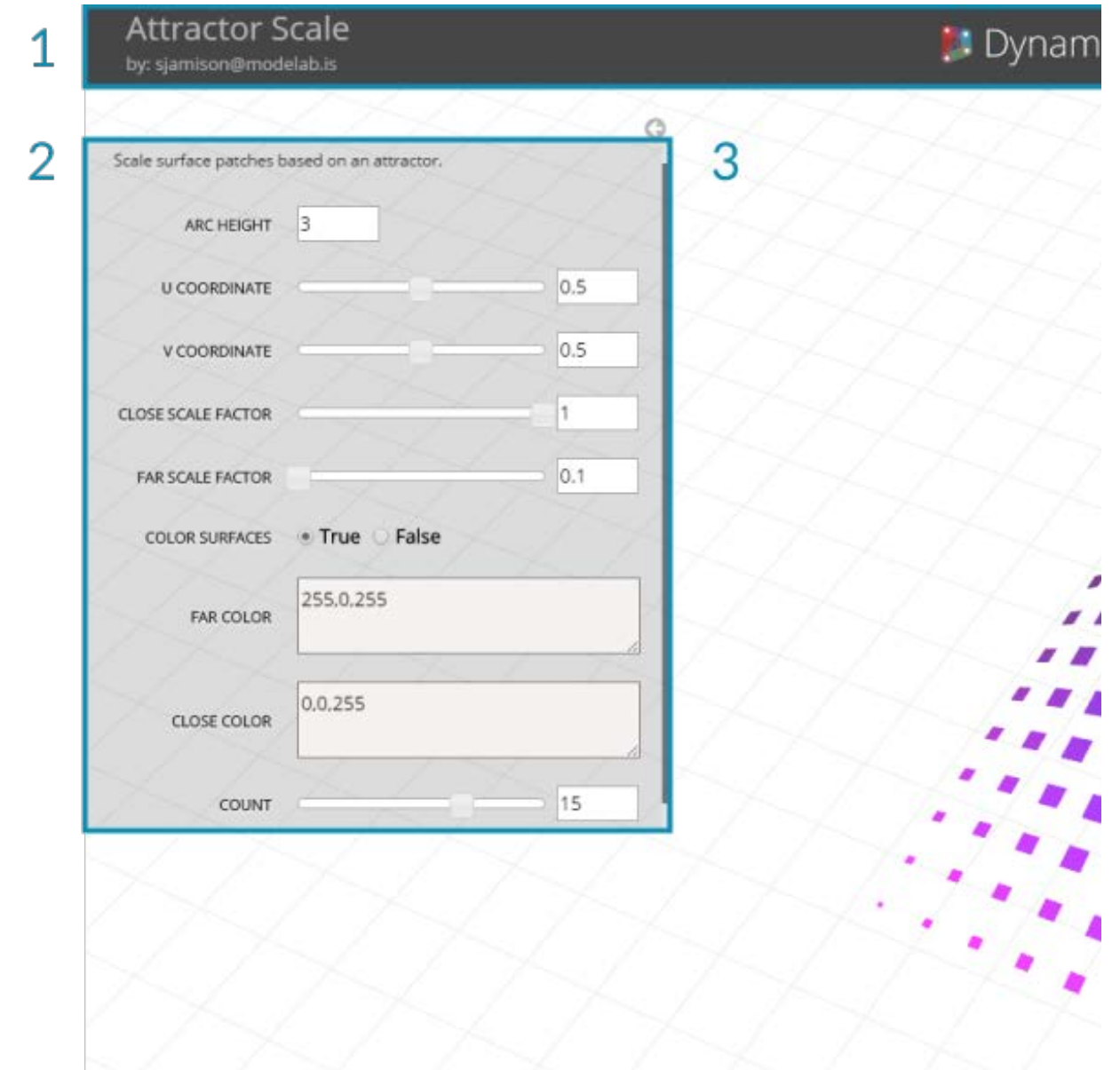
- Allows you to publish a curated version of your work that is web accessible through an online link.



Customizer View

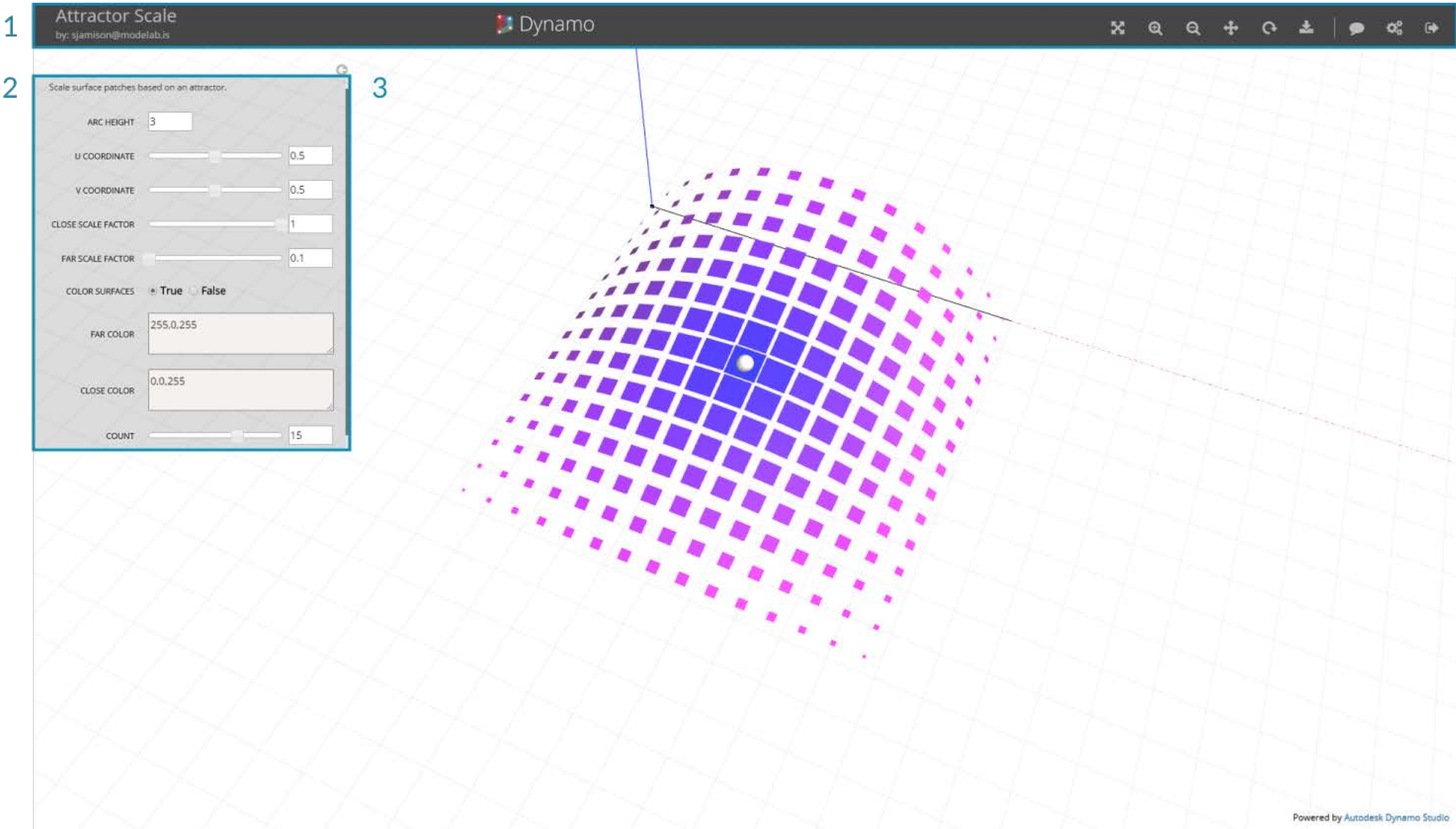
Send to Web (Dynamo Studio)

1. Menu Bar
2. Controls
3. 3D Preview



Customizer View

Send to Web (Dynamo Studio)



Customizer View

