



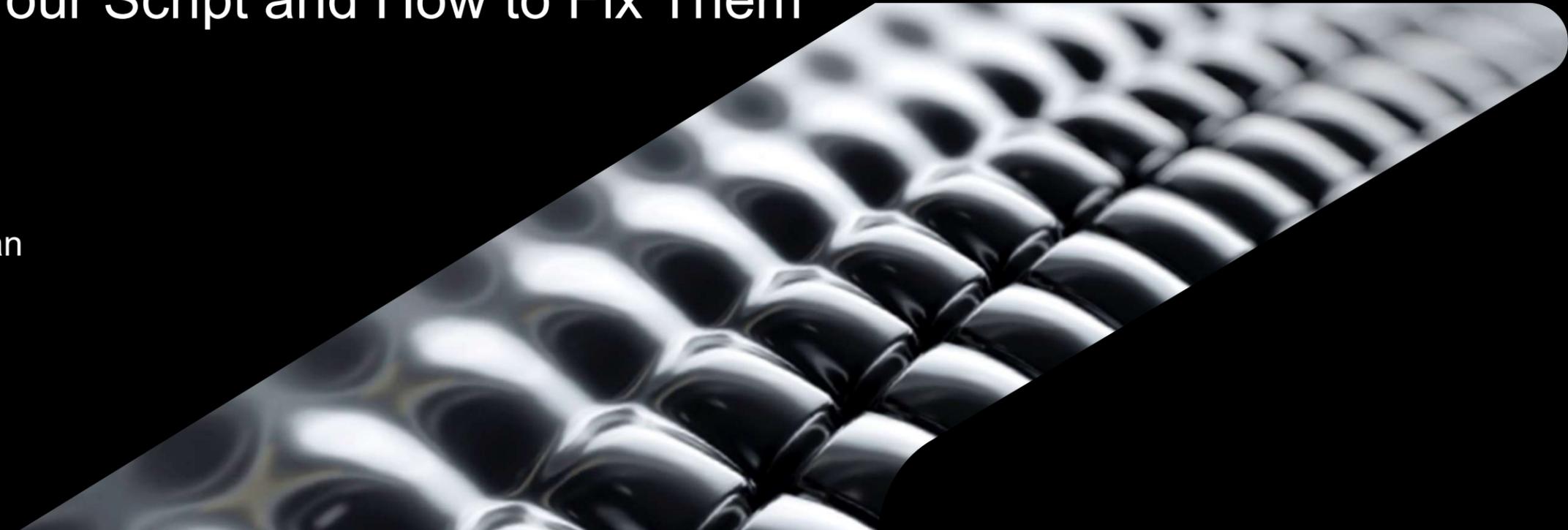
# Dynamo Blues:

10 Things to Avoid in Your Script and How to Fix Them

SD501709

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# Session Description

Like any other programming experience, Dynamo has its share of headaches. But once you know what to avoid, you can move on to success. Visual scripting has been growing in popularity in the architecture, engineering, and construction (AEC) industry throughout the years with a lot of adventurous users. However, with adventures come pitfalls that can be challenging to navigate. In this talk, we'll explore the 10 big things that can cause script errors and strange behavior in Dynamo. We'll review the signs of the problem in the script, what to look for in an error, steps to try to fix the problem, and documentation to help you along the way. Come and get a helping hand in this talk to learn the ropes of solving any problem you run into with Dynamo!

# Learning Objectives

1. Learn about the 10 common issues people run into with scripts and how to use templates and standards to reduce error rates.
2. Learn about what errors and warnings are in Dynamo and how to use them to troubleshoot your script.
3. Learn how to diagnose the problem with your script so you can find and resolve the bug either in Dynamo or your intelligent model.
4. Find out about document sites that can provide community resources for support and examples to help you solve the problem.

# Disclaimer

## What to expect

- The examples vary between high level concepts and management to node control options
- This is an overview common problems most users run into and how to deal with them
- This is meant to be a starting point and continue with all the resources in Autodesk University and Dynamo sites
- Plus there are some tips at the end about how to solve more specific problems yourself

**DISCLAIMER**

# About Me – Tadeh Hakopian



- (Todd-A) (Ha-co-pea-on)
- @tadeh\_Hakopian
- Experience in large scale coordination in Design and Construction projects for Architects and Builders
- Coordinator for Data, BIM and VDC assets
- Contract review for Data and BIM delivery requirements, compliance and hand off

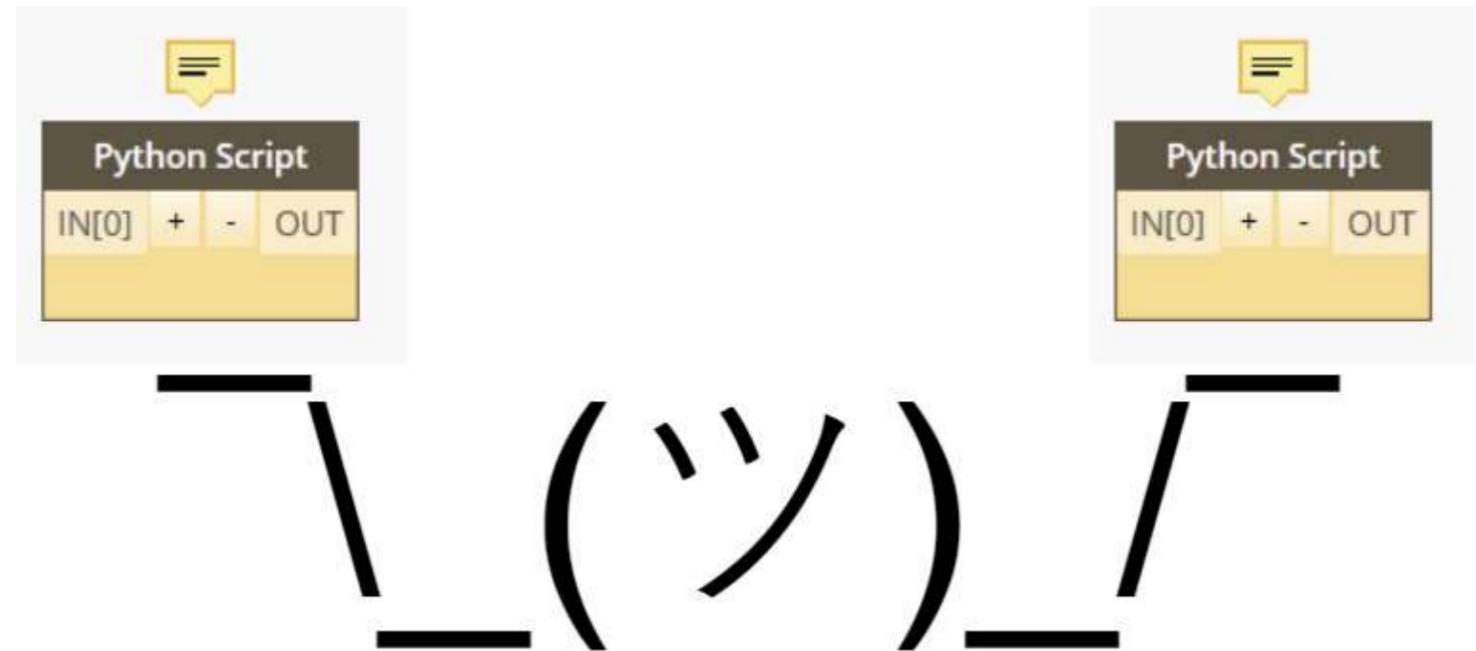
# My Experience

## What I have worked on before

- My Past Autodesk University Sessions:
- Dynamo Super Powers Part 1 - <https://www.autodesk.com/autodesk-university/class/Unlock-Hidden-Super-Powers-Dynamo-2020#presentation>
- Dynamo Super Powers Part 2 - <https://www.autodesk.com/autodesk-university/class/Hidden-Super-Powers-Dynamo-Part-2-Package-Managers-Assemble-2021#presentation>
- Deploying Dynamo for your Company - <https://www.autodesk.com/autodesk-university/class/Deploying-Dynamo-Your-Company-Getting-Everyone-Node-and-Code-2020>
- Dynamo and Python - <https://www.autodesk.com/autodesk-university/class/Exploring-Python-Nodes-Dynamo-2019#presentation>
- Forge Data API - <https://www.autodesk.com/autodesk-university/class/Forge-Project-Data-Analytics-Case-Study-Data-Management-API-2021>

# Question

- Do you ever have problems with Dynamo?



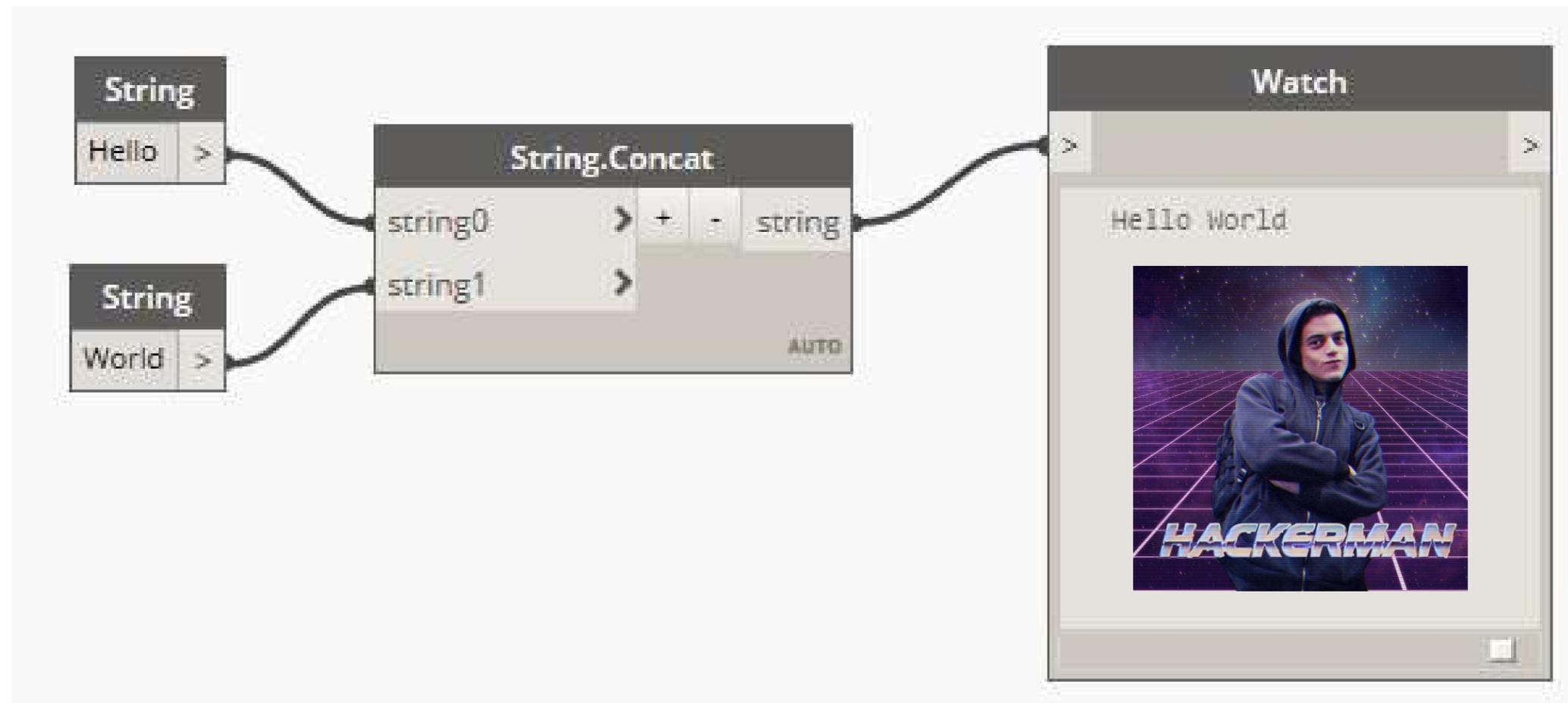


# BASIC CONCEPTS

Key notes

# Getting Started

## Basics

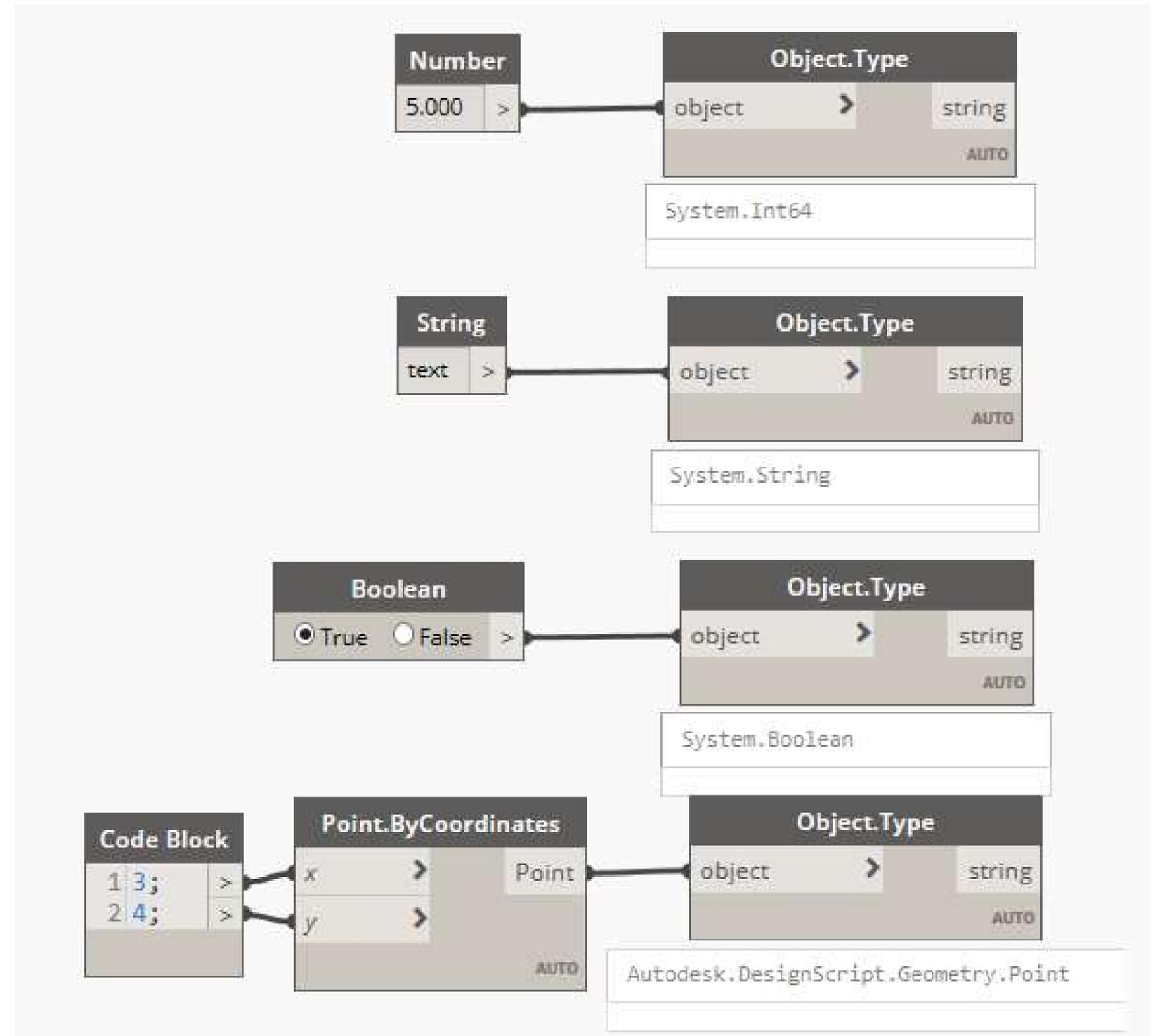


- Obligatory Hello World Message

# Terms and Concepts

## Data Types

- String - Text
- Number – Number with Decimals
- Boolean – True/False
- Nulls - Nothing
- Lists – Sequence of Data
- Curve – Geometric Line



# Terms and Concepts

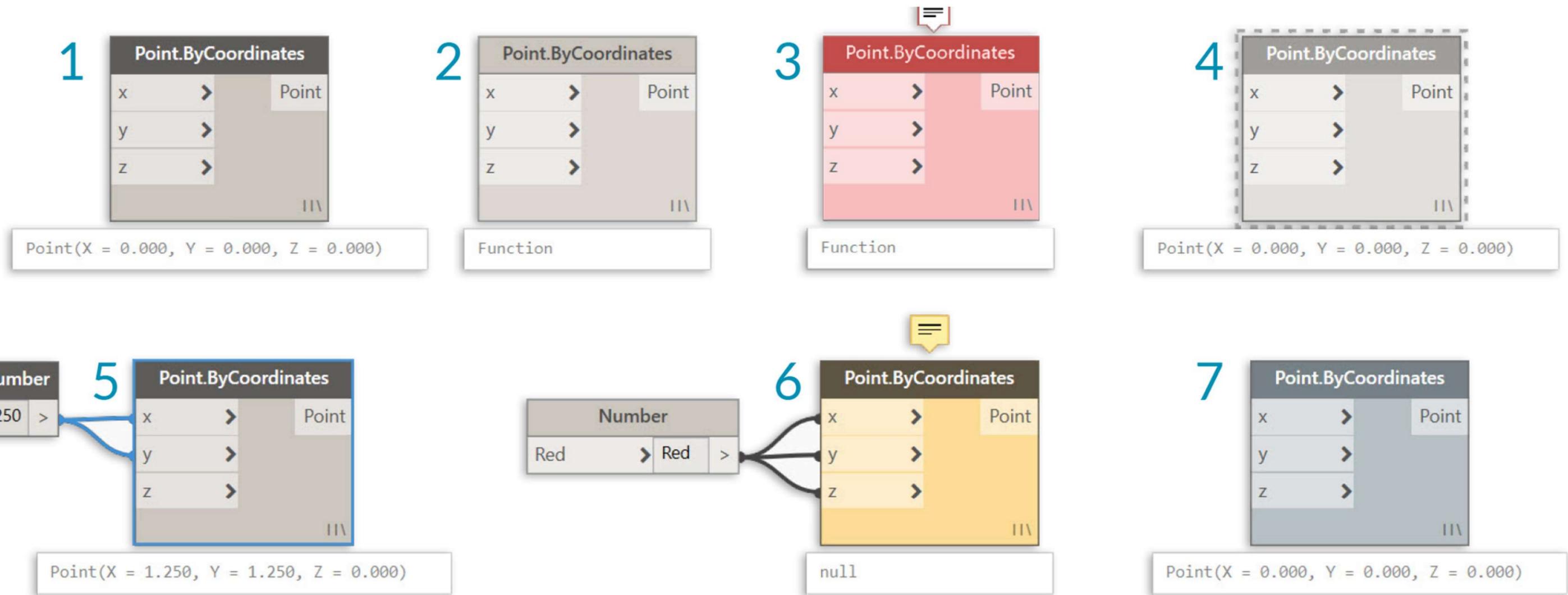
## Data Types

Common Type	Which Means...
Int32	A.K.A.: <b>Integer</b> , <b>32-bit Integer</b> , <b>int</b> . These are whole numbers. More <a href="#">here</a> .
Double	A.K.A.: <b>number</b> , <b>double precision value</b> . Any number that has decimal places like 3.14, 1.00. More <a href="#">here</a> .
String	A.K.A.: <b>text</b> , <b>character string</b> . More <a href="#">here</a> .
Boolean	A.K.A.: <b>bool</b> . This is basically either "true" or "false." More <a href="#">here</a> .
StackValue	A.K.A.: <b>Function</b> , <b>_SingleFunctionObject</b> . Believe it or not, even Dynamo functions are a type of data. They can be called different things like " <b>f(x)</b> ", " <b>combinator</b> ", or the like, but it just means that the type of the "data" is actually a function.
var	Absolutely anything. This is just generic data.* More <a href="#">here</a> .

<https://dynamobim.org/what-does-var-mean/>

# Terms and Concepts

## Node States



[https://primer.dynamobim.org/03\\_Anatomy-of-a-Dynamo-Definition/3-1\\_dynamo\\_nodes.html](https://primer.dynamobim.org/03_Anatomy-of-a-Dynamo-Definition/3-1_dynamo_nodes.html)

# Terms and Concepts

## Acronyms

- **OOTB** – Out of the box, these are the features that come package with every Dynamo install
- **DLL** - Dynamic-link library, files that can be used by programs to run code, standard for Dynamo files for loading packages that contain nodes
- **LIST** – A sequence of values from a data set
- Learn more at the official learning resources - <https://dynamobim.org/>



# THE 10

The birth of the blues

# THE 10

1. Revit Software Changes

2. Dynamo Software Updates

3. Script won't run because of nodes

4. Script won't run because of missing files

5. Your scripts are a mess

6. Cannot find the file you are looking for

7. The Script is runs very slowly or freezes

8. The data inputs are wrong

9. The script isn't passing information correctly

10. Everything is just acting weird



Software Management



Package Management



Script Management



Data Management



Last Resort



**#1**

Revit

# Problem

## Revit Versions and Dynamo compatibility

- Revit is version locked for its files
- That goes for plugins like Dynamo as well



Revit2016.png



Revit2017.png



Revit2018.png



Revit2019.png



Revit2020.png



Revit2021.jpg



Revit2022.png

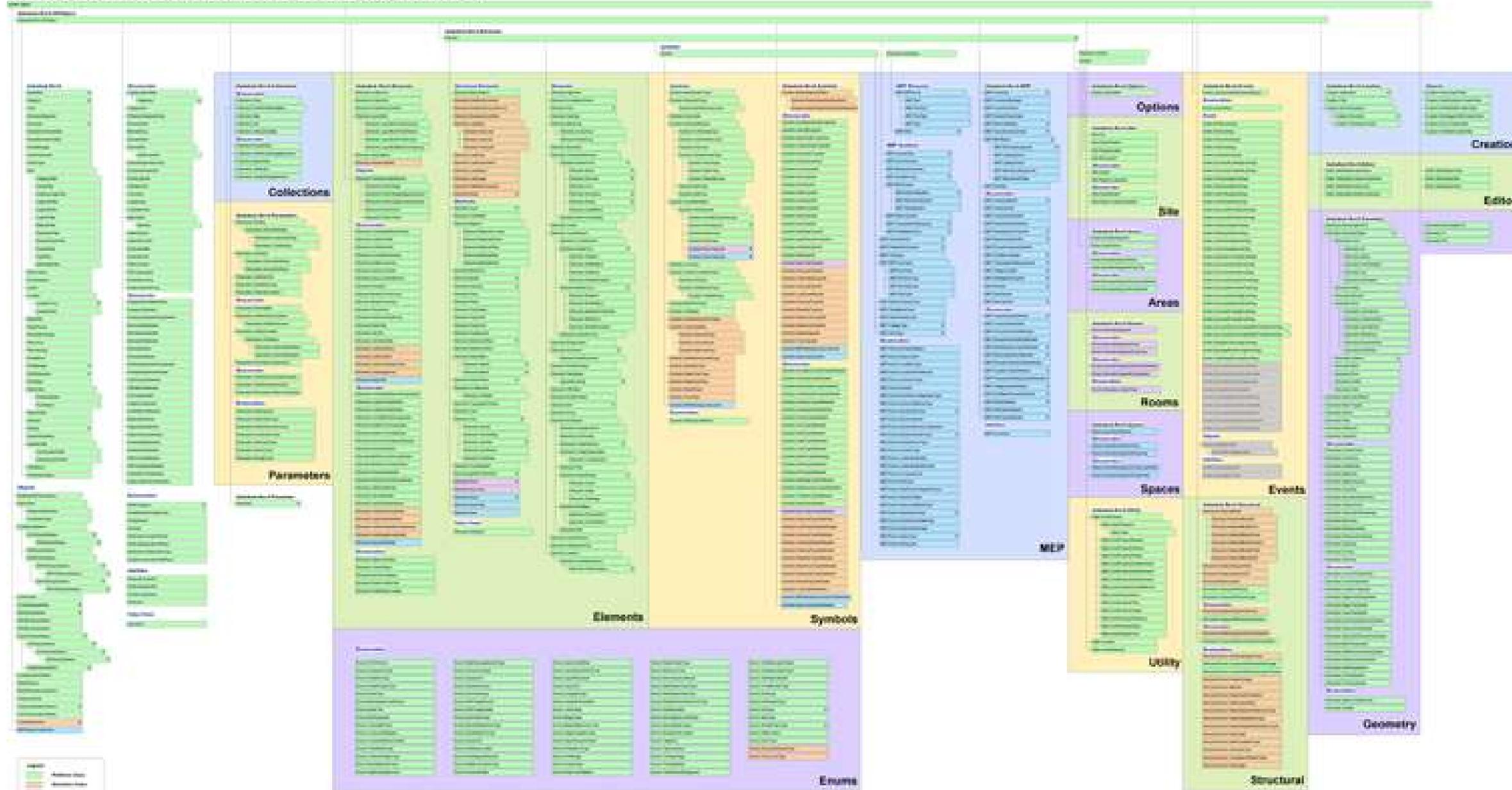
# Cause

## Software is out of date

Revit Version	First Stable Dynamo Version	Last Supported Dynamo for Revit Version
2013	0.6.1	0.6.3
2014	0.6.1	0.8.2
2015	0.7.1	1.2.1
2016	0.7.2	1.3.2
2017	0.9.0	1.3.4 / 2.0.3
2018	1.3.0	1.3.4 / 2.0.3
2019	1.3.3	1.3.4 / 2.0.4
2020+	2.1.0 - Revit 2020+ now includes Dynamo and receives updates as Revit does.)	N/A

- API changes with different Versions of Revit

## Autodesk Revit 2010 API Object Model

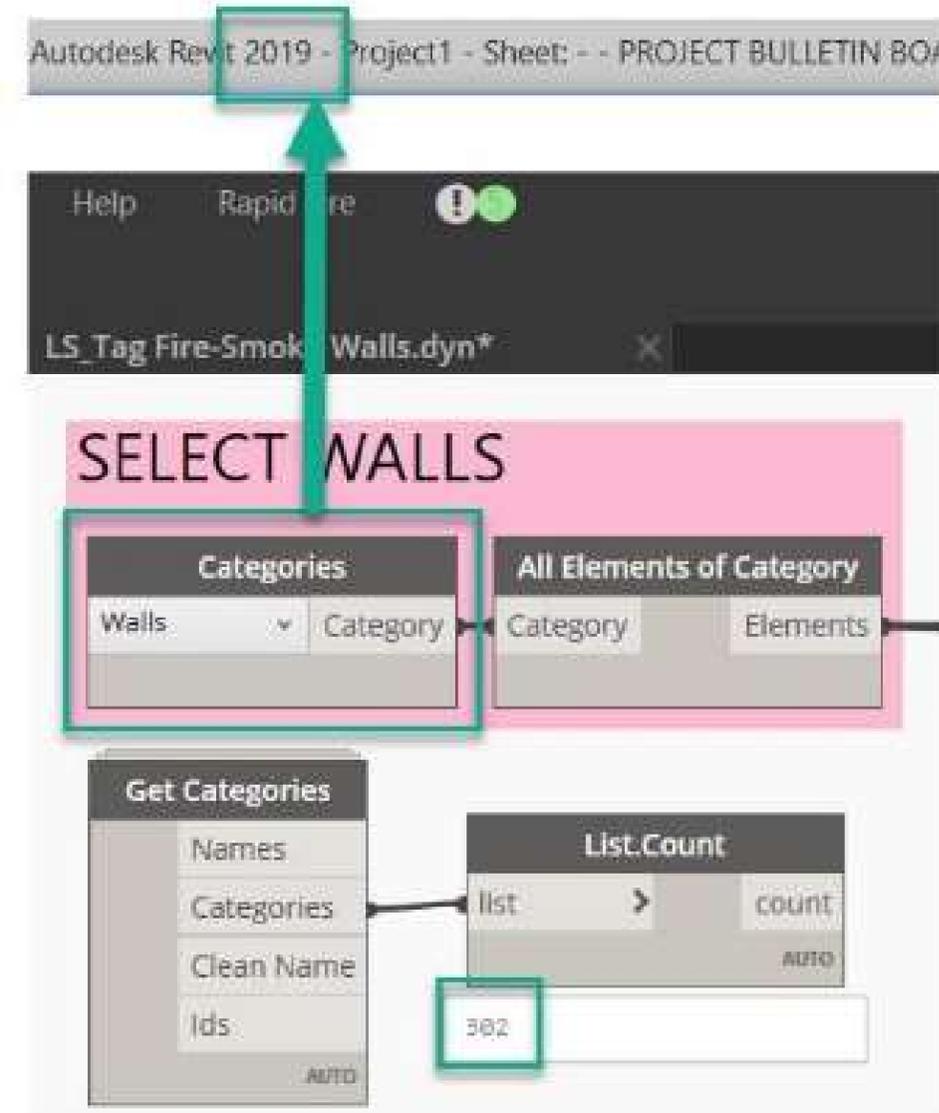
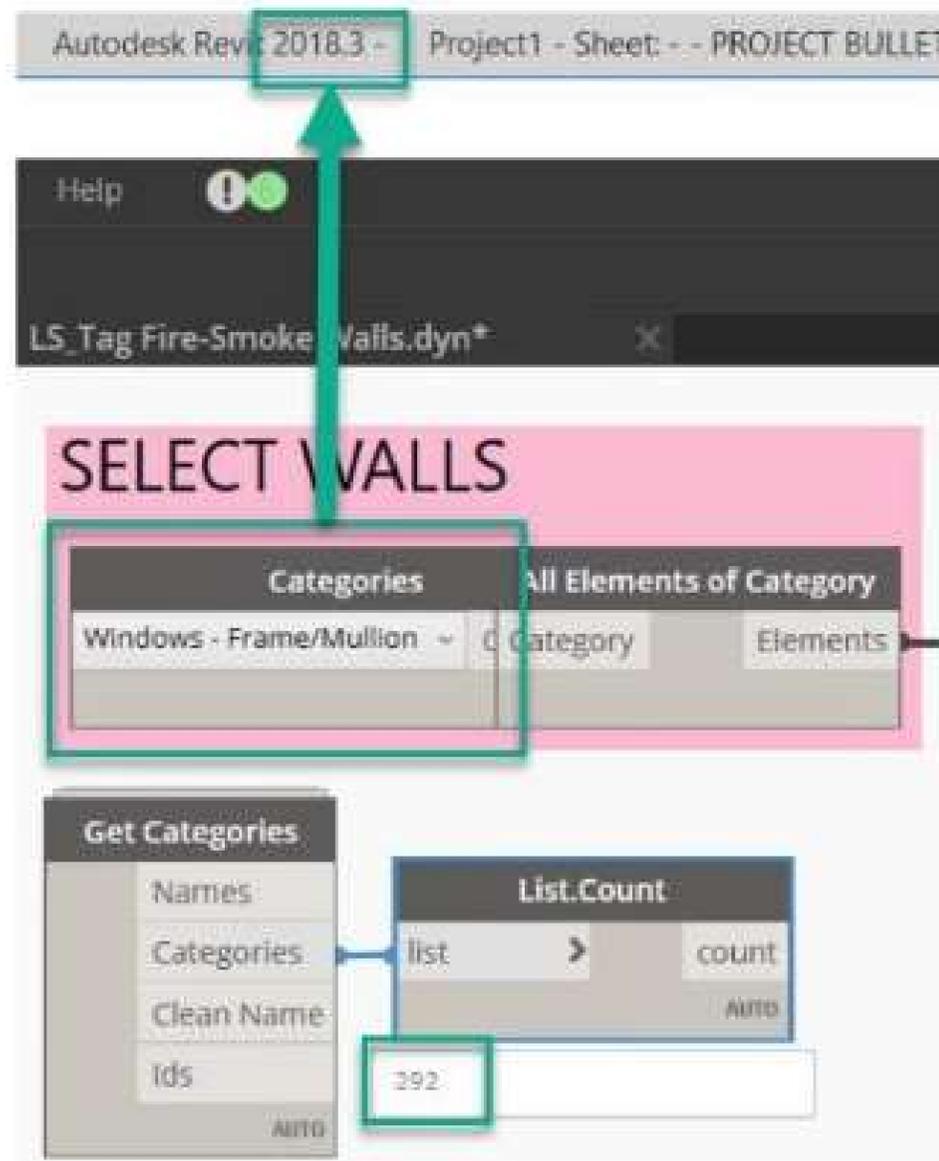


<https://thebuildingcoder.typepad.com/blog/2012/01/no-revit-api-class-diagram.html>

- API changes with different Versions of Revit
- There's A LOT of stuff in the Revit API

# Cause

The same script can behave differently with different versions of Revit



<https://www.autodesk.com/autodesk-university/class/Dynamo-Isnt-Magic-These-Tips-and-Tricks-Might-Seem-Magical-2020#presentation>

# Solution

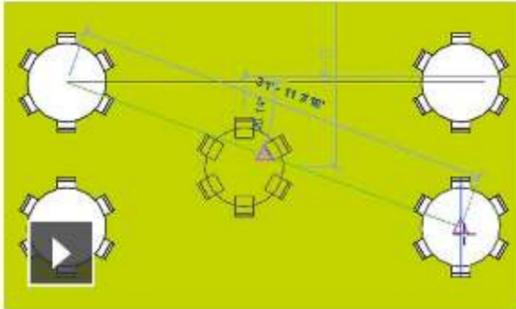
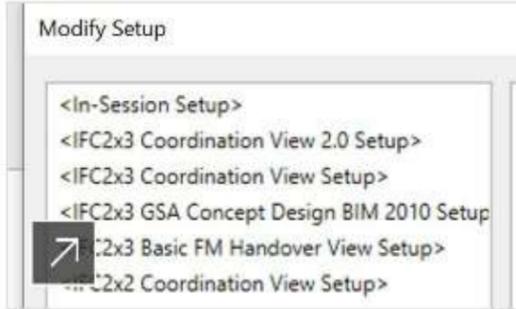
## Don't get out of date!

- Keep up to date on the Documentation and release schedules
- Always test your script library with a new Revit product release including the service pack releases
- Do this every year or after a major release update

## Features

### What's New in Revit 2022.1

The latest release Autodesk Revit® software improves interoperability, boosts efficiency for document production, and offers many performance upgrades to BIM workflows.

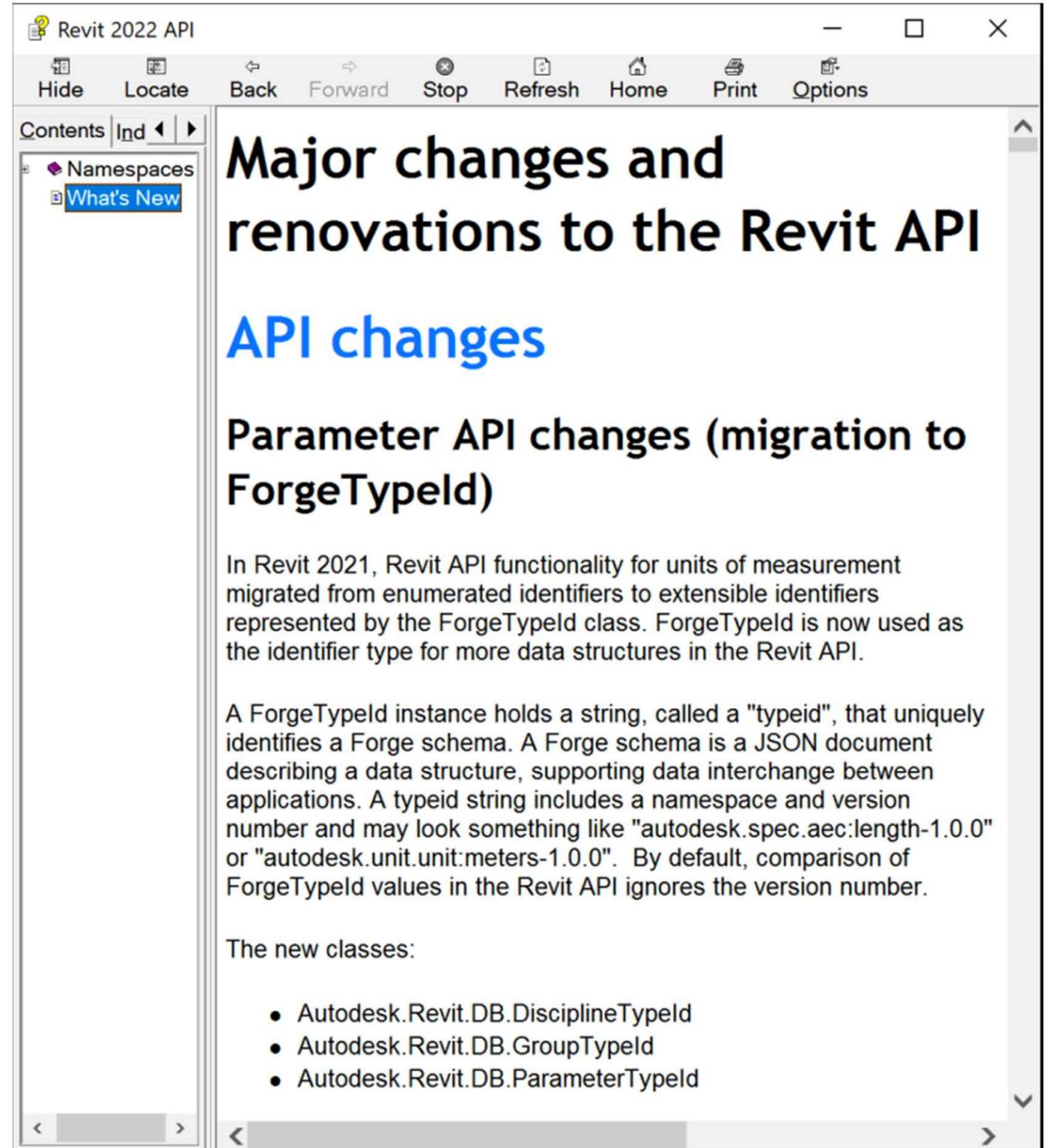
 <p>→ Duplicate Duplicate the view as an independent view.</p> <p>→ Duplicate with Detailing Duplicate the view and detailing as an independent view.</p> <p>▶ Duplicate as a Dependent Duplicate the view as a dependent view.</p>		
<p><b>Duplicate Sheets</b> Accelerate documentation with duplicate sheet dialog to reproduce title block and parameters, detailing, and views on sheets. (video: 1:26 min.)</p>	<p><b>Snap to middle of two points</b> Place components, sketch, and measure quickly and accurately in 2D and 3D views with new snap to mid-point functionality. (video: 1:41 min.)</p>	<p><b>Improved IFC performance</b> Link and export to IFC with the Open Design Alliance (ODA) software development kit, improving performance.</p>



# Protip

Read the API of the software you use

- Developers post changes - <https://thebuildingcoder.typepad.com/blog/2021/04/whats-new-in-the-revit-2022-api.html>
- (Thanks Jeremy)
- More searchable version at RevitAPIdocs - <https://www.revitapidocs.com/>
- (Thanks Gui!)



Revit 2022 API

Hide Locate Back Forward Stop Refresh Home Print Options

Contents | Ind |

- Namespaces
- What's New

## Major changes and renovations to the Revit API

### API changes

#### Parameter API changes (migration to ForgeTypeId)

In Revit 2021, Revit API functionality for units of measurement migrated from enumerated identifiers to extensible identifiers represented by the ForgeTypeId class. ForgeTypeId is now used as the identifier type for more data structures in the Revit API.

A ForgeTypeId instance holds a string, called a "typeid", that uniquely identifies a Forge schema. A Forge schema is a JSON document describing a data structure, supporting data interchange between applications. A typeid string includes a namespace and version number and may look something like "autodesk.spec.aec:length-1.0.0" or "autodesk.unit.unit:meters-1.0.0". By default, comparison of ForgeTypeId values in the Revit API ignores the version number.

The new classes:

- Autodesk.Revit.DB.DisciplineTypeId
- Autodesk.Revit.DB.GroupTypeId
- Autodesk.Revit.DB.ParameterTypeId



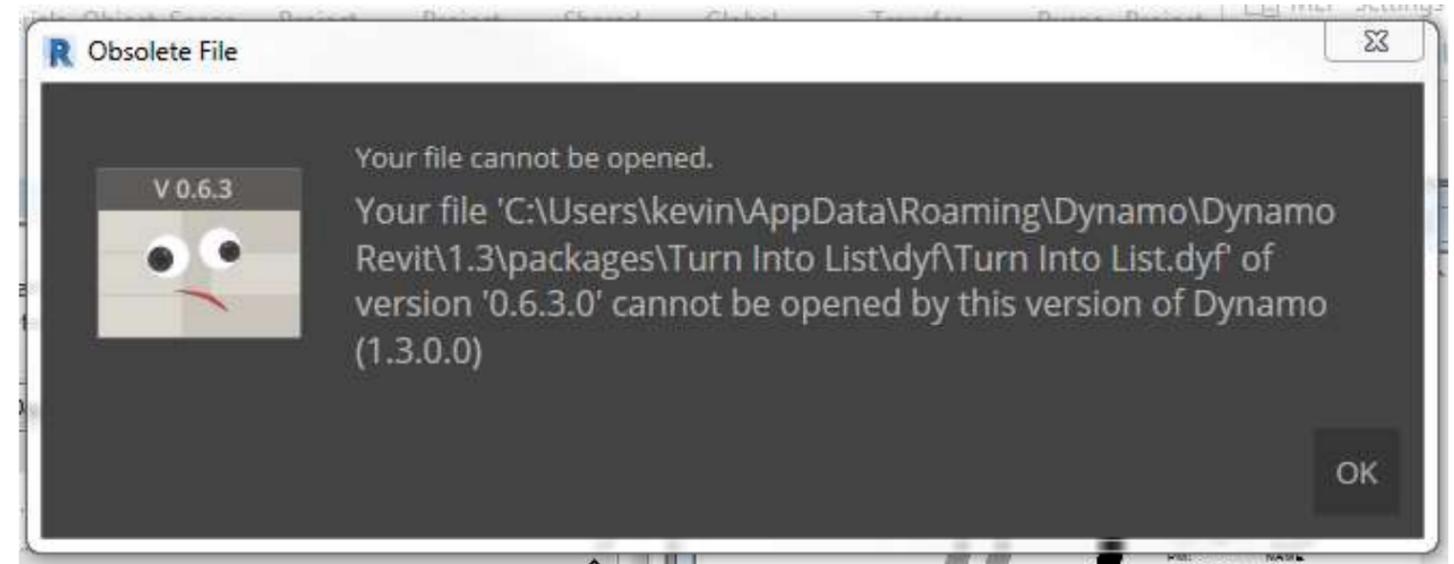
# #2

Dynamo for Revit

# Problem

## A script cannot be opened

- Your scripts won't work if you don't upgrade them!
- Just like Revit the Dynamo software itself changes all the time.
- A big shift from 1x to 2x occurred so make sure to migrate your files to the latest version



<https://forum.dynamobim.com/t/error-file-cannot-be-opened/12127>

# Cause

You didn't upgrade Dynamo!

# XML



# JSON

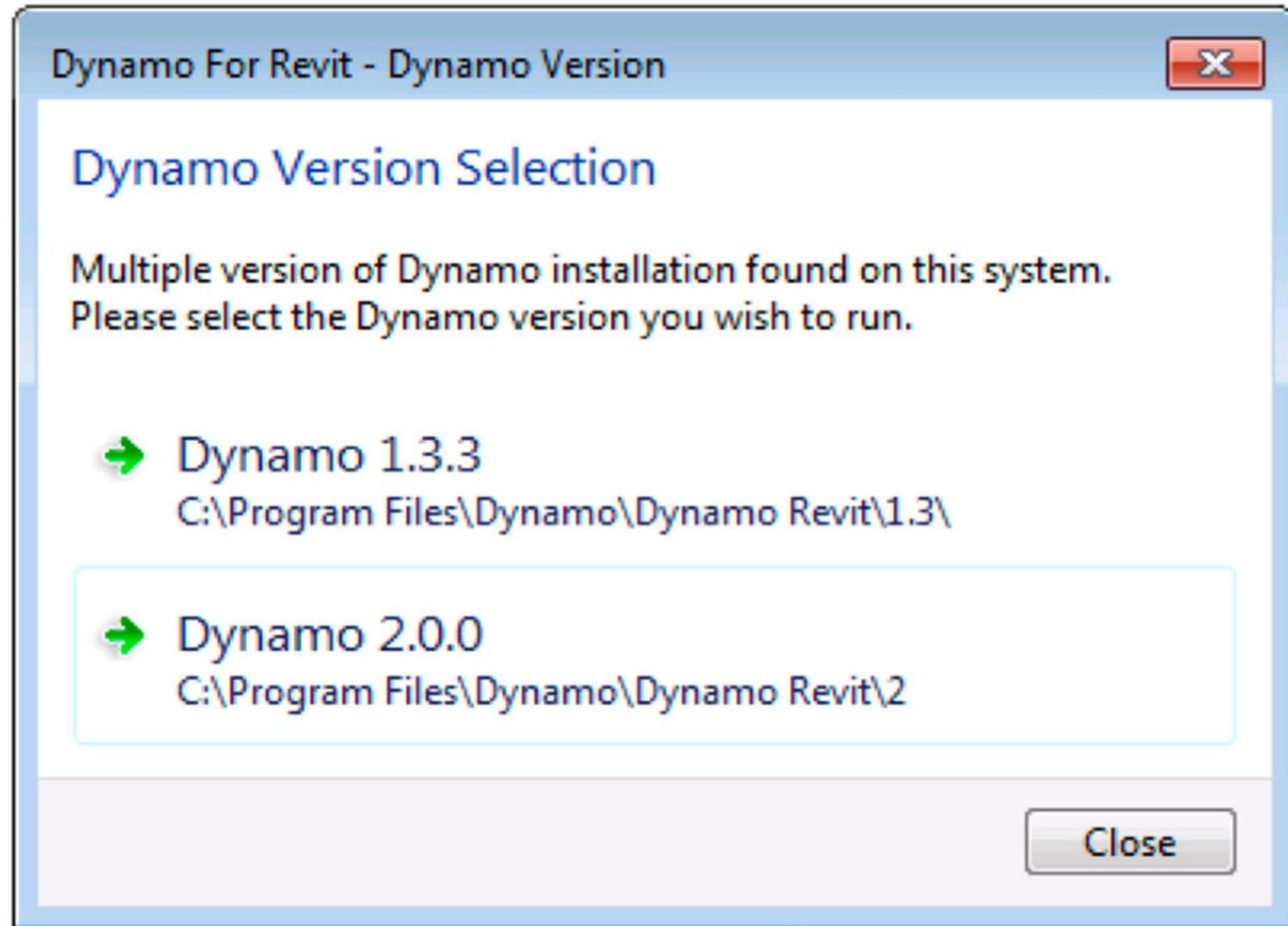
```
<Workspace Version="1.3.1.1736" X="-49.8510260619664" Y="553.599321446294" zoom=
<NamespaceResolutionMap />
<Elements>
  <Dynamo.Graph.Nodes.ZeroTouch.DSFunction guid="9250339a-7087-4423-8598-189a7
    <PortInfo index="0" default="True" />
    <PortInfo index="1" default="True" />
  </Dynamo.Graph.Nodes.ZeroTouch.DSFunction>
  <Dynamo.Graph.Nodes.CodeBlockNodeModel guid="27a48dae-f0dc-4466-b1ec-412332f
  <Dynamo.Graph.Nodes.ZeroTouch.DSFunction guid="2ced2388-db6f-4ed9-afc1-aebff
    <PortInfo index="0" default="False" />
  </Dynamo.Graph.Nodes.ZeroTouch.DSFunction>
  <Dynamo.Graph.Nodes.CodeBlockNodeModel guid="c499fee9-14dc-444e-8d8a-60ba71k
  <Dynamo.Graph.Nodes.ZeroTouch.DSFunction guid="00e70d92-c12d-4490-b403-d7ad3
    <PortInfo index="0" default="False" />
    <PortInfo index="1" default="False" />
    <PortInfo index="2" default="False" />
  </Dynamo.Graph.Nodes.ZeroTouch.DSFunction>
  <Dynamo.Graph.Nodes.ZeroTouch.DSFunction guid="1bae56fe-94e7-4e5e-b7e5-2aa29
    <PortInfo index="0" default="True" />
    <PortInfo index="1" default="True" />
  </Dynamo.Graph.Nodes.ZeroTouch.DSFunction>
  <Dynamo.Graph.Nodes.ZeroTouch.DSFunction guid="6e0bf546-4150-47d7-b24d-d9f29
    <PortInfo index="0" default="False" />
    <PortInfo index="1" default="False" />
    <PortInfo index="2" default="True" />
    <PortInfo index="3" default="True" />
    <PortInfo index="4" default="True" />
  </Dynamo.Graph.Nodes.ZeroTouch.DSFunction>
  <Dynamo.Graph.Nodes.CodeBlockNodeModel guid="a899d2a0-c461-4b19-b90a-ce3062c
    <PortInfo index="0" default="False" />
  </Dynamo.Graph.Nodes.CodeBlockNodeModel>
```

```
{
  "Uuid": "3c9d0464-8643-5ffe-96e5-ab1769818209",
  "IsCustomNode": false,
  "Description": "",
  "Name": "Home",
  "ElementResolver": {
    "ResolutionMap": {}
  },
  "Inputs": [
    {
      "Id": "bc6e8a615f604bd4a351d9e09cccd3bb",
      "Name": "Number Slider: Midpoint X of Arc",
      "Type": "number",
      "Value": "5",
      "MaximumValue": 10.0,
      "MinimumValue": 0.0,
      "StepValue": 0.1,
      "NumberType": "Double",
      "Description": "A slider that produces numeric values."
    },
    {
      "Id": "e61b7061e02946dea06bf0f7eedf7b0a",
      "Name": "Number Slider: Width of Arc",
      "Type": "number",
      "Value": "10",
      "MaximumValue": 10.0,
      "MinimumValue": 0.0,
      "StepValue": 0.1,
      "NumberType": "Double"
    }
  ]
}
```

<http://dynamobim.org/to-dynamo-2-0-and-beyond/>

# Solution

Out with the old and in with the new



<http://dynamobim.org/to-dynamo-2-0-and-beyond/>

# Solution

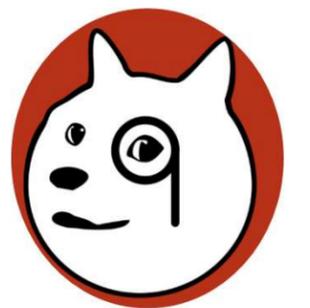
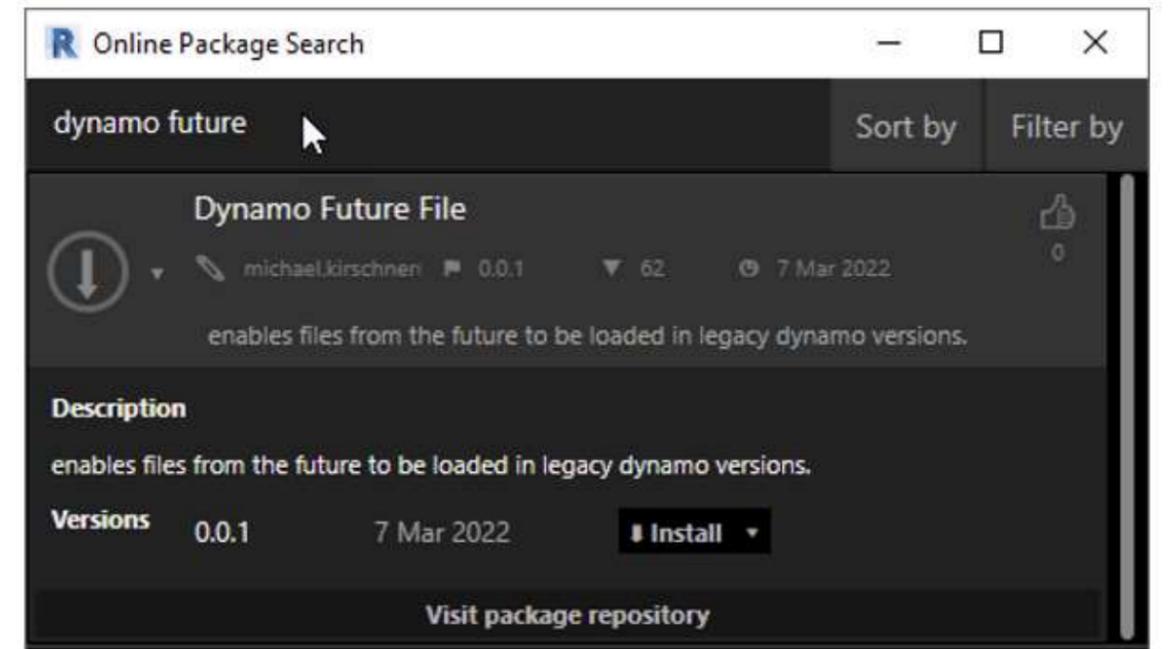
- Check your version history of Dynamo and make sure you stay up to date
- Look at the official blog for updates - <https://dynamobim.org/blog/>
- There's another release (2.15) - <https://dynamobim.org/dynamo-core-2-15-release/>
- Don't get lazy



# Protip

You can use some specialized tools to open newer scripts in older versions

- It's possible to open some scripts to be loaded into legacy Dynamo (2x versions only)
- Check out Pierson's Post about it - <https://designtechunraveled.com/2022/09/15/cant-open-a-dynamo-graph-heres-one-reason-why/>





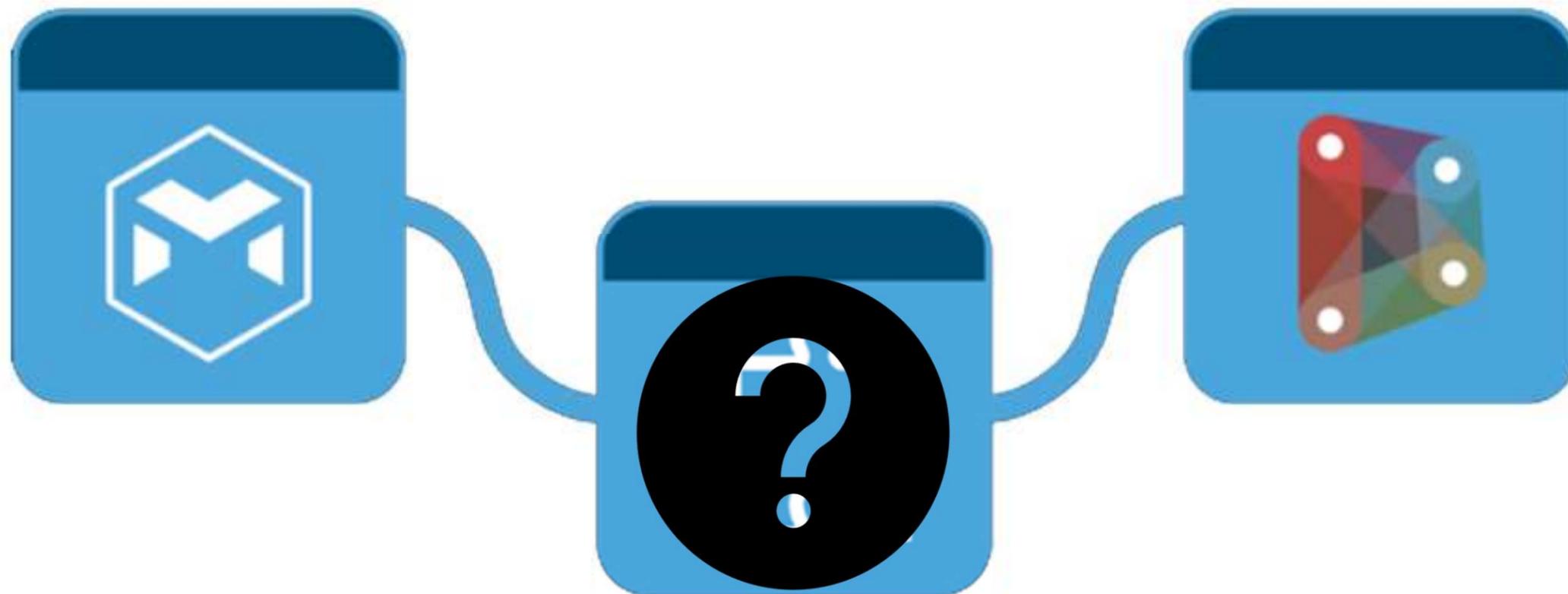
# #3

Packages for Dynamo for Revit

# Problem

## A script has a node that doesn't work

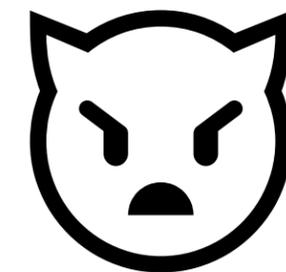
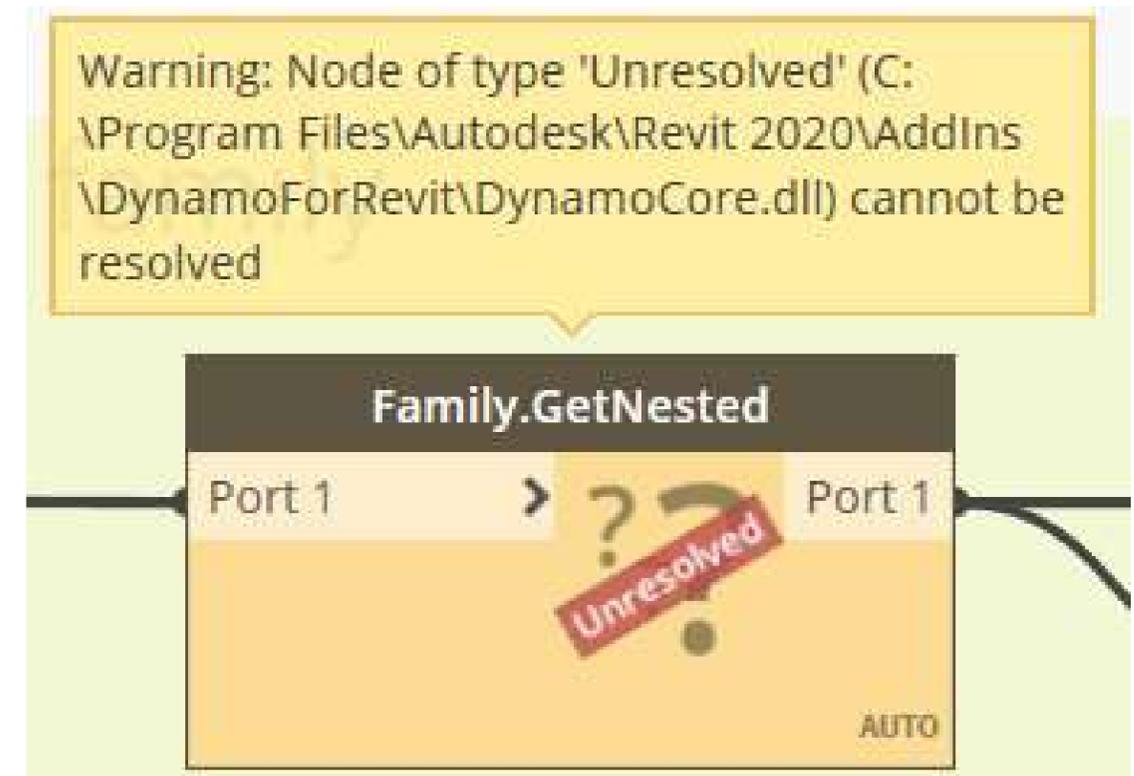
- The script doesn't run because you don't have special nodes from a specific package
- If you don't have these packages installed per computer then the script won't work



# Cause

## You have Package Problems

- You have a lot of custom packages in a script
- Usually says 'unresolved' on the node
- Sometimes you don't have the right package installed to run the script on another computer
- This is called dependency hell



# BimorphNodes v2.1

The latest version of Bimorph Nodes (v2.1) introduces ultra-efficient clash detection and geometry intersection Nodes!

We've developed a new range of geometry intersection nodes that are unmatched in performance and add entirely new functionality to Dynamo, while the new clash detection nodes achieve game-changing performance increases of up to 99.7% compared to current methods, opening-up entirely new inference workflows for Dynamo BIM.

## CAD

CAD.CurvesFromCADLayers	
importInstance	Curves[]
layerNames	layerKeys[]
createModelCurves	
lineStyleMap	

Convert curves from a CAD link or import by layer name. Curves are organised into sublists by layer. Enter LineStyle names to map each sublist to that style during conversion.

The node is optimised to convert curve types that typically fail when using Dynamo Element.Curves node or Revit Explode

CAD.DetailCurvesFromCADLayers	
importInstance	DetailCurves[]
view	layerKeys[]
layerNames	
lineStyleMap	

Convert curves from a CAD link or import to Revit Detail curves by layer name. Detail Lines are organised into sublists by layer. Enter LineStyle names to map each sublist to that style during conversion.

The node is optimised to convert curve types that typically fail when using Dynamo Element.Curves node or Revit Explode

CAD.SymbolicCurvesFromCADLayers	
importInstance	SymbolicCurves[]
layerNames	layerKeys[]
lineStyleMap	

Convert curves from a CAD link or import to Revit Family Symbolic curves by layer name. Symbolic Lines are organised into sublists by layer. Enter LineStyle names to map each sublist to that style during conversion.

The node is optimised to convert curve types that typically fail when using Dynamo Element.Curves node or Revit Explode

CAD.LayerNames	
importInstance	layerNames[]

Get the full list of layer names from a CAD Link or Import

CAD.LayerNamesInUse	
importInstance	layerNames[]

Get the list of layer names from a CAD link or import that are in use and contain curves

CAD.SetObjectStyle	
importInstance	report
layerName	
projectionWeight	
color	

Set weight and colour of CAD link or import layers Object Styles. Enter the layers to set as strings. The layer names are case-sensitive. The line weight and colour lists are mapped to the layerNames list using longest lacing

CAD.ReportInstances	
filePath	report[]
refresh	CADLinks[]
close	CADImports[]

Generates a report of all CAD links and imports in the document with key metrics. Linked and Imported CAD links are output into lists to aid with CAD link management.

## Element

Element.IntersectsElement	
elementSetA	Element[]
elementSetB	

Finds intersections between two sets of elements. Elements in set B that intersect set A are output into sublists. Self-intersection is automatically prevented if an element is found in both lists.

The node is optimised using Revit Quick and Slow filters to output rapid results even with massive element sets

Element.IntersectsSolid	
solids	Element[]
elements	

Finds intersections between Solids and Revit elements. Elements that intersect a Solid are output into sublists.

The node is optimised using Revit Quick and Slow filters to output rapid results even with massive element sets

Element.IsElementSupported	
element	bool

Returns true if the element is supported by the Element.IntersectsElement node, false if its not

Element.IsCategorySupported	
element	bool

Returns true if the element Category is supported by the Element.IntersectsElement node, false if its not

## BoundingBox

BoundingBox.GetElementsInside	
boundingBox	Element[]
elements	
tolerance	

Filter and return Revit elements inside a bounding box. Element Outlines (BoundingBox) are used to determine the result

BoundingBox.GetElementsIntersect	
boundingBox	Element[]
elements	
tolerance	

Filter and return Revit elements intersecting or inside a bounding box. Element Outlines (BoundingBox) are used to determine the result

## Sheet

Sheet.Duplicate	
sheets	report[]
run	Sheet[]
duplicateWithViews	
duplicateOption	
suffix	
prefix	

Duplicate selected Sheets with options to control if placed Views are also duplicated and the method of duplication.

The report output provides a list of any Sheets and/or Views that fail to duplicate or View names that were cleaned of illegal characters

Sheet.RenumberRename	
sheets	Sheet[]
numbers	
names	

Renumber and/or rename Revit sheets. To renumber or rename only, leave the other input empty. Sheets and newNumbers list's must be equal in length to run.

The node uses an algorithm that handles common Revit sheet renumber warnings for more consistent results

Sheet.FromSchedule	
scheduleView	Sheet[]
refresh	

Collects and returns all Revit sheets from a Sheet List Schedule

Ensure the Sheet Number field is included in the Schedule

## Curve

Curve.RemoveDuplicates	
curves	cleanedCurves[]
retainByLineStyle	duplicateCurves[]
deleteRevitCurves	report[]

Removes duplicates from a list of Curves. Dynamo Curves, Revit Model or Detail Lines are all supported. Revit Curves can be deleted from the document. Input LineStyle names to retain curves of that style.

LineStyle list are iterated until a match is found. If no matches are found, first-in first-out rules apply. To simplify model element selection in Revit, heterogeneous lists (any element type) can be input as the list is filtered before processing

Curve.IntersectAll	
curves	Point[]

Finds and returns all intersection points between a set of curves.

Curve.SolidIntersection	
solid	Curve[]
curves	
invert	

Finds and returns all intersecting curve segments between a solid and a list of curves. Setting invert to true has the reverse effect and trims curves that intersect the solid

## Schedule

Schedule.GetData	
scheduleView	ScheduleData[]
removeHeadings	
refresh	

Gets all the table data from a given schedule as strings

Schedule.GetDataColumns	
scheduleView	ScheduleData[]
columnIndex	
removeHeadings	
refresh	

Get the specified column data from a given schedule as strings

Column indexes start at 0

Schedule.GetDataRows	
scheduleView	ScheduleData[]
rowIndex	
refresh	

Get the specified row data from a given schedule as strings

Schedules have a blank row after the headings. Row indexes start at 0

## LineStyle

LineStyle.Create	
name	report
weight	GraphicStyle
color	
run	

Create single or multiple new Line Styles in a Revit document from name, line weight and RGB values

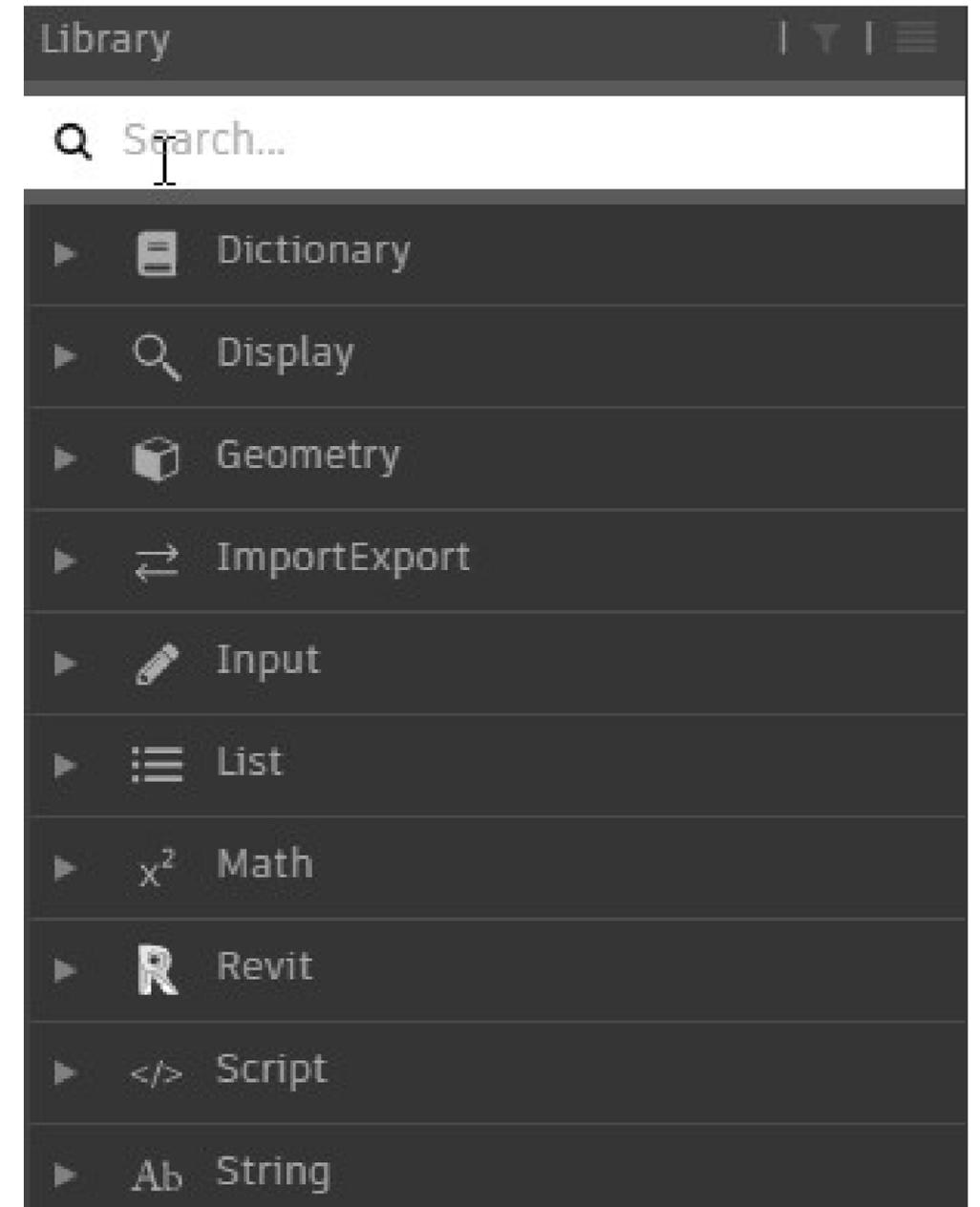
LineStyle.AllAttributes	
refresh	name[]
	weight[]
	Color[]
	GraphicStyle[]

Gets all the Revit Line Styles in the document and reports their Line Style Name, Weight and Colour as strings and integers. The Revit GraphicsStyle (Category) element for each Line Style is also output

# Solution

## Keep it simple

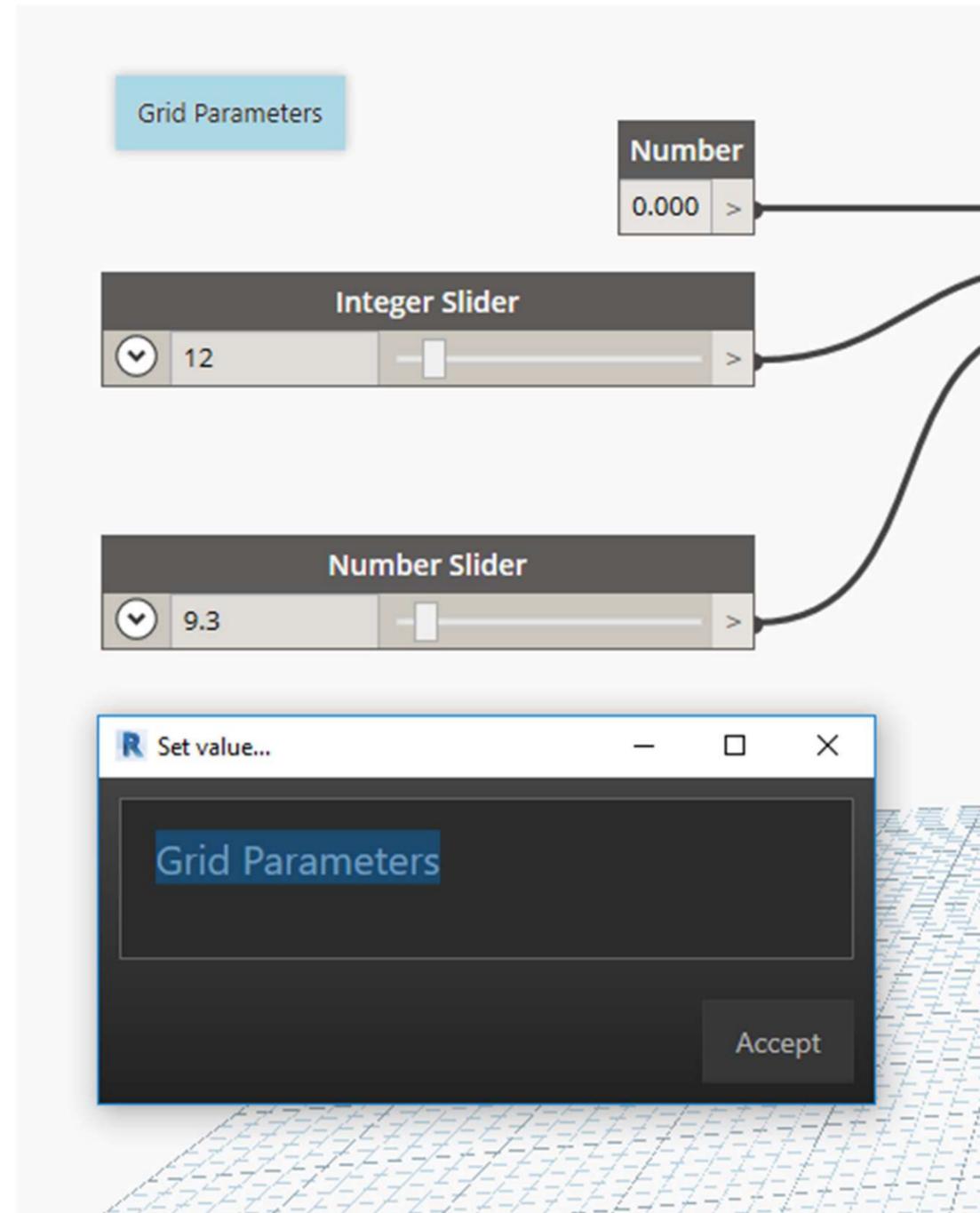
- Try the Vanilla (OOTB) Dynamo whenever possible to get started especially for starter scripts
- Use packages when justified including more extensive scripting which requires a lot of steps anyway when you create a script
- Try out the default installed nodes and features before going to packages



# Solution

## Write down notes in your scripts

- If you are going to use a custom package then **WRITE IT DOWN IN YOUR NOTES!**
- Let people know what they need in order to get started



# Solution

## Write down notes in your scripts

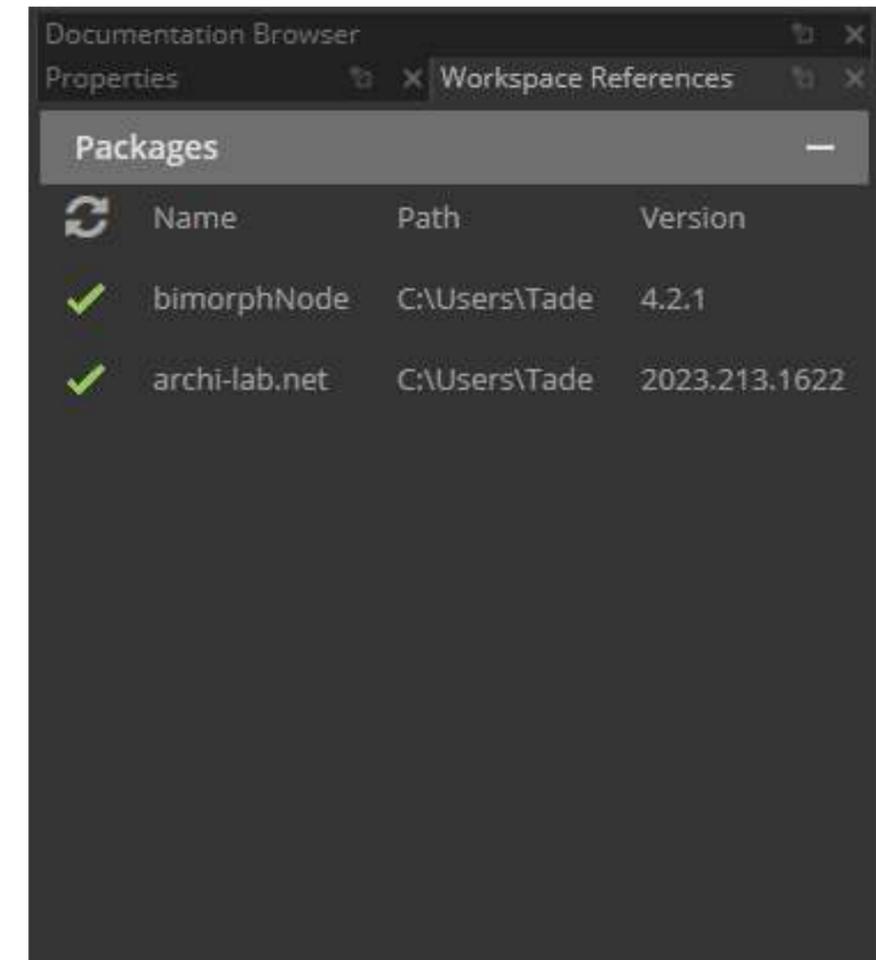
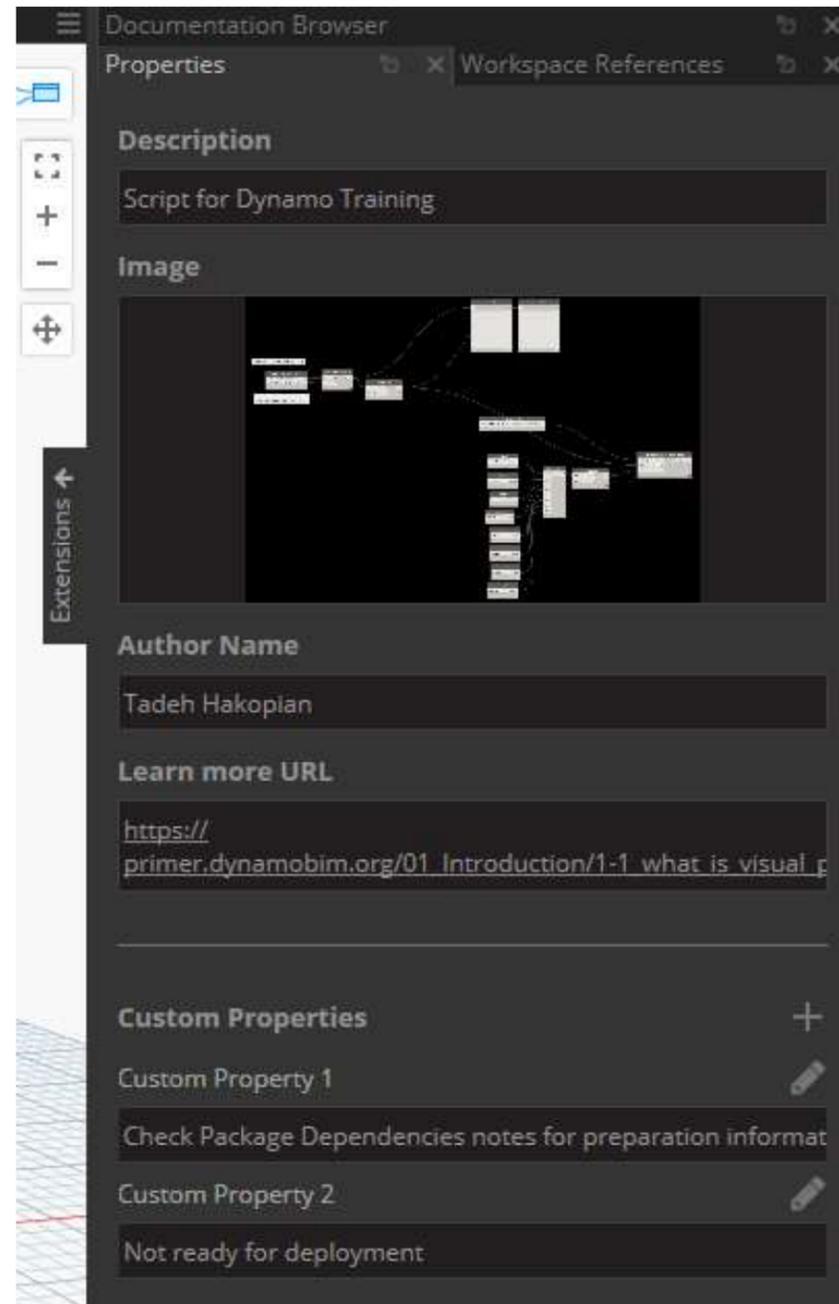
- Lots of ways to do this – even with code blocks and multi-line text if you prefer

```
Code Block Note Renamed
1 /**
2 This is a multi-line note
3 This is a multi-line note
4 This is a multi-line note
5 **/;
```

# Protip

## Note pane exists – use it

- Dynamo has enhanced documentation and package information in the browser
- It is part of Dynamo since v2.3
- Add description, images, notes, links for context





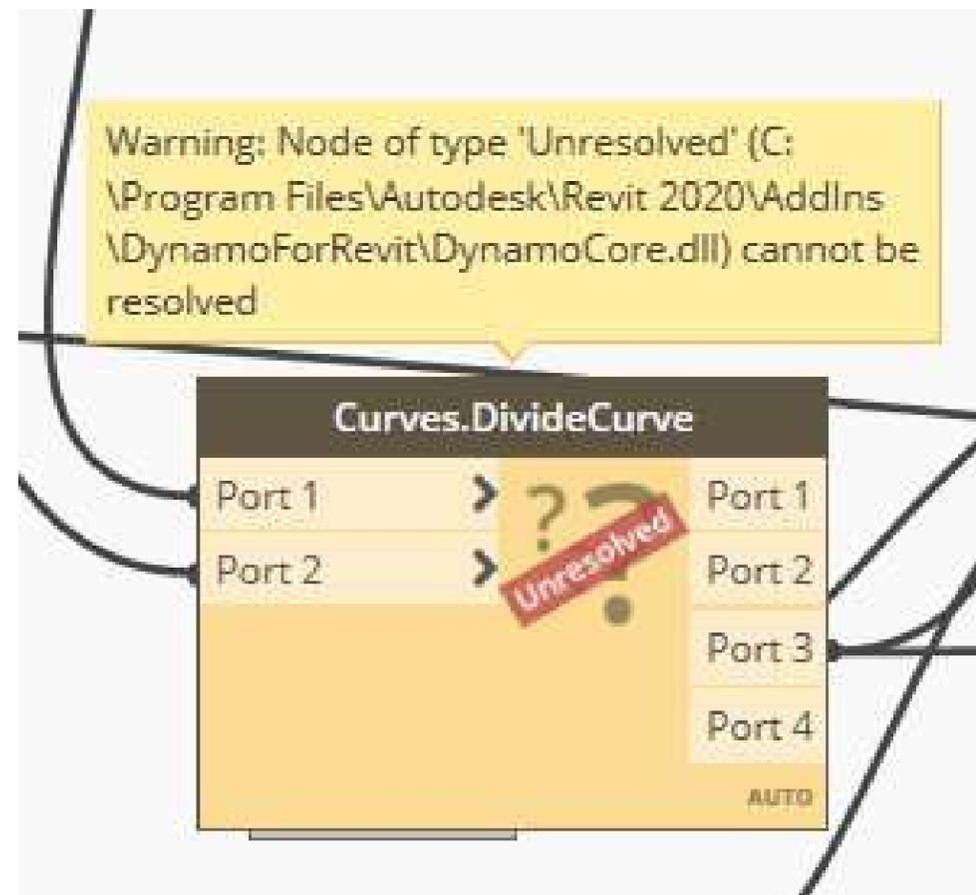
# #4

What's in your computer

# Problem

## More Package Problems – DLL files in the wrong place

- Looks like the Nodes still won't work
- Your DLL files are in the wrong place even for the OOTB nodes



# Cause

## DLL files may be in the wrong place

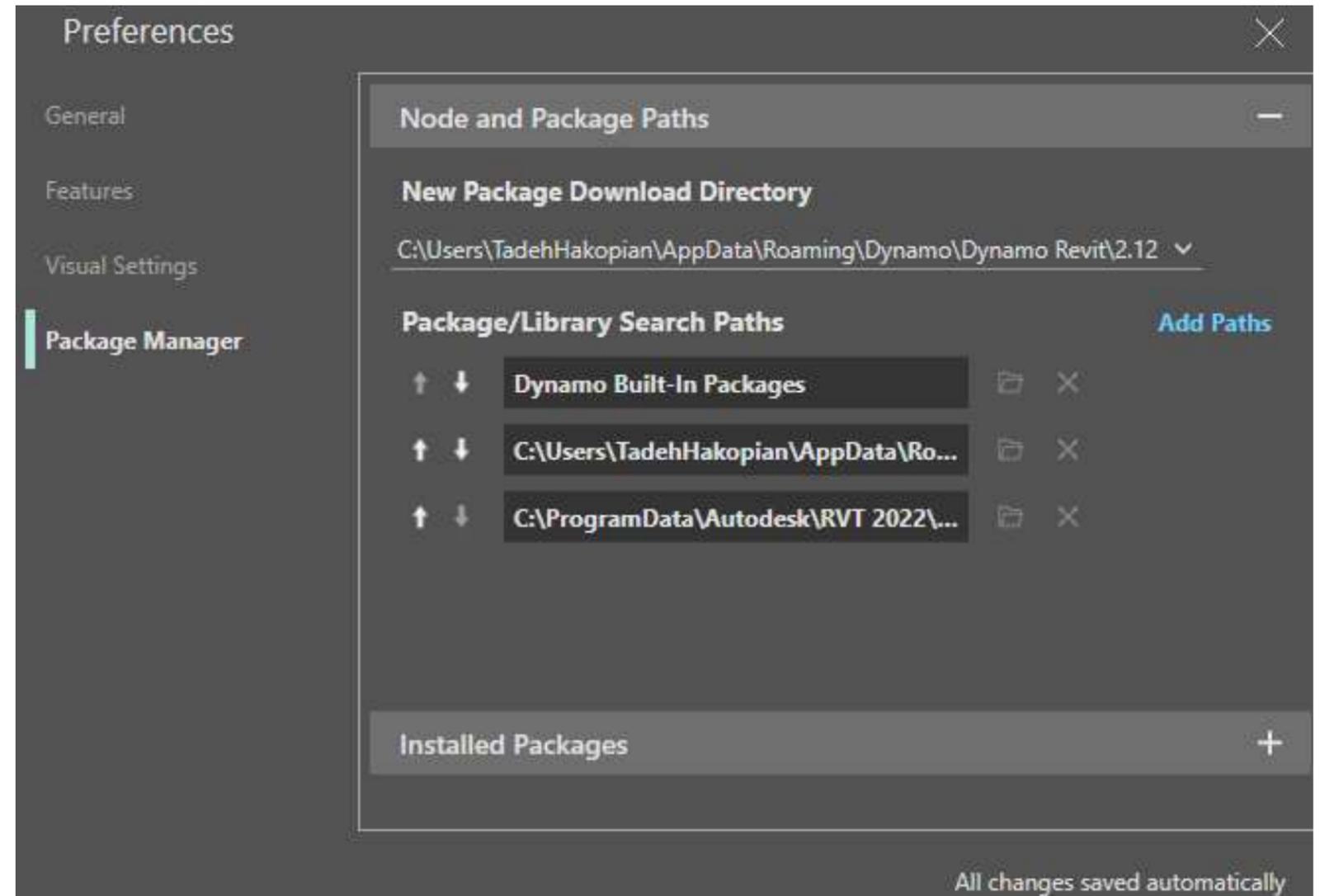
- Your package paths likely aren't matching to the current location of the libraries on your computer
- C:\Program Files\Autodesk\Revit 2022\AddIns\DynamoForRevit
- C:\ProgramData\Autodesk\RVT 2022\Dynamo
- C:\Users\TadehHakopian\AppData\Roaming\Dynamo\Dynamo Revit\2.12\packages

Name	Date modified	Type	Size
Dynamo.cer	2/4/2015 12:25 AM	Security Certificate	1 KB
DynamoAddInGenerator.exe	1/23/2022 12:34 PM	Application	14 KB
DynamoApplications.dll	1/23/2022 12:34 PM	Application exten...	33 KB
DynamoArduino.dll	1/23/2022 12:34 PM	Application exten...	21 KB
DynamoArduino.XML	2/9/2015 3:37 PM	XML Document	4 KB
DynamoCLI.exe	1/23/2022 12:34 PM	Application	23 KB
DynamoCLI.exe.config	2/20/2020 1:00 PM	Configuration Sou...	1 KB
DynamoConversions.dll	1/23/2022 12:34 PM	Application exten...	16 KB
DynamoCore.customization.dll	1/23/2022 12:34 PM	Application exten...	19 KB
DynamoCore.dll	1/23/2022 12:34 PM	Application exten...	887 KB
DynamoCore.dll.config	9/4/2020 12:38 PM	Configuration Sou...	1 KB
DynamoCore.XML	1/23/2022 12:34 PM	XML Document	795 KB
DynamoCoreWpf.dll	1/23/2022 12:34 PM	Application exten...	1,953 KB
DynamoCoreWpf.dll.config	9/4/2020 12:38 PM	Configuration Sou...	1 KB
DynamoCrypto.dll	1/23/2022 12:34 PM	Application exten...	16 KB
DynamoInstallDetective.dll	1/23/2022 12:34 PM	Application exten...	27 KB
DynamoManipulation.dll	1/23/2022 12:34 PM	Application exten...	51 KB
DynamoPackages.dll	1/23/2022 12:34 PM	Application exten...	78 KB
DynamoPackages.dll.config	9/4/2020 12:38 PM	Configuration Sou...	1 KB
DynamoPackagesWPF.dll	1/23/2022 12:34 PM	Application exten...	17 KB
DynamoServices.dll	1/23/2022 12:34 PM	Application exten...	38 KB

# Cause

## DLL files may be in the wrong place

- You can check in Dynamo
- Check under preferences > package manager > library search paths
- Dynamo Built-In packages
- Roaming
- Program Data



# Solution



## Option 1

- Uninstall then Reinstall Dynamo
- Safest Option to fix everything
- Downside is you have to reset a lot of configurations in Dynamo



## Option 2

- Add an extra folder or sort folders yourself
- You need a copy of the correct packages and DLLs you are looking for to make this work



## Option 3

- Change the path to a folder that has vetted files for your DLL content
- May have some issues loading the DLL files so test it out first

# Protip

## Keep a stable copy of the DLL

- Check out RoboCopy to automate file copying for company wide resources to the same directory - <https://petri.com/a-complete-guide-to-robocopy/>
- Also useful for managing package dependencies from a central source to a local directory
- Check out this session for more - <https://www.autodesk.com/autodesk-university/class/Deploying-Dynamo-Your-Company-Getting-Everyone-Node-and-Code-2020>

```
PS C:\> robocopy /?

-----
ROBOCOPY      ::      Robust File Copy for Windows
-----

Started : Wednesday, January 23, 2019 10:12:30 AM
Usage    :: ROBOCOPY source destination [file [file]...] [options]

source   :: Source Directory (drive:\path or \\server\share\path).
destination :: Destination Dir (drive:\path or \\server\share\path).
file     :: File(s) to copy (names/wildcards: default is "*.*").

::
:: Copy options :
::
    /S :: copy Subdirectories, but not empty ones.
    /E :: copy subdirectories, including Empty ones.
    /LEV:n :: only copy the top n LEVELs of the source directory tree.

    /Z :: copy files in restartable mode.
    /B :: copy files in Backup mode.
    /ZB :: use restartable mode; if access denied use Backup mode.
    /J :: copy using unbuffered I/O (recommended for large files).
    /EFSRAW :: copy all encrypted files in EFS RAW mode.

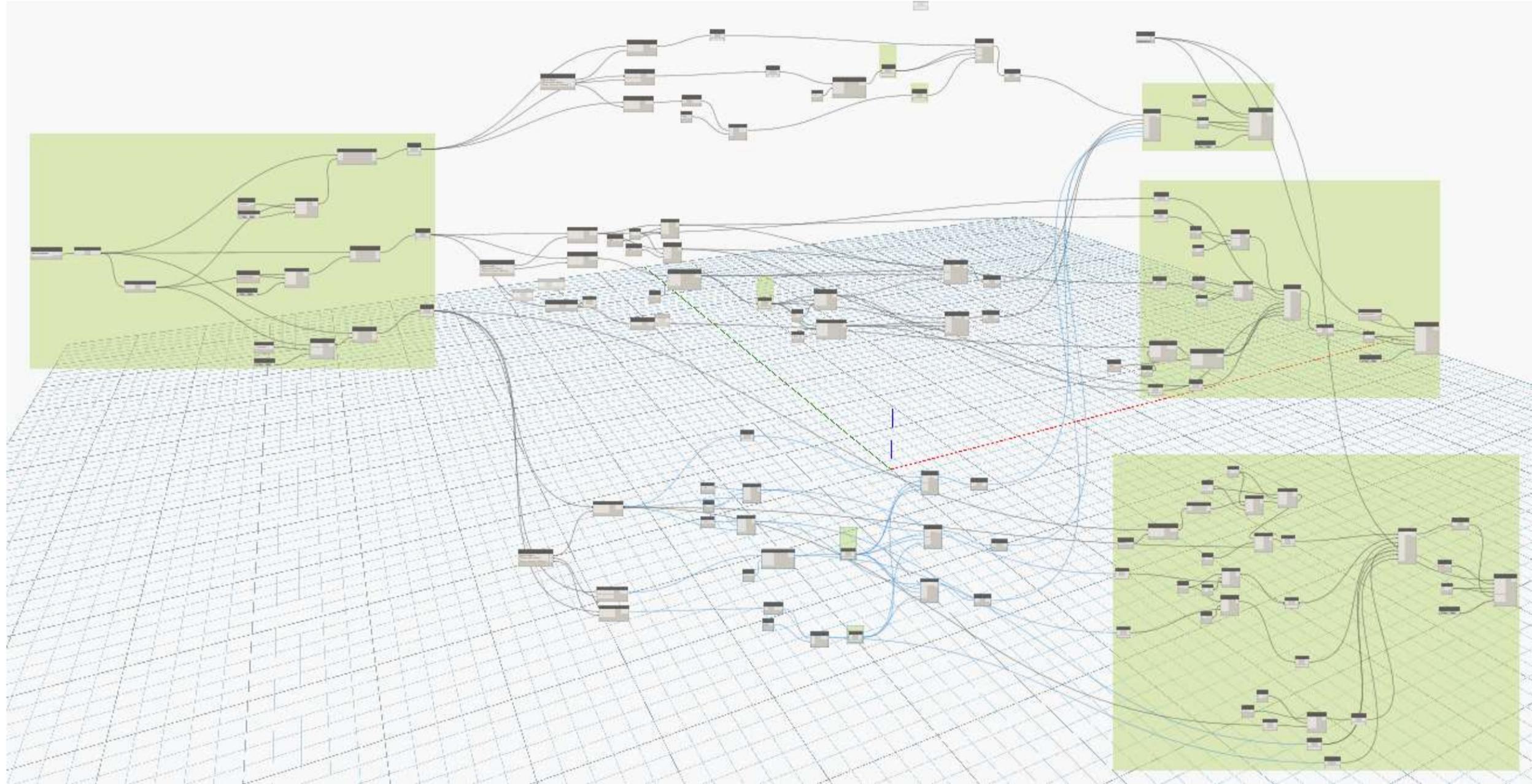
/COPY:copyFlag[s] :: what to COPY for files (default is /COPY:DAT).
                    (copyflags : D=Data, A=Attributes, T=Timestamps).
                    (S=Security=NTFS ACLs, O=Owner info, U=auditing info).
```

# #5

Staying in good order

# Problem

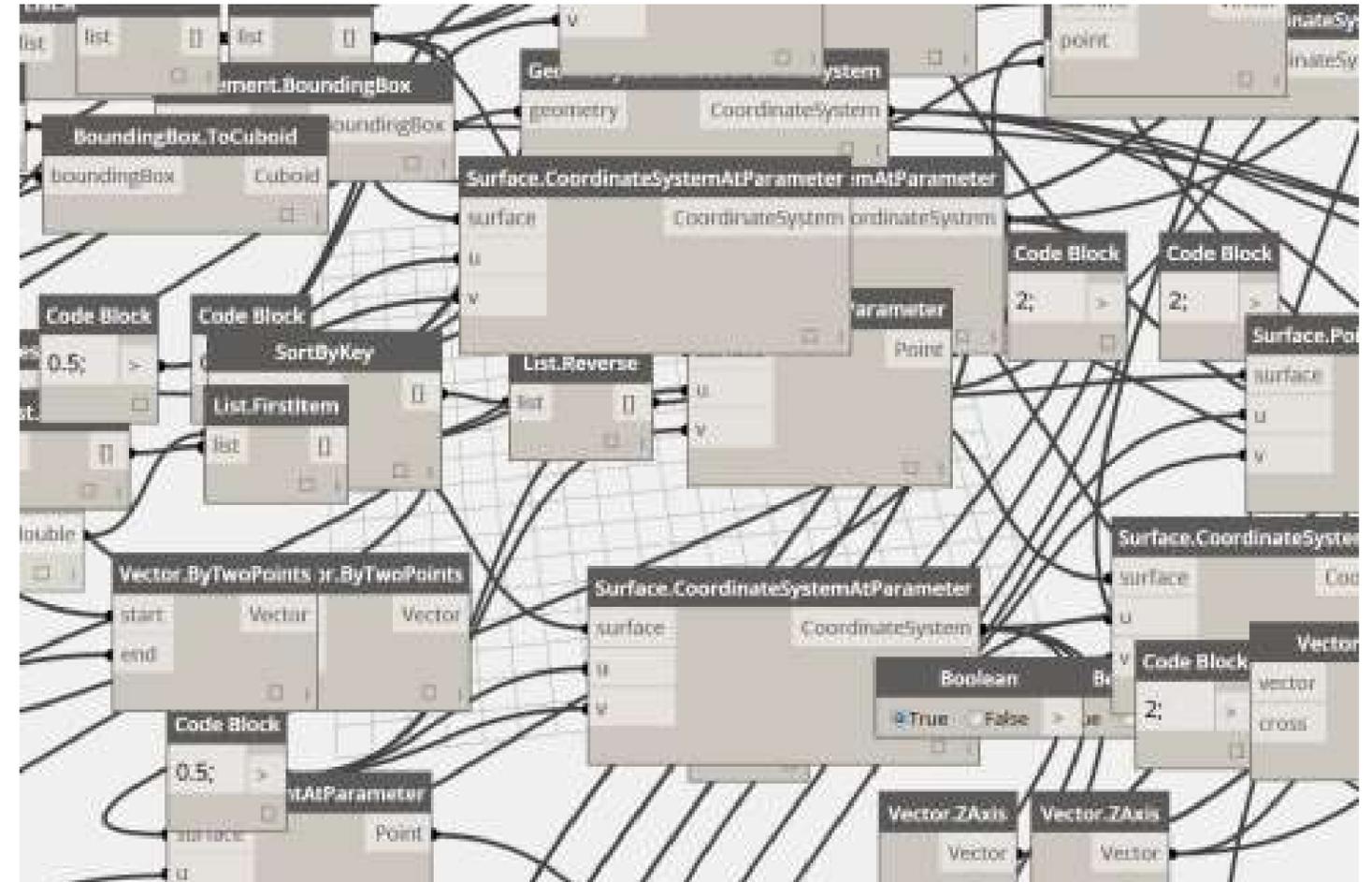
## Messy Graphs



# Problem

## Messy Graphs

- The graph is so disorganized and hard to follow that it is hard to sort through
- Don't be the obstacle to your own success



# Cause

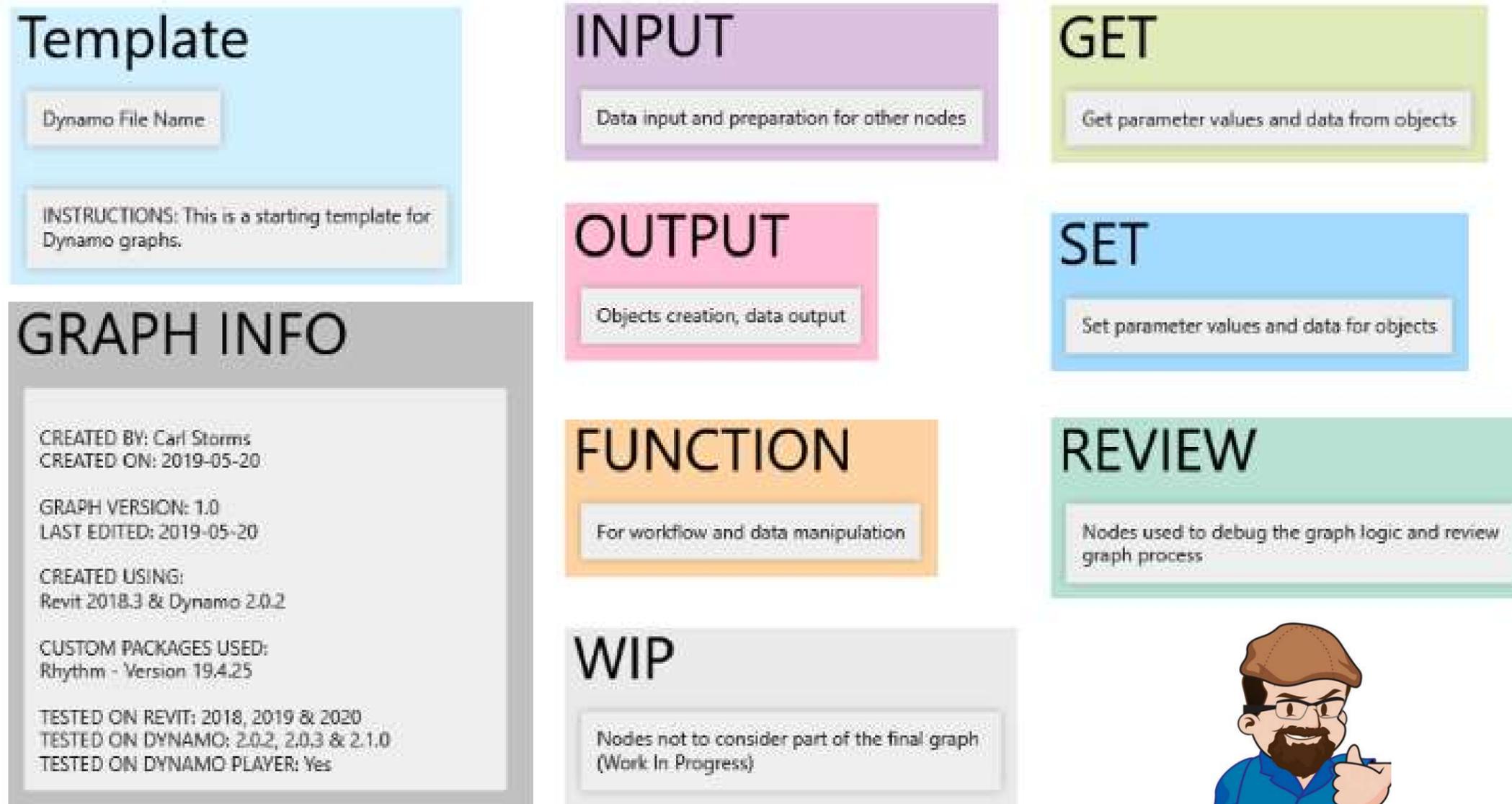
## You don't have standards

- Beta version of the script is the final version of the script
- 'If it works it works' mentality
- No standards or requirements for scripting

**LOW  
STANDARDS  
MEANS  
NO  
STANDARDS!**

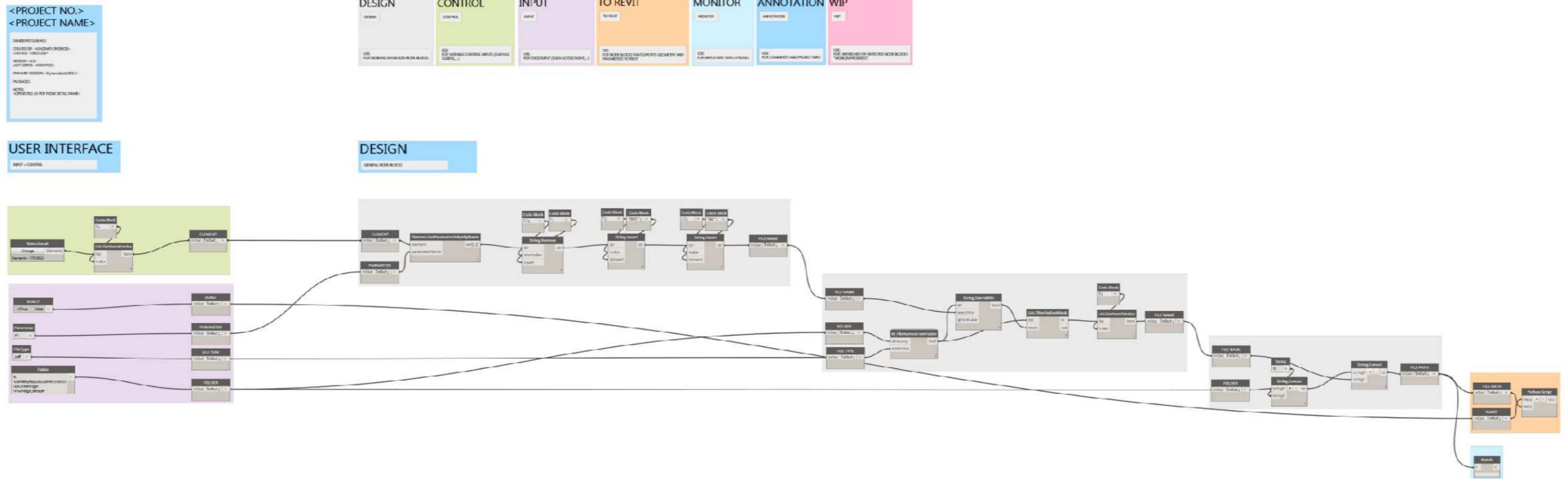
# Solution

## Use a Template file with Standardized layout



# Solution

Much easier to follow and understand the data flow quickly



# Protip

Keep it stored somewhere that you can open it



The screenshot shows the Dynamo software interface. On the left, the 'FILES' menu is open, with the 'Open' option highlighted in blue. Below the 'FILES' menu are sections for 'RECENT' and 'BACKUP' (Backup location). On the right, there are sections for 'ASK' and 'REFERENCE'. The 'ASK' section includes 'Discussion forum' and 'Dynamo website'. The 'REFERENCE' section includes 'Getting Started', 'Dynamo Primer', 'Video Tutorials', and 'Dynamo Dictionary'.

FILES	ASK
New	Discussion forum
Custom Node	Dynamo website
Open	

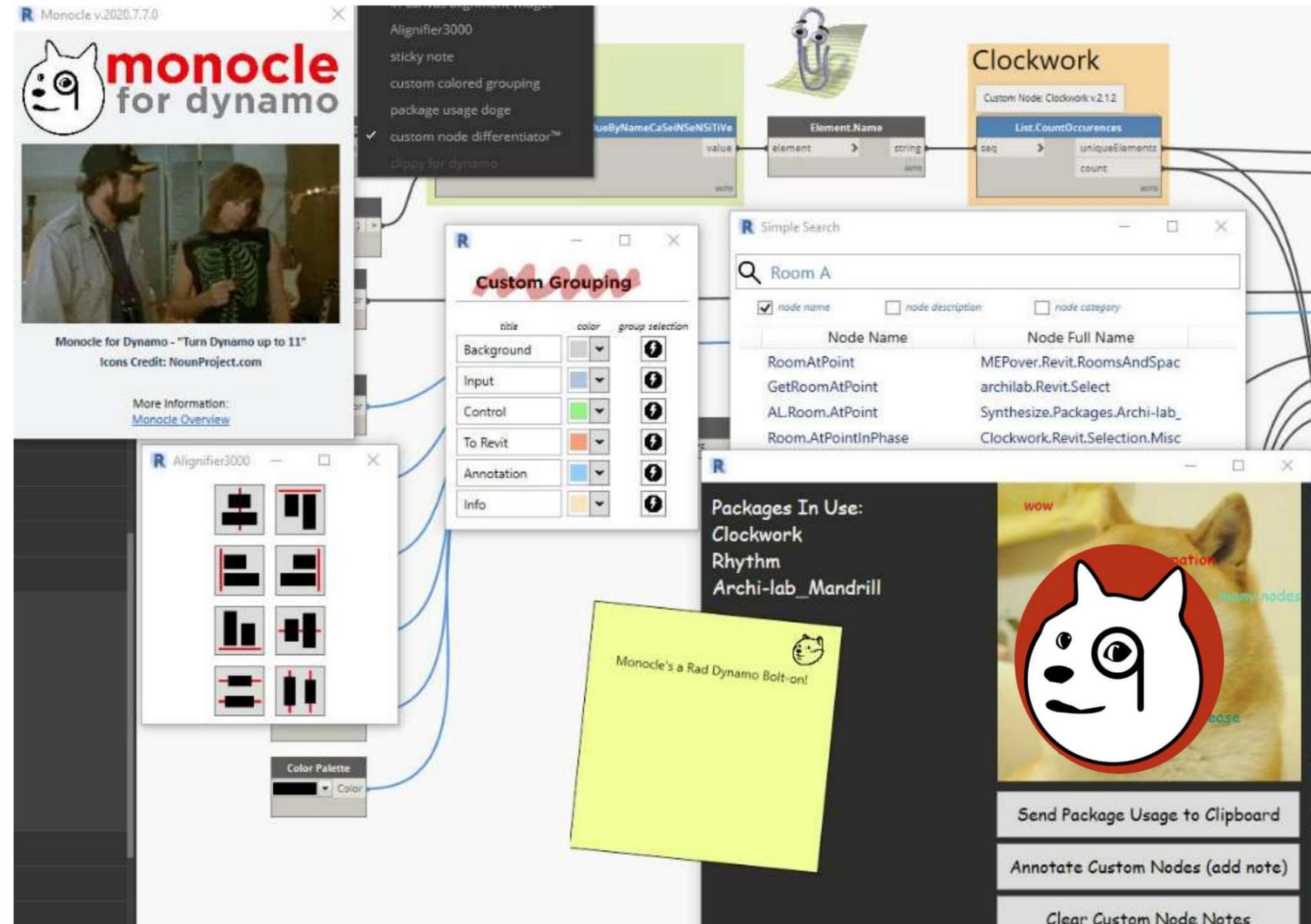
RECENT	REFERENCE
	Getting Started
	Dynamo Primer
	Video Tutorials
	Dynamo Dictionary

BACKUP  
Backup location

# Protip

## There are extensions

- Monocle Extension organizes your Scripts with a lot of customization and speed
- Grouping and sorting nodes
- Auto notes
- Post-its in Dynamo!
- Check it out - <https://www.parallaxteam.com/monocle-for-dynamo-released/>



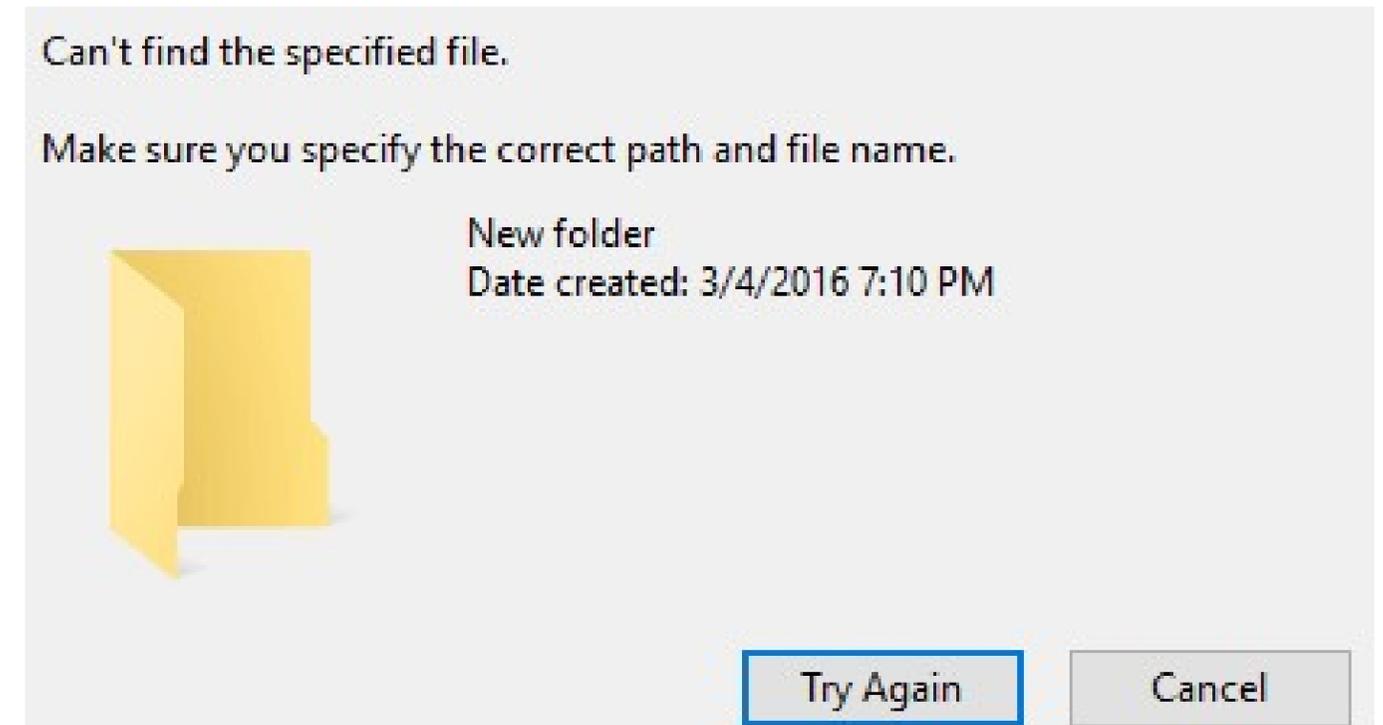
# #6

Keeping track of changes

# Problem

## Out of date Graph

- Your Graph is the wrong one
- Where is the right one?
- How do you know it is the right one?



# Cause

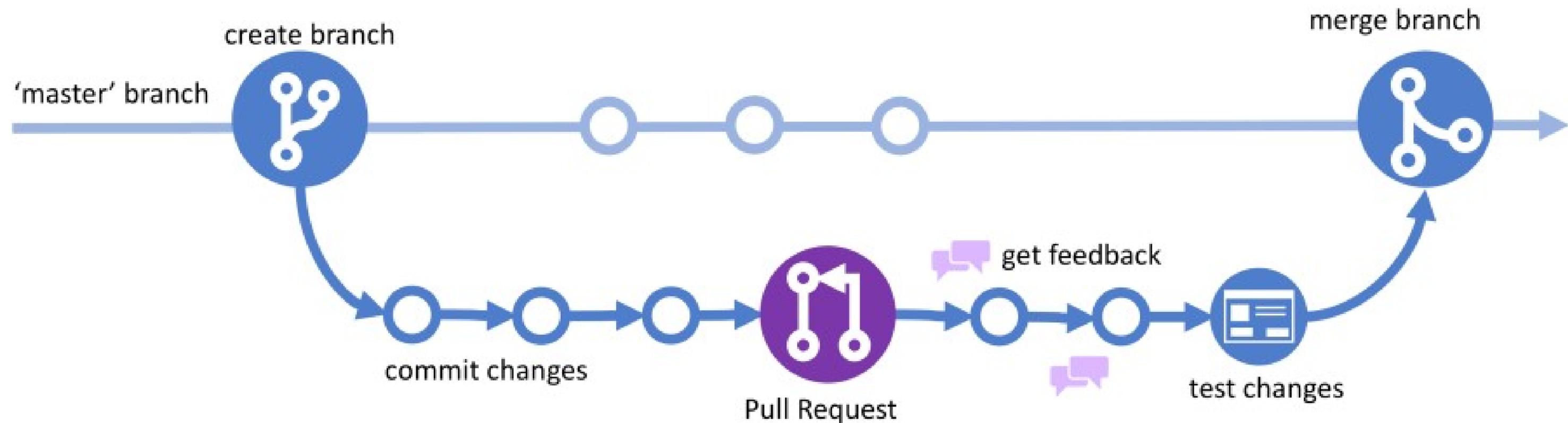
## No Version Control

- You don't know about Version Control
- Here's the basic breakdown:
- You set a file as 'main'
- Any editing you are doing will 'merge' to that main via a 'branch'
- Then commit all changes to that main
- All other file versions are not used for work



# Solution

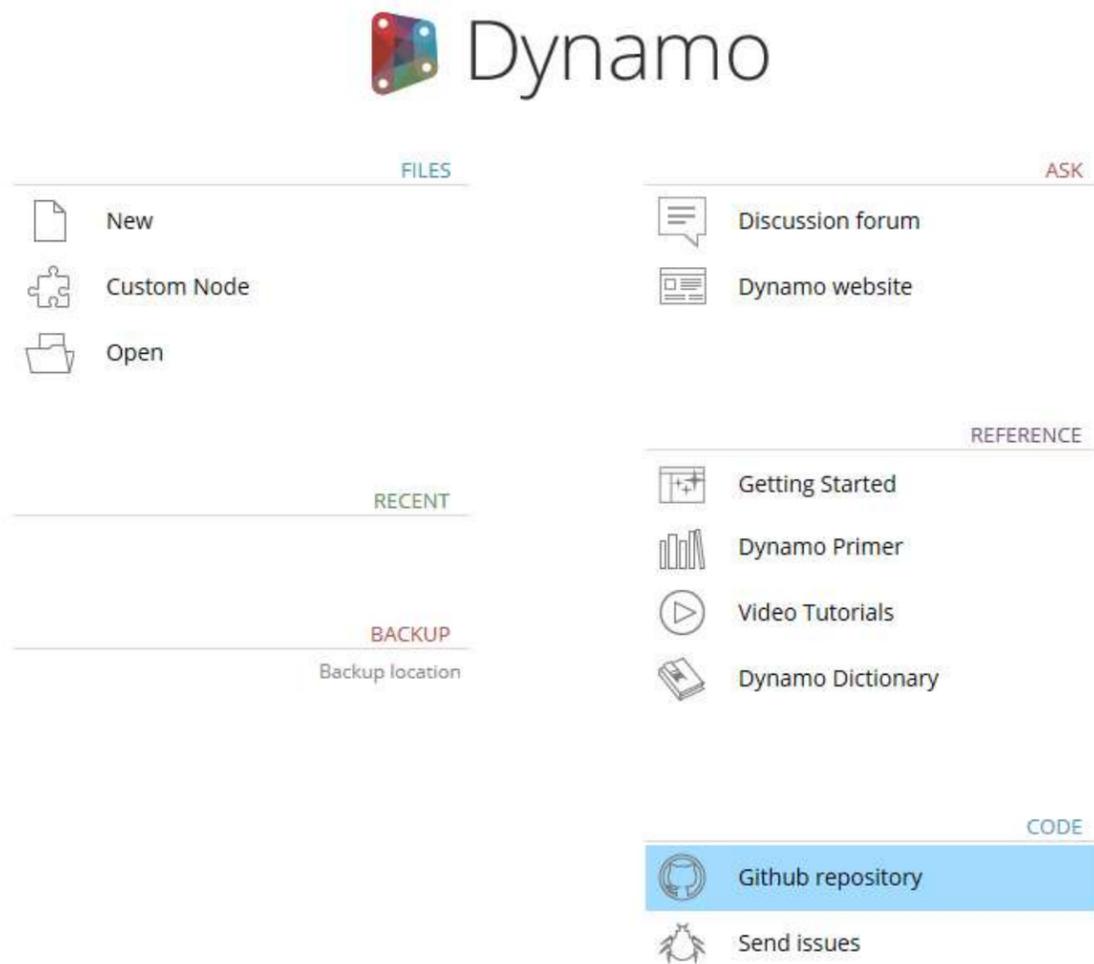
Git is a system that anyone can use for version control



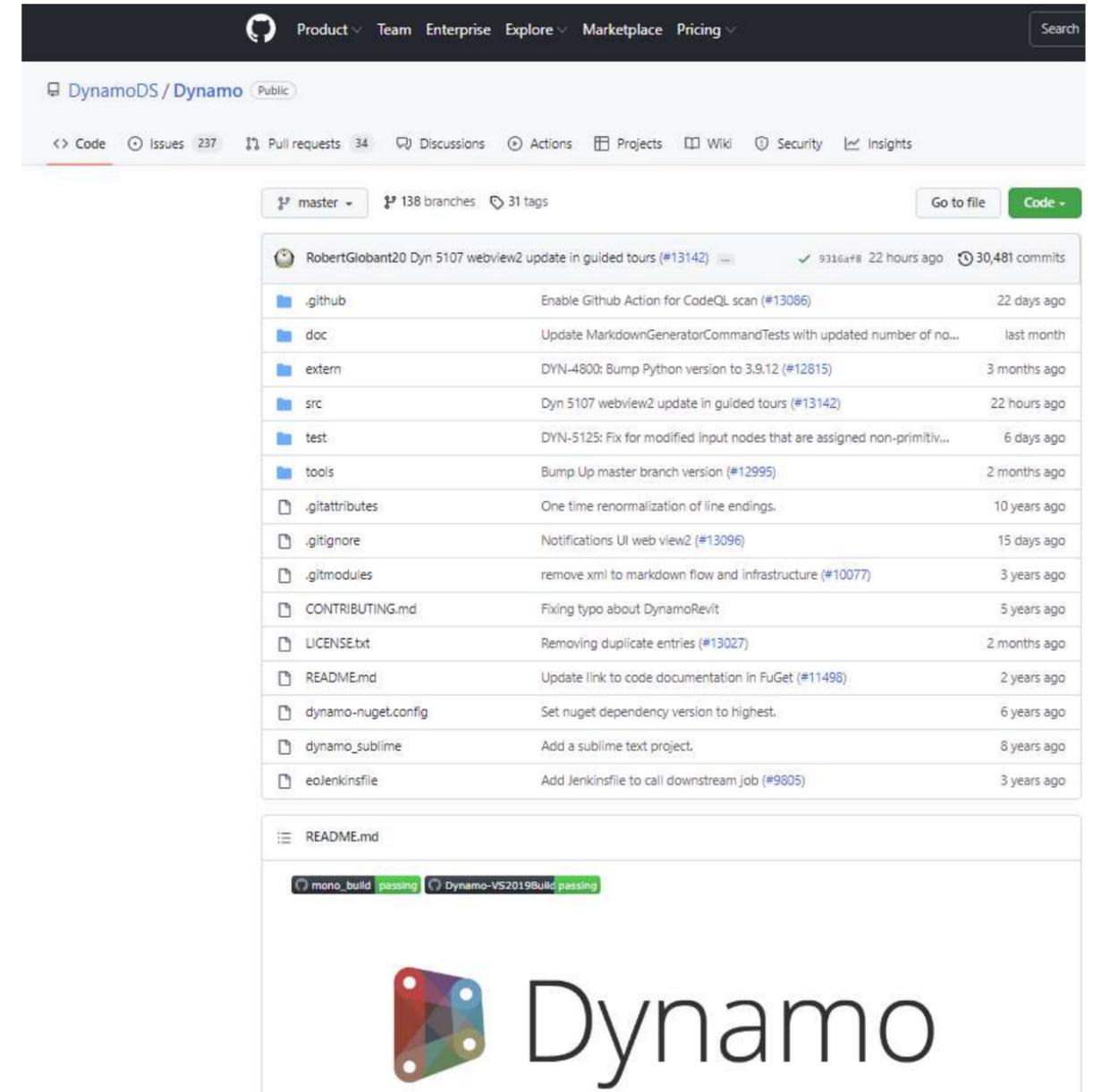
<https://about.gitlab.com/topics/version-control/what-is-git-version-control/>

# Solution

## Use Github – Dynamo has one too!



The screenshot shows the Dynamo website's home page. At the top is the Dynamo logo. Below it are four main sections: FILES, ASK, RECENT, and BACKUP. The FILES section includes 'New', 'Custom Node', and 'Open'. The ASK section includes 'Discussion forum' and 'Dynamo website'. The RECENT section is currently empty. The BACKUP section shows 'Backup location'. Below these is a 'REFERENCE' section with 'Getting Started', 'Dynamo Primer', 'Video Tutorials', and 'Dynamo Dictionary'. At the bottom is a 'CODE' section with 'Github repository' (highlighted in blue) and 'Send issues'.



The screenshot shows the GitHub repository for Dynamo. The repository name is 'DynamoDS / Dynamo' and it is public. It has 237 issues, 34 pull requests, and 31 tags. The current branch is 'master'. A commit by RobertGlobant20 is highlighted, titled 'Dyn 5107 webview2 update in guided tours (#13142)'. Below the commit is a list of files and folders with their commit dates:

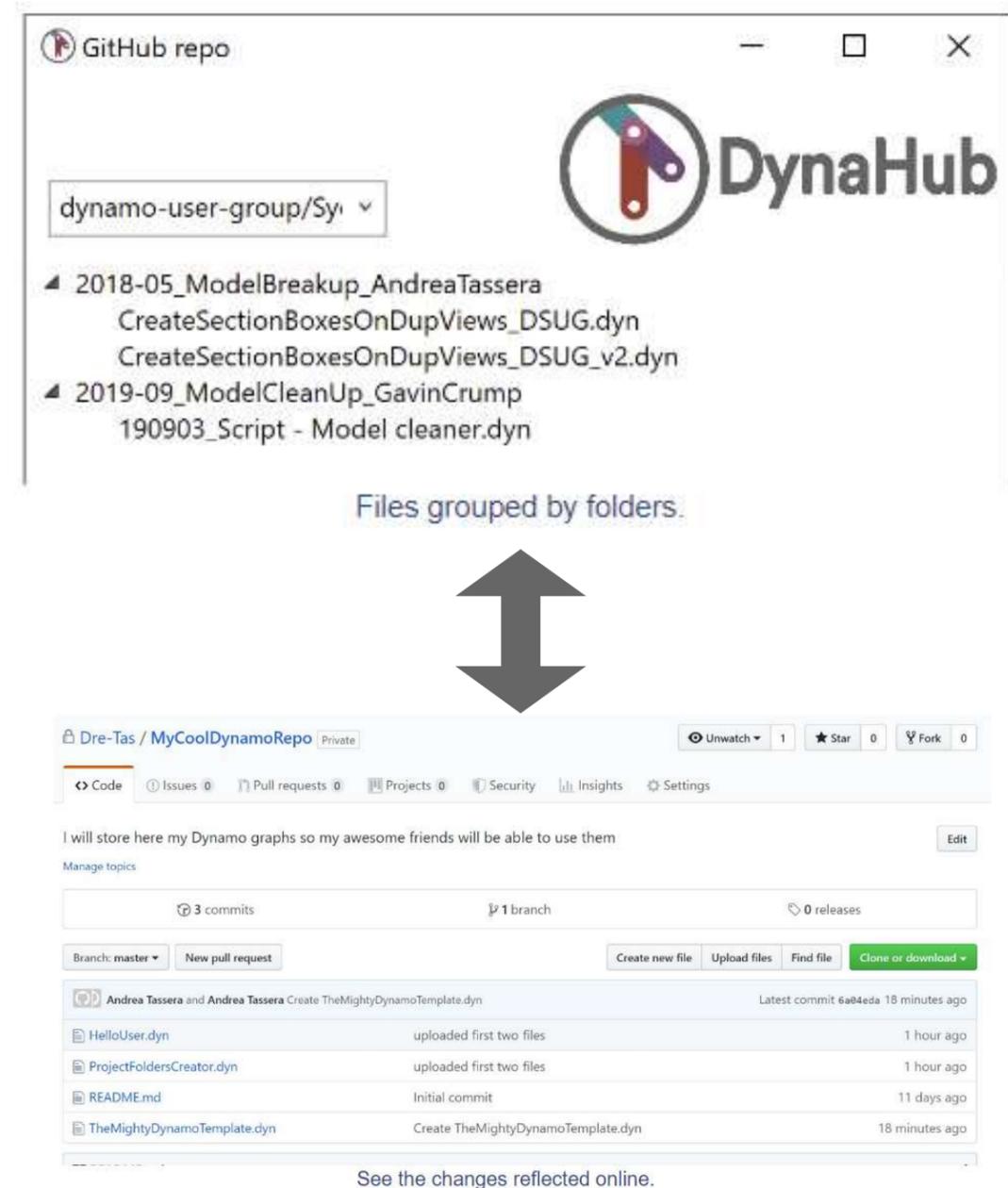
File/Folder	Commit Message	Commit Date
.github	Enable Github Action for CodeQL scan (#13086)	22 days ago
doc	Update MarkdownGeneratorCommandTests with updated number of no...	last month
extern	DYN-4800: Bump Python version to 3.9.12 (#12815)	3 months ago
src	Dyn 5107 webview2 update in guided tours (#13142)	22 hours ago
test	DYN-5125: Fix for modified input nodes that are assigned non-primtiv...	6 days ago
tools	Bump Up master branch version (#12995)	2 months ago
.gitattributes	One time renormalization of line endings.	10 years ago
.gitignore	Notifications UI web view2 (#13096)	15 days ago
.gitmodules	remove.xml to markdown flow and infrastructure (#10077)	3 years ago
CONTRIBUTING.md	Fixing typo about DynamoRevit.	5 years ago
LICENSE.txt	Removing duplicate entries (#13027)	2 months ago
README.md	Update link to code documentation in FuGet (#11498)	2 years ago
dynamo-nuget.config	Set nuget dependency version to highest.	6 years ago
dynamo_sublime	Add a sublime text project.	8 years ago
eojenkinsfile	Add Jenkinsfile to call downstream job (#9805)	3 years ago

Below the file list is the 'README.md' section, which shows two build status checks: 'mono\_build' and 'Dynamo-VS2019Build', both with a green 'passing' status. At the bottom of the README is the Dynamo logo.

# Protip

## Use a Package for Github with Dynamo Graph files

- There's an AU class for Dynahub!
- It's a great tool for connecting your graphs to Github
- <https://www.autodesk.com/autodesk-university/class/Dynamo-GitHub-DynaHub-Adopting-New-innovative-Repository-Dynamo-Content-2019#handout>
- Thanks Andrea Tassera!





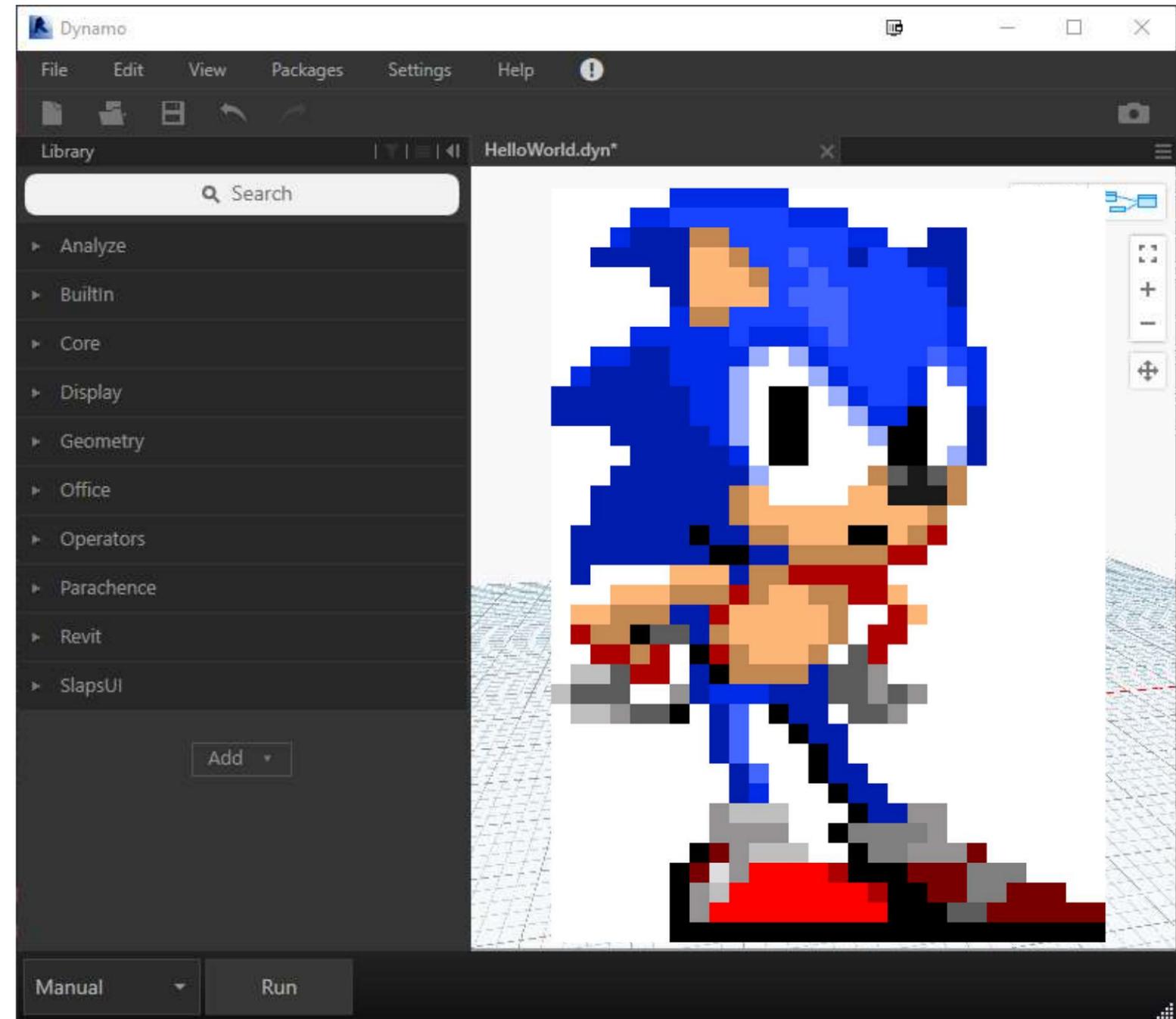
**#7**

What's taking so long?

# Problem

## Long Script Run Time

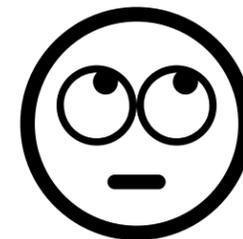
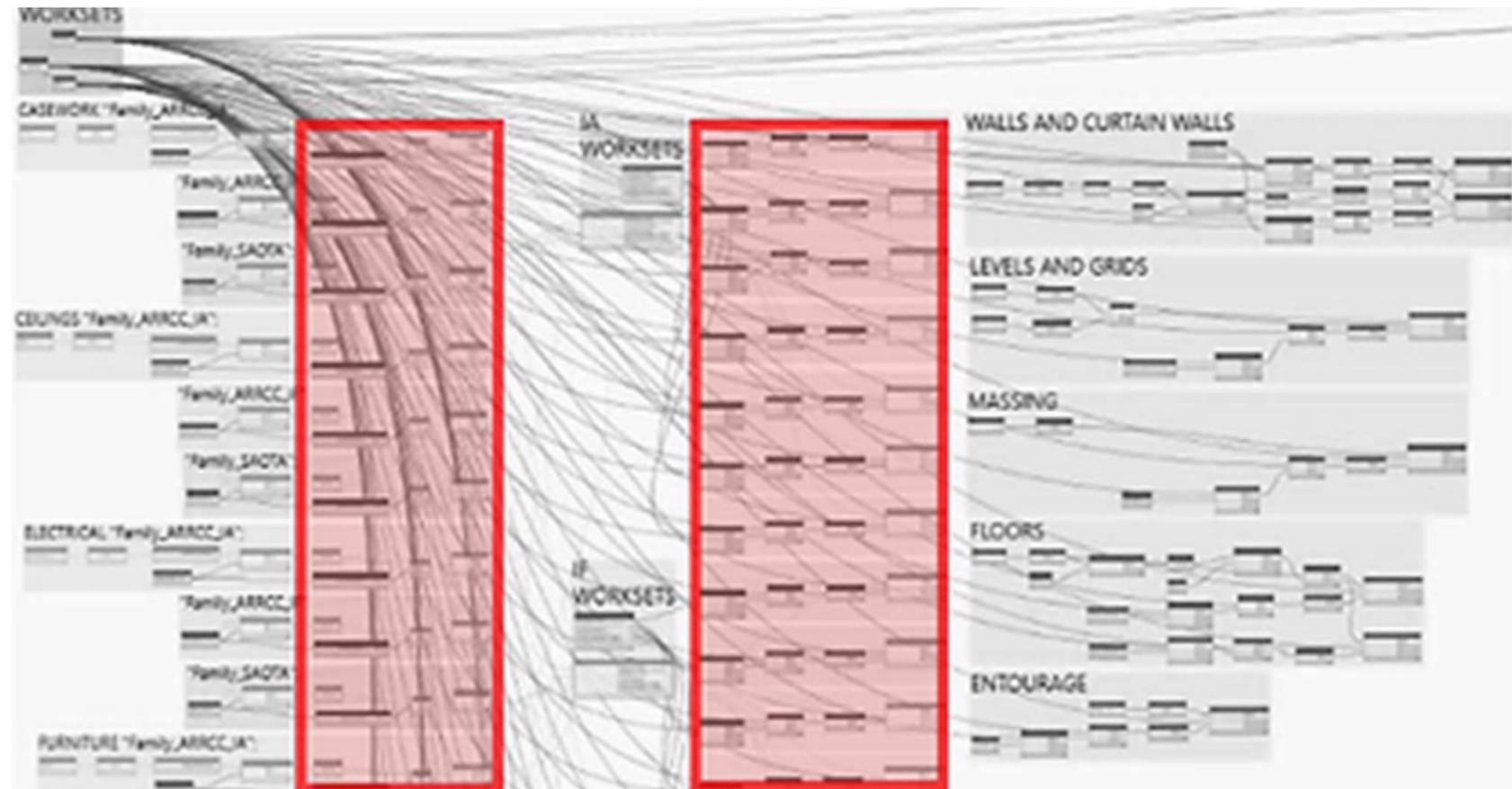
- Does it feel like your scripts run forever?
- Sometimes a script can take a minute to work but you have no idea how long it will take
- Maybe 30 minutes!
- That is likely not a coincidence



# Cause

## It's a monolith!

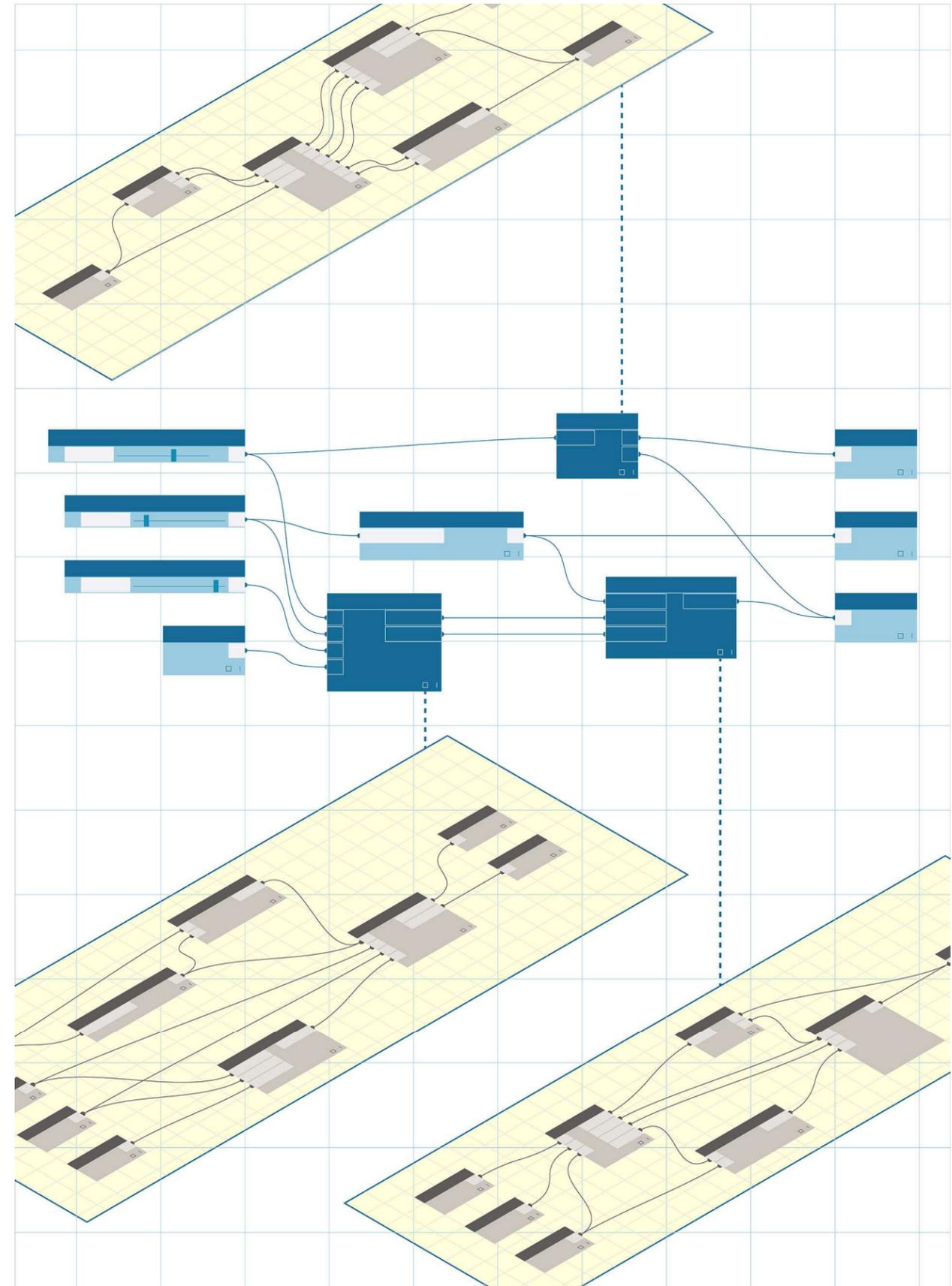
- Your Script is too long and complex
- Your Revit file is very big and takes time to process and add all the content you are applying
- Your computer is not fast enough to process the script adequately



# Solution

## Break it up

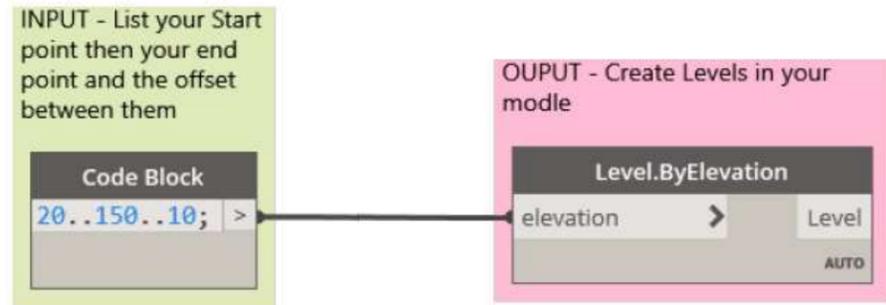
- Break up your script into smaller parts to run in different chunks
- It is good to refactor (make your code more efficient) and reduce complexity in your script
- A separate series of scripts can help check if different operations are running efficiently and isolating a problem to a given section instead of breaking or freezing the whole process
- You can even modularize a script section for more compact formatting



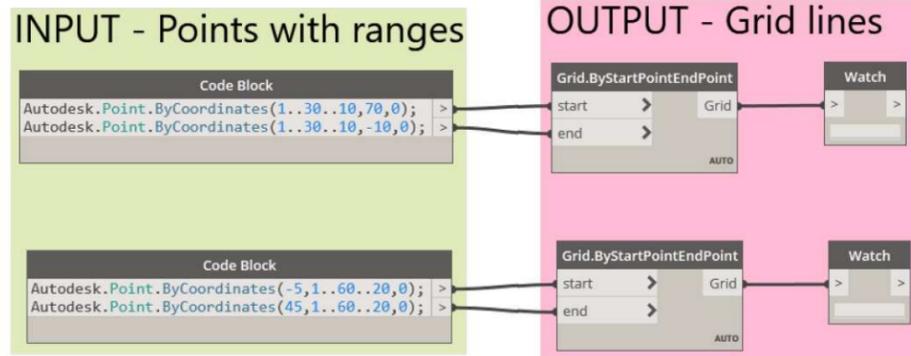
# Solution

Break it up into separate dedicated scripts – Example Below

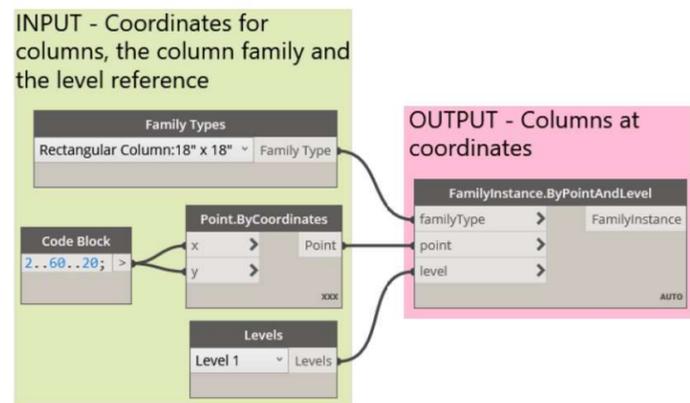
1



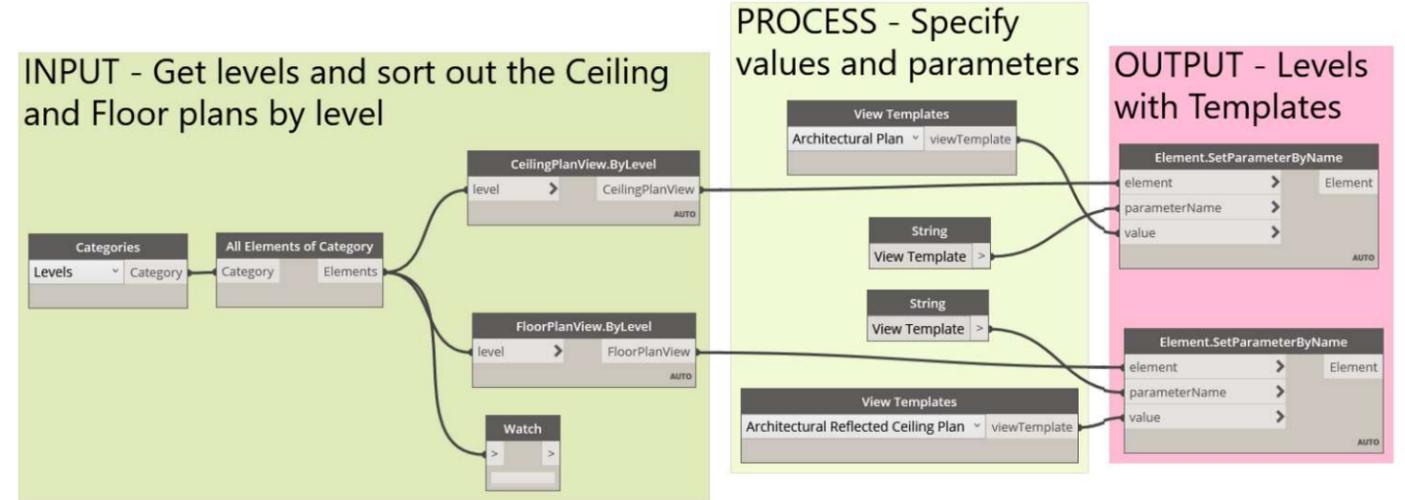
2



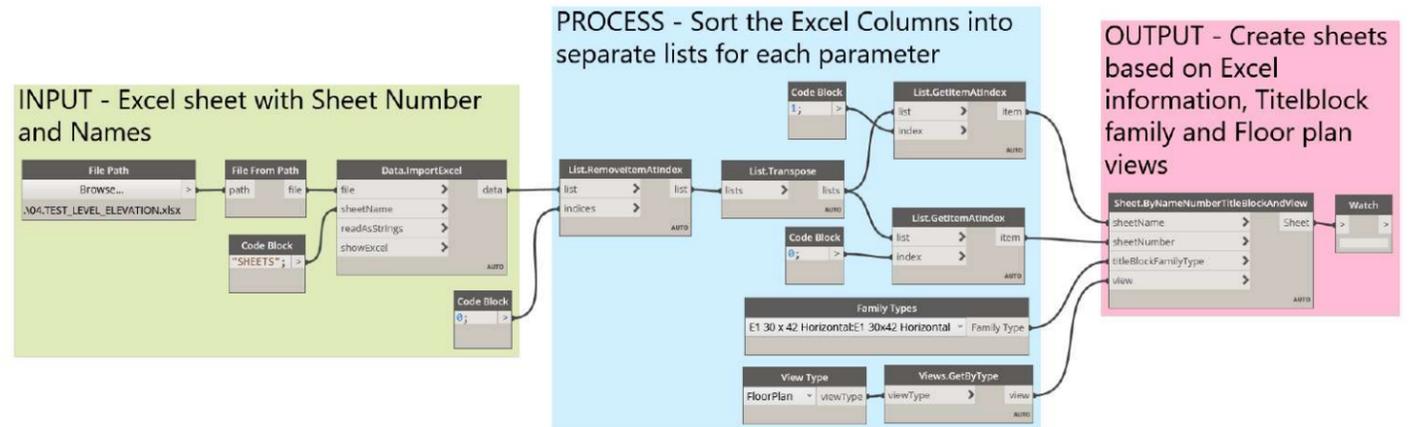
3



4



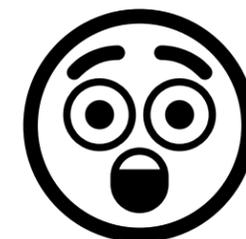
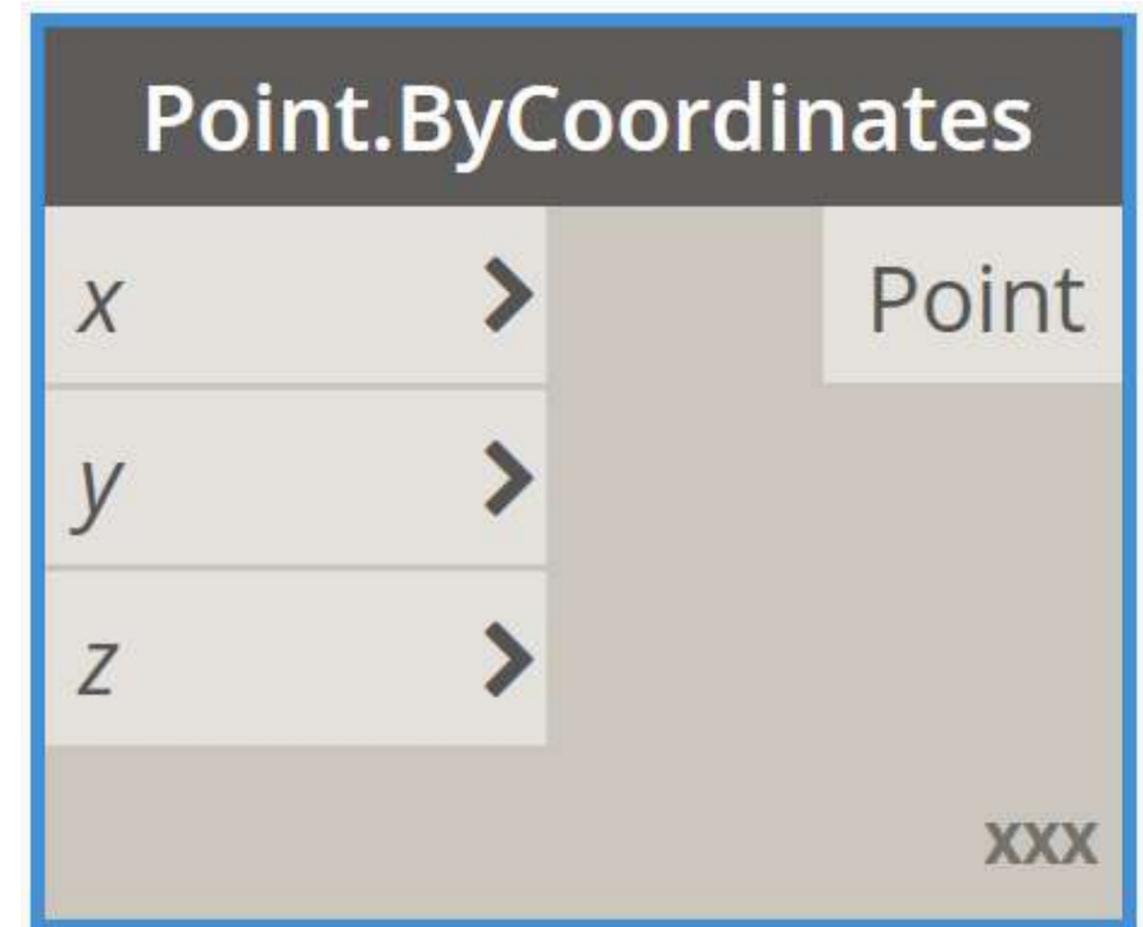
5



# Protip

## Be careful of lacing options

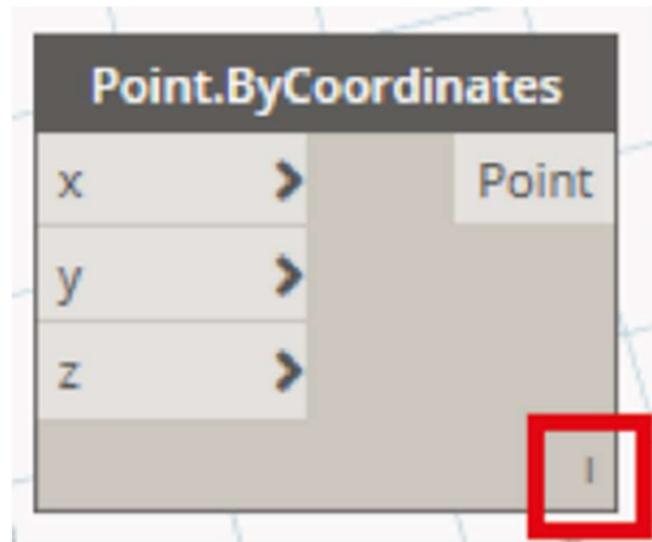
- The XXX cross product lacing option can get you into sticky situations
- It's basically maximum matching which is a lot of computational power
- Especially if you are writing Revit components via Dynamo
- Use the XXX wisely!



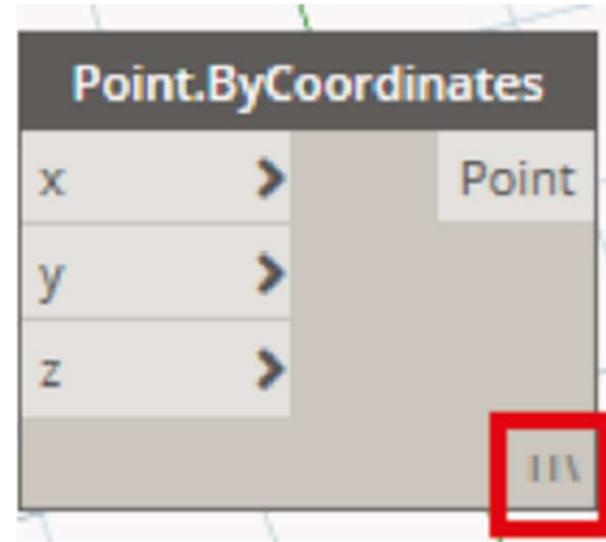
# Protip

## Review of Lacing results

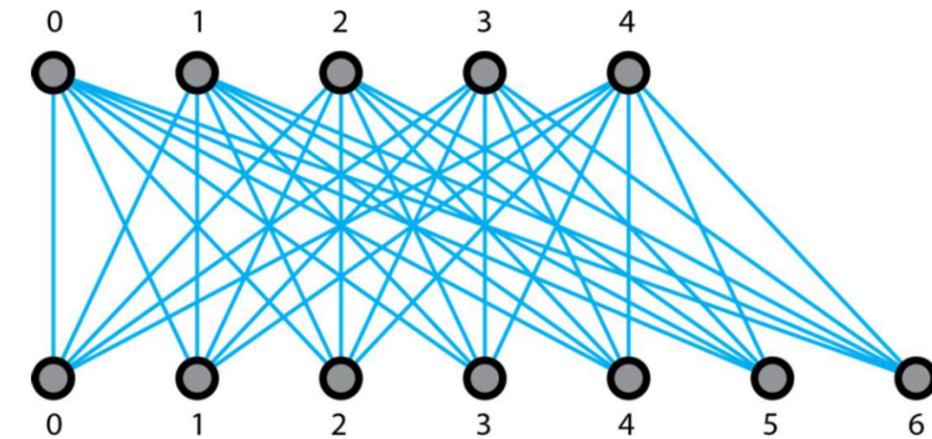
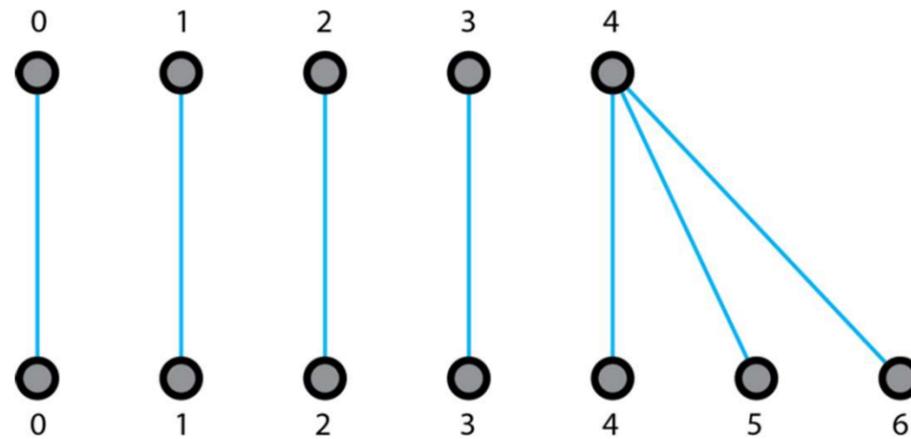
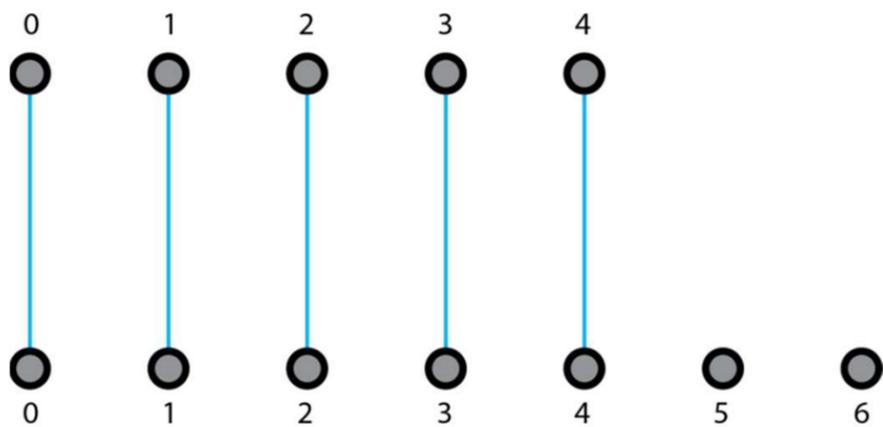
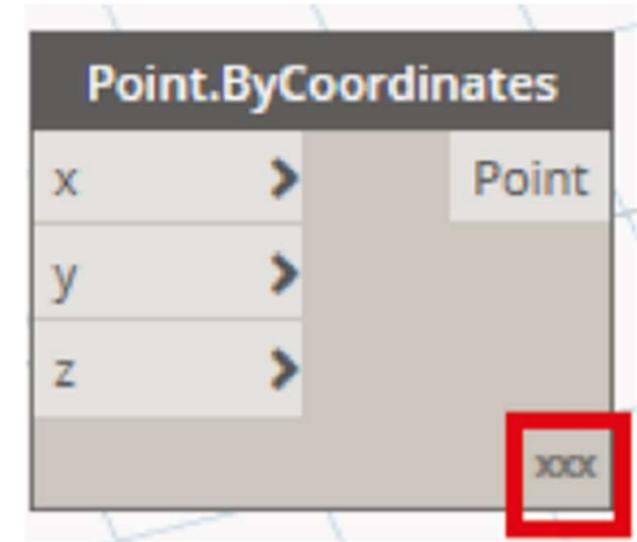
Shortest



Longest



Cross-Product



# Protip

If you want to do this more efficiently then consider the Python Nodes

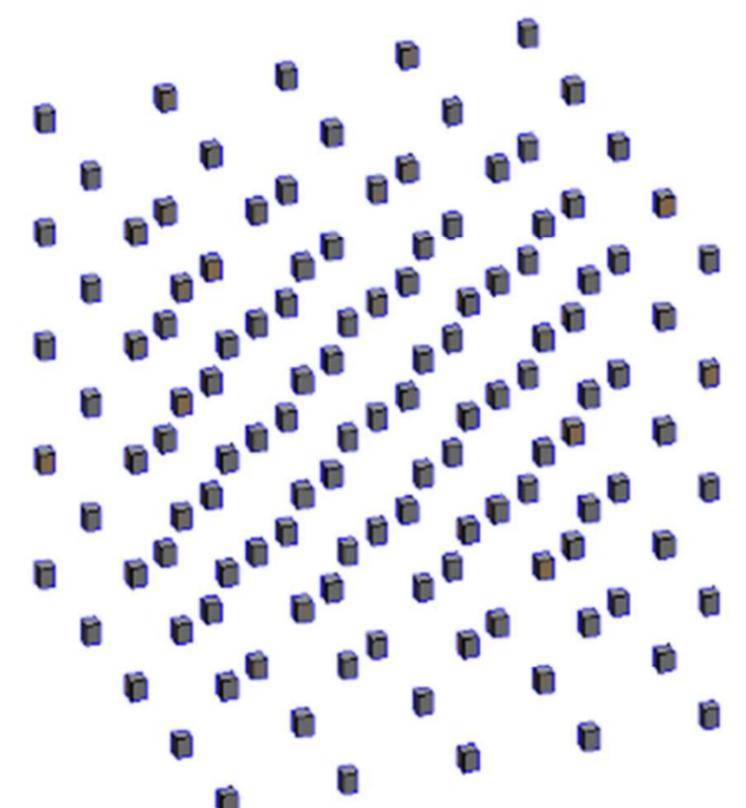
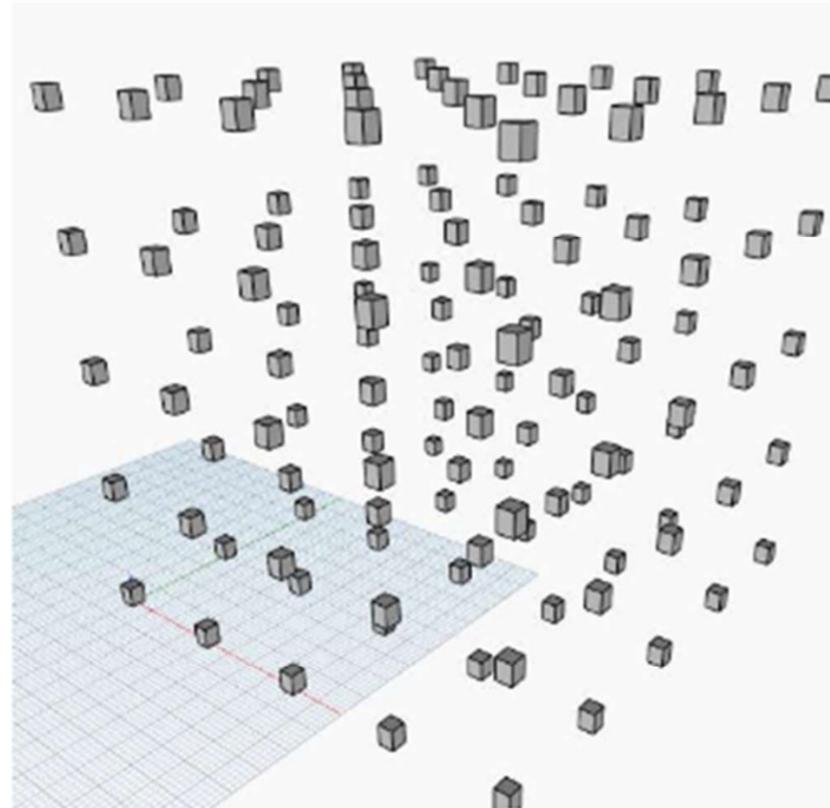
Python in Dynamo

Solids in Dynamo

Elements in Revit

PS - XYZ matrix Family PY

```
1 # Enable Python support and load DesignScript library
2 import clr
3 clr.AddReference('ProtoGeometry')
4 from Autodesk.DesignScript.Geometry import *
5 clr.AddReference('RevitNodes')
6 from Revit.Elements import *
7
8 famtype = IN[0]
9 pbc = Point.ByCoordinates(0,0,0)
10 output = []
11
12 for x in range(0, 100, 20):
13     for y in range(0, 100, 20):
14         for z in range(0, 100, 20):
15             pbc = Point.ByCoordinates(x,y,z)
16             col = FamilyInstance.ByPoint(famtype,pbc)
17             output.append(col)
18
19 OUT = output
```



<https://www.autodesk.com/autodesk-university/class/Exploring-Python-Nodes-Dynamo-2019#presentation>



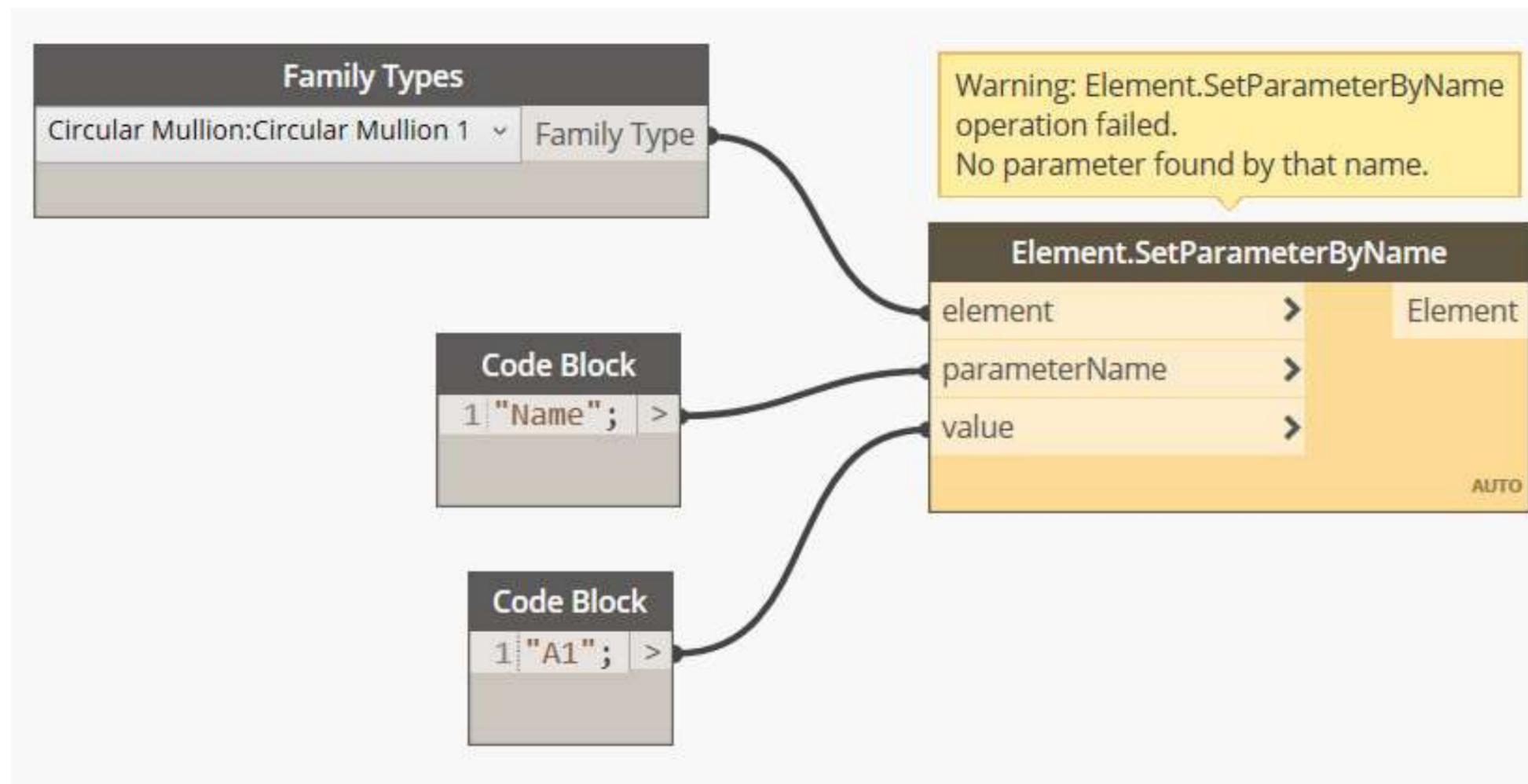
# #8

Input and outputs

# Problem

## Node data types and inputs not working

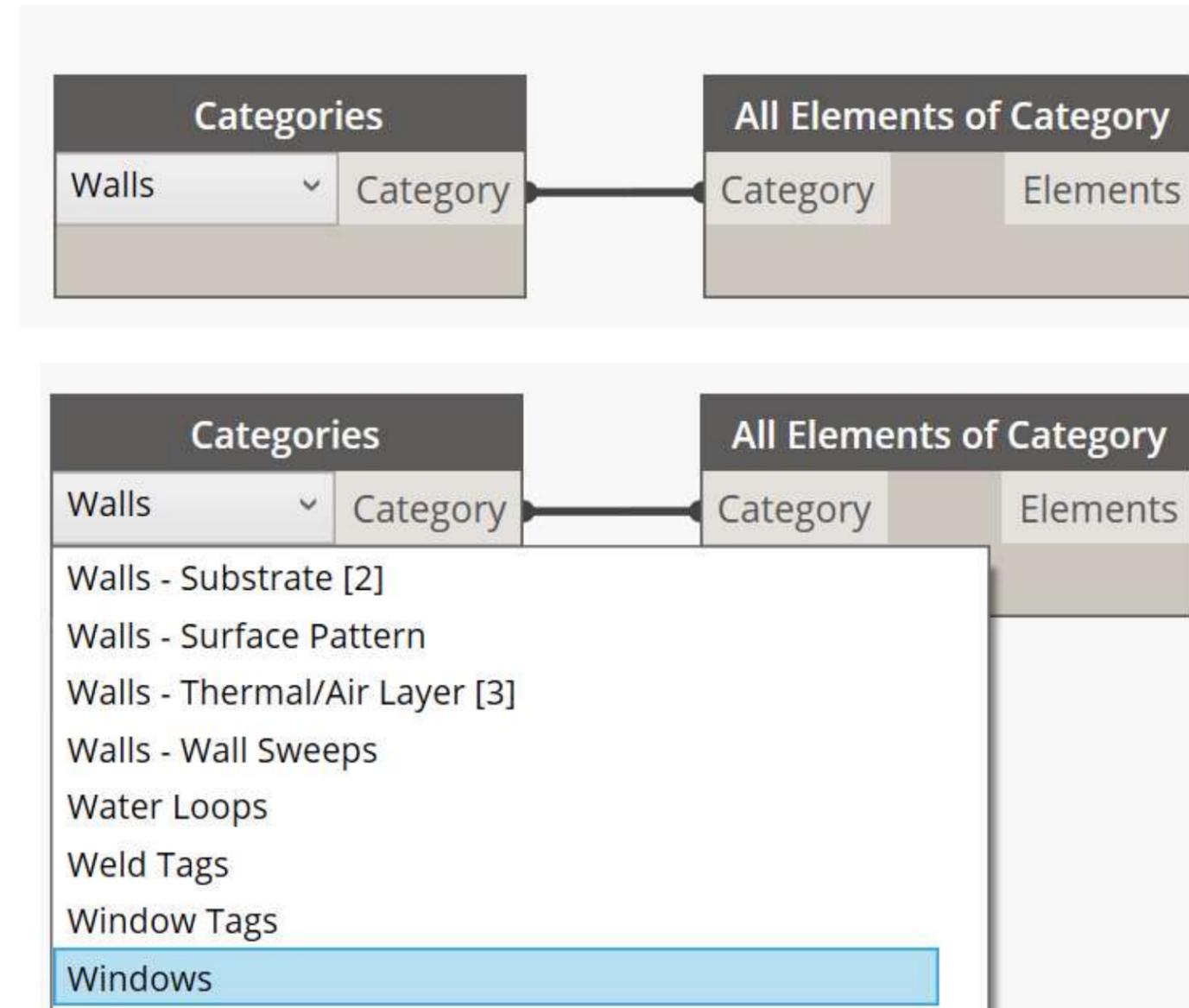
- Sometimes your nodes just won't run properly because the inputs won't work
- Usually means the inputs are incorrect



# Cause

## Nodes data type inputs not defined

- Sometimes the dropdown options you can use don't stay stable
- Categories node and other changeable nodes may default to the first item in the list from one user or session to another
- That often leads to errors in processing throughout a script since so much of our interaction with Revit is determined by categories in Dynamo



# Solution

Type in the information and hardcode where possible

- Hardcode the category in your script
- Usually only one category option should be selected like a Wall or a selection of walls for your script
- So use a 'category.ByName' node with a code block to maintain that relationship
- Find opportunities like this to control your scripts and avoid breaks

Categories can change



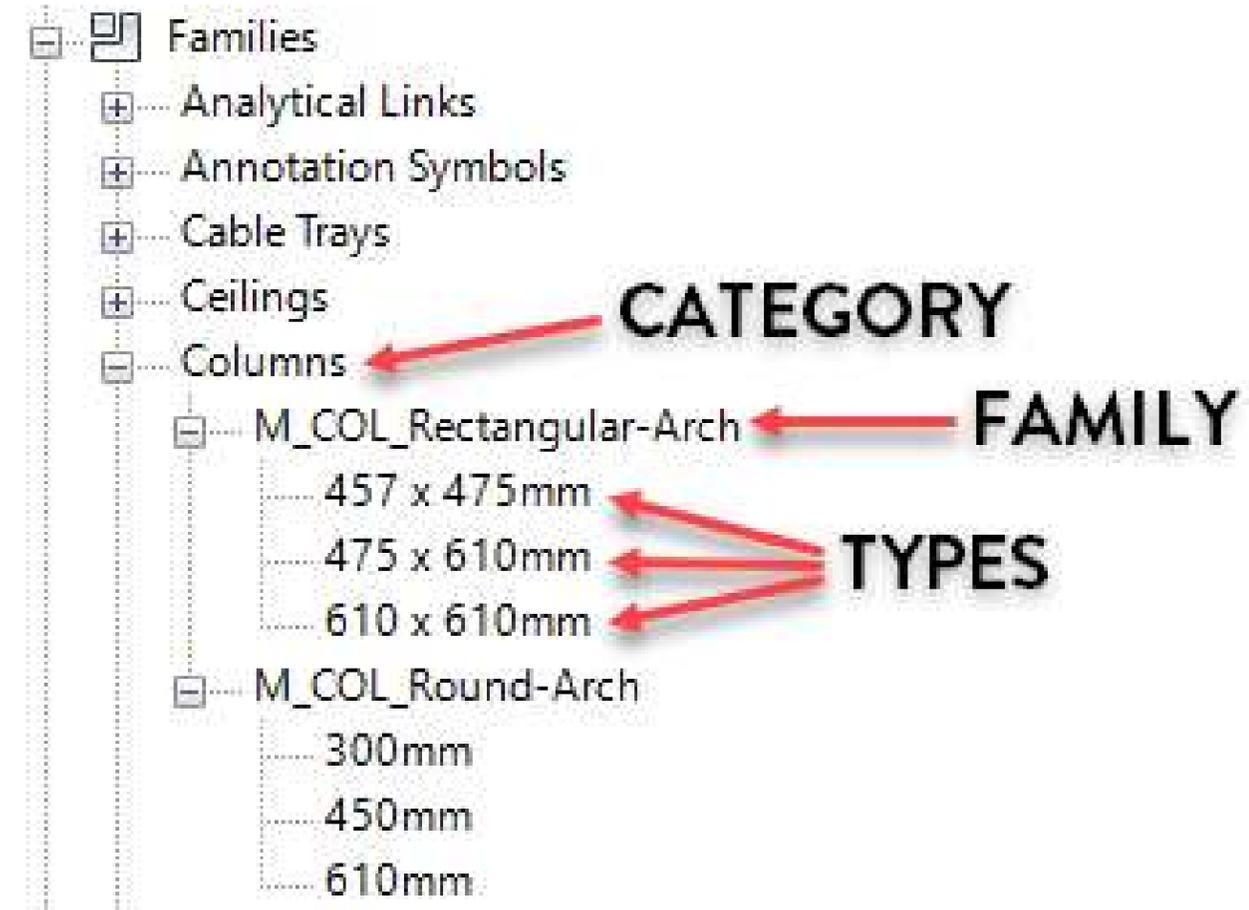
Categories will not change



# Protip

You can find out the string for the category pretty easily

- Look for the Category in your Revit model Browser
- Category dropdown shows you the strings for all the names you can use
- Same holds true for things like parameters drop down
- Plus a category list here - <https://forum.dynamobim.com/t/list-of-all-revit-categories/1732/9>



<https://revitpure.com/blog/13-tips-to-understand-and-organize-revit-families>



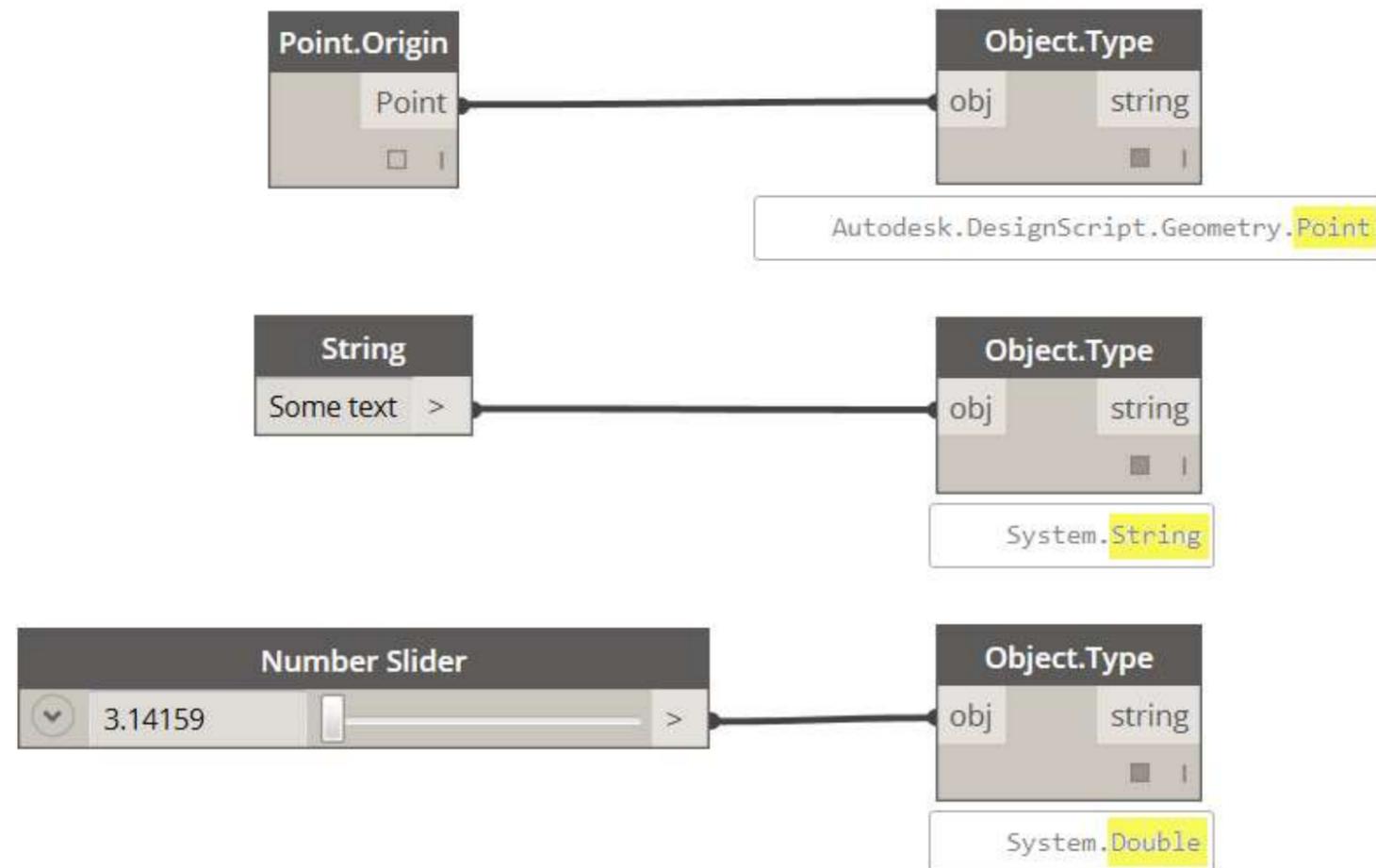
**#9**

Data Conversions

# Problem

Your nodes don't pass data to the next node

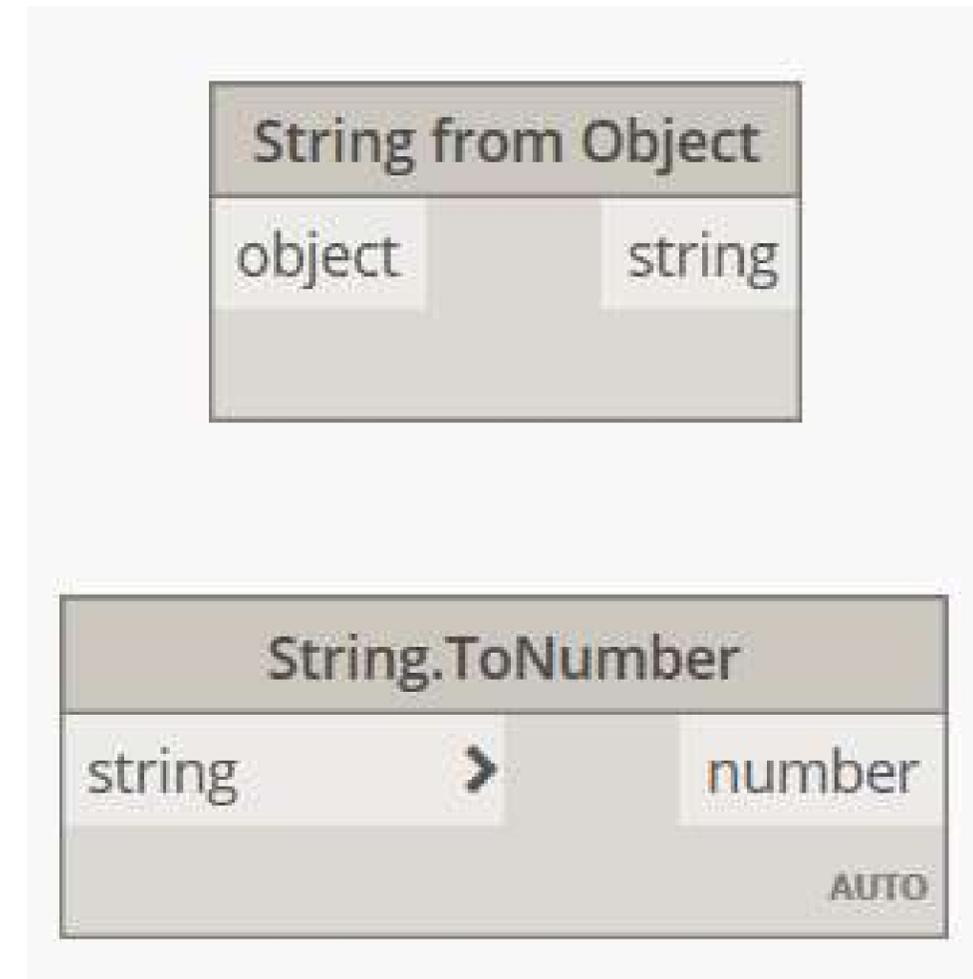
- There are a lot of data types in Dynamo
- Sometimes your scripts do not take into account a data type that needs to be converted to continue
- String to Integer
- Boolean vs Number
- Etc.



# Cause

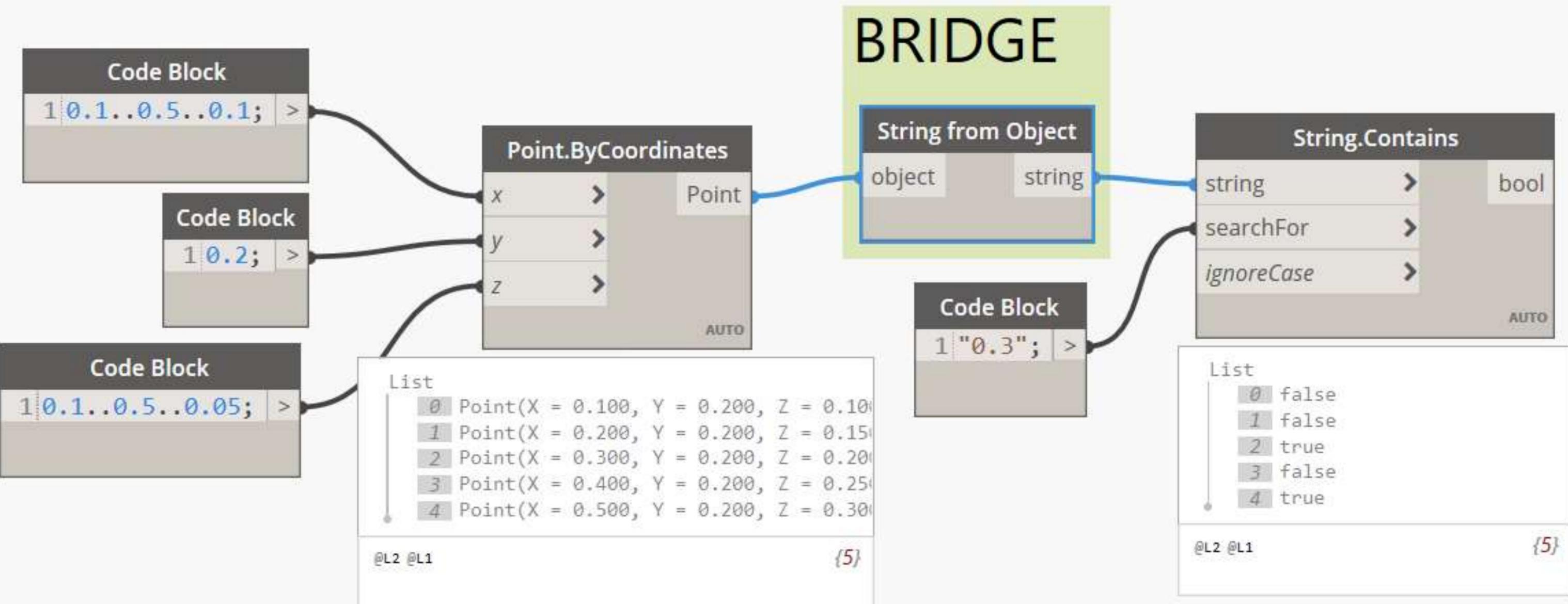
## Data types are not converted

- You need a bridge node to convert one datatype to another
- Dynamo has a lot of these nodes available
- String from Object is one example
- String to Number
- Or you can use custom solutions like designscript or python code to do the conversions



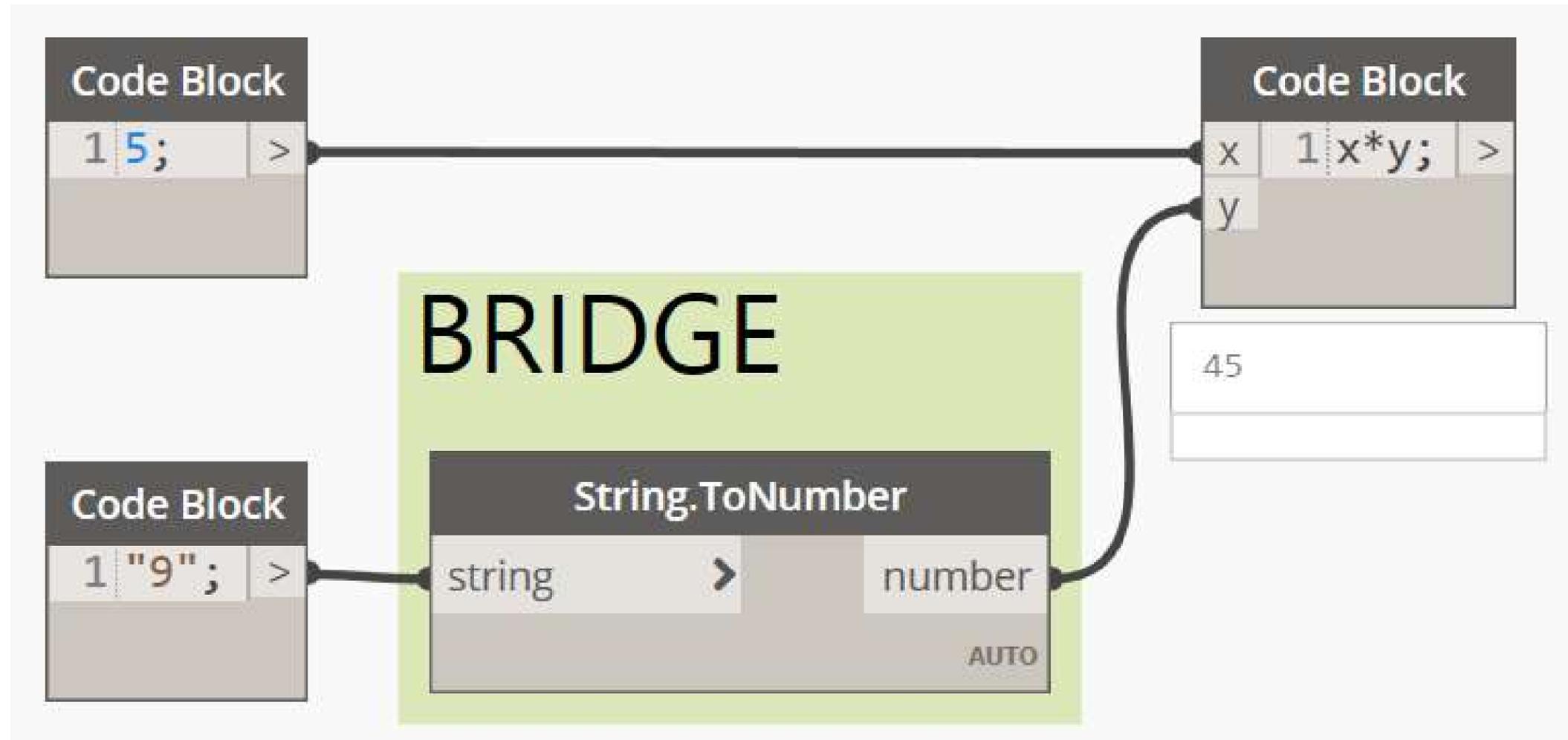
# Solution

## Convert Data Types with Bridge Nodes



# Solution

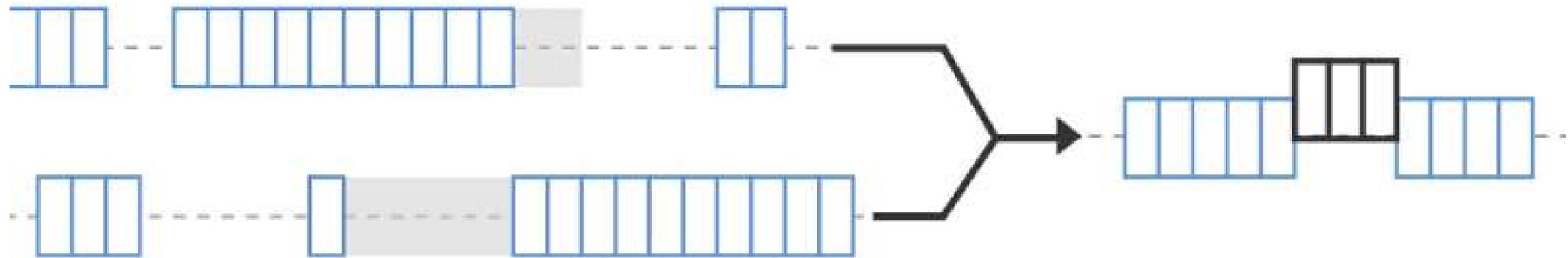
## Convert Data Types with Bridge Nodes



# Protip

## Review the fundamentals of data and lists

- Dynamo Primer has a good training on Data Types and Lists
- Data - [https://primer.dynamobim.org/04\\_The-Building-Blocks-of-Programs/4-1\\_data.html](https://primer.dynamobim.org/04_The-Building-Blocks-of-Programs/4-1_data.html)
- Lists - [https://primer.dynamobim.org/06\\_Designing-with-Lists/6\\_designing-with-lists.html](https://primer.dynamobim.org/06_Designing-with-Lists/6_designing-with-lists.html)



# Protip

## The never ending journey

- Review the datatypes
- Get comfortable with datatypes
- Get used to converting lists of datatypes
- Forever!





# #10

The last resort

# Problem

Everything is slow and things Crash

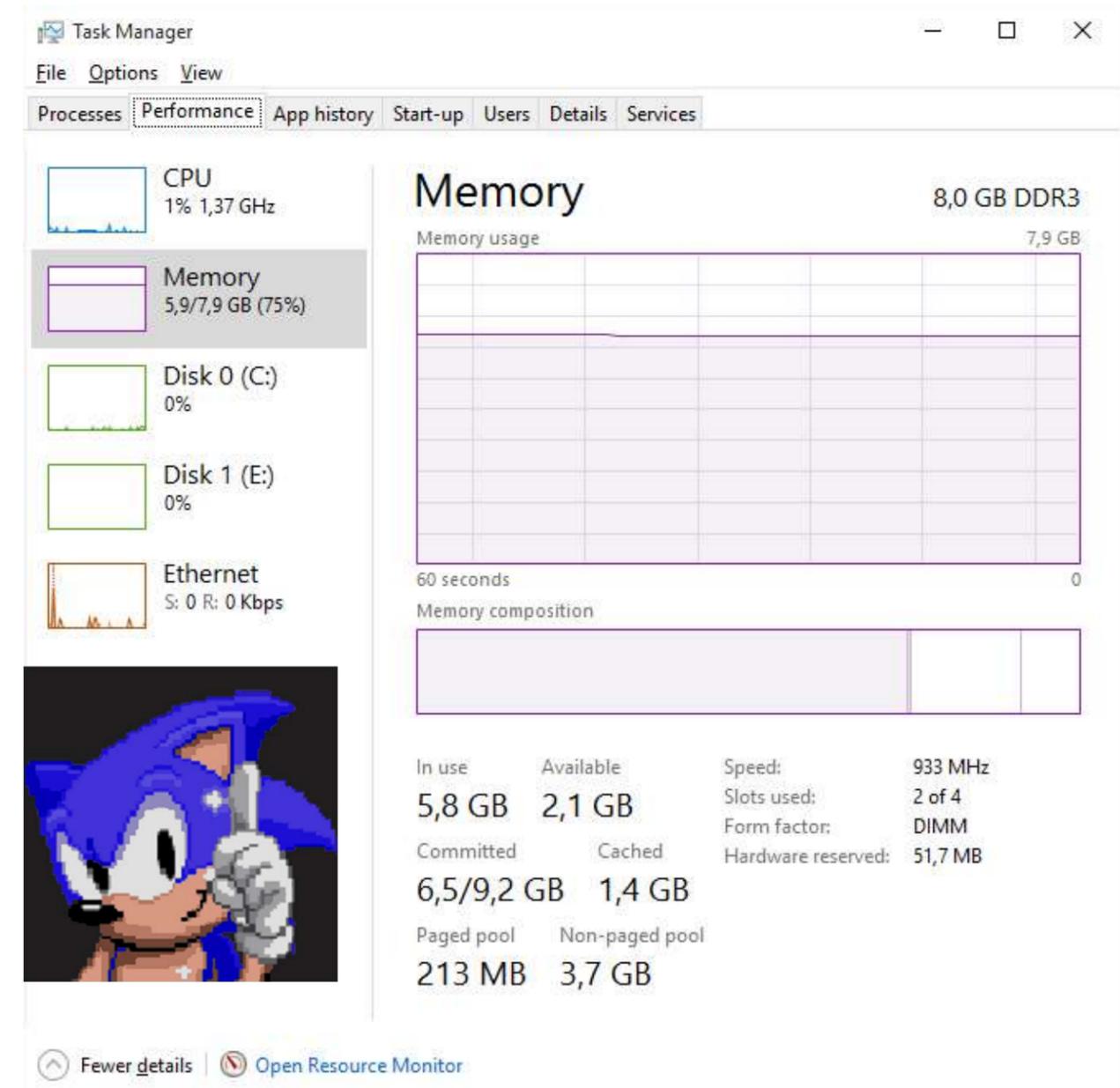
- The computer is running slow
- Things won't work
- You just keep fixing things and nothing seems to work



# Cause

???

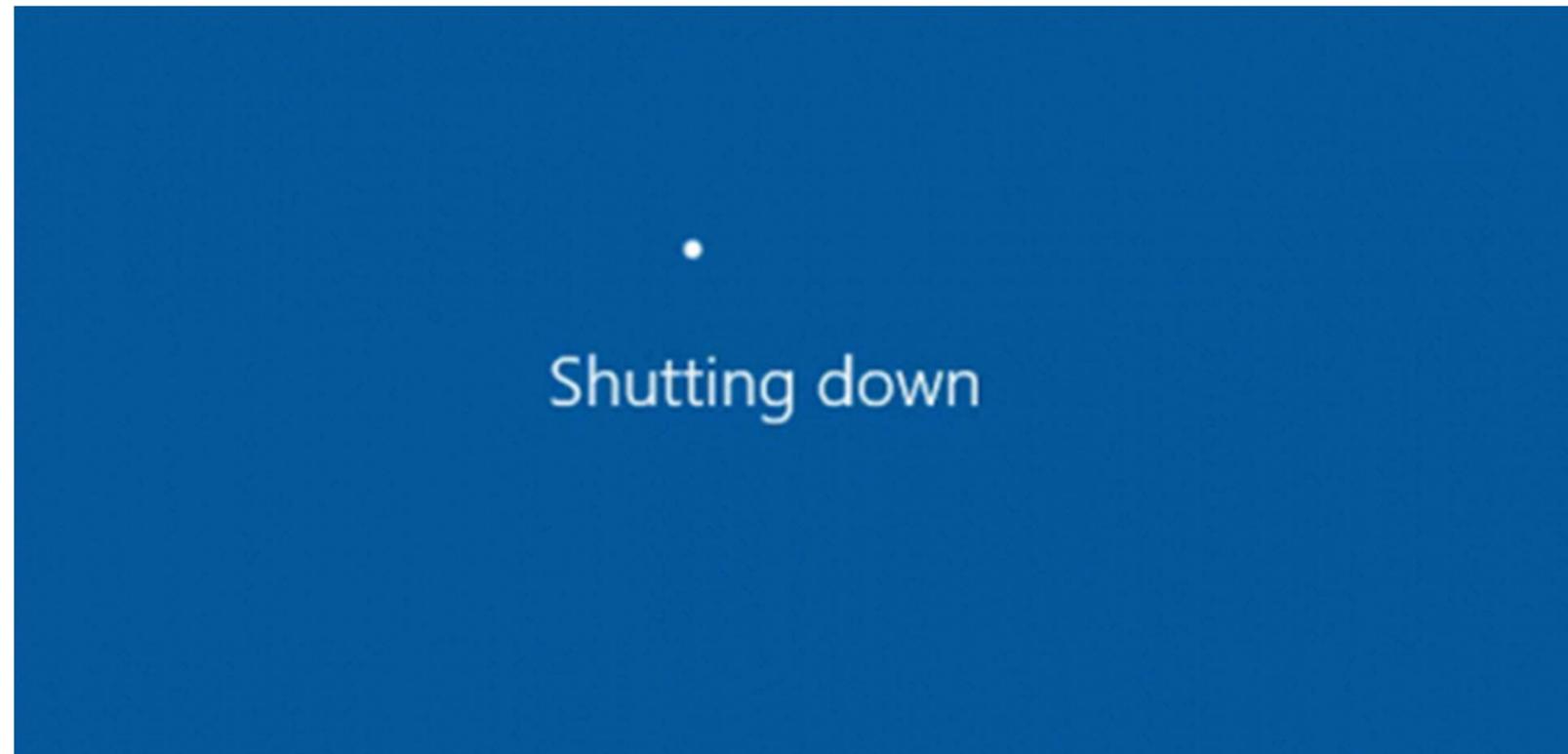
- Could be anything really...
- Leave your computer on long enough and a lot of weird things can happen
- Memory usage is usually the culprit
- Could be a Dynamo Reboot
- Could be a Revit Reboot
- Could be a Windows OS Reboot



# Solution

Sometimes you just need to flip the switch off

- Just Reboot





# PROBLEM SOLVING PROCESS

Keeping your head on straight

# TIP

## When in doubt, sketch it out

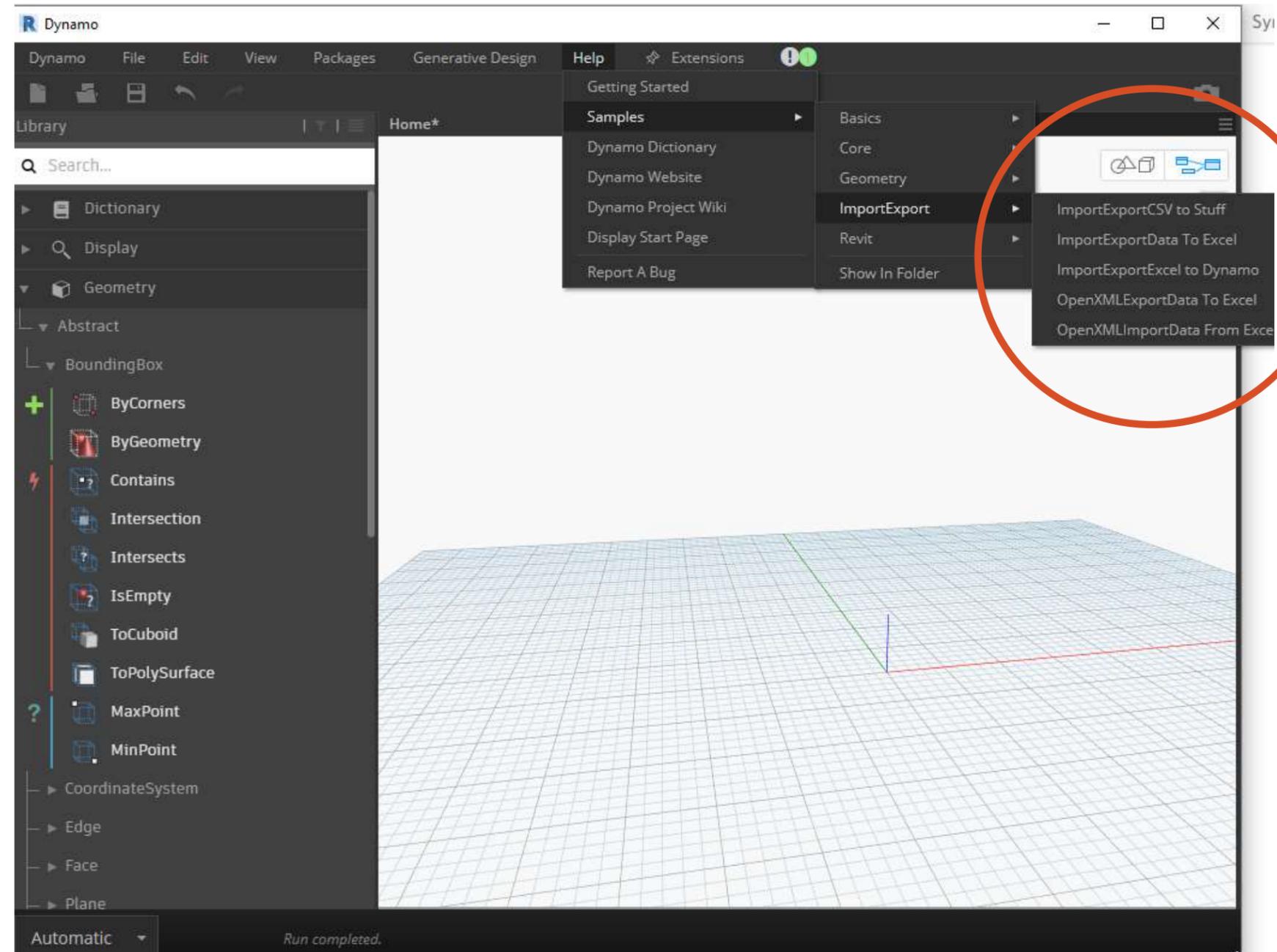
- If you hit a wall then write things down on a paper
- Or take a break
- Usually following the problem solving tips on a fundamental level helps a lot in figuring out your bugs



# TIP

## Use the help files

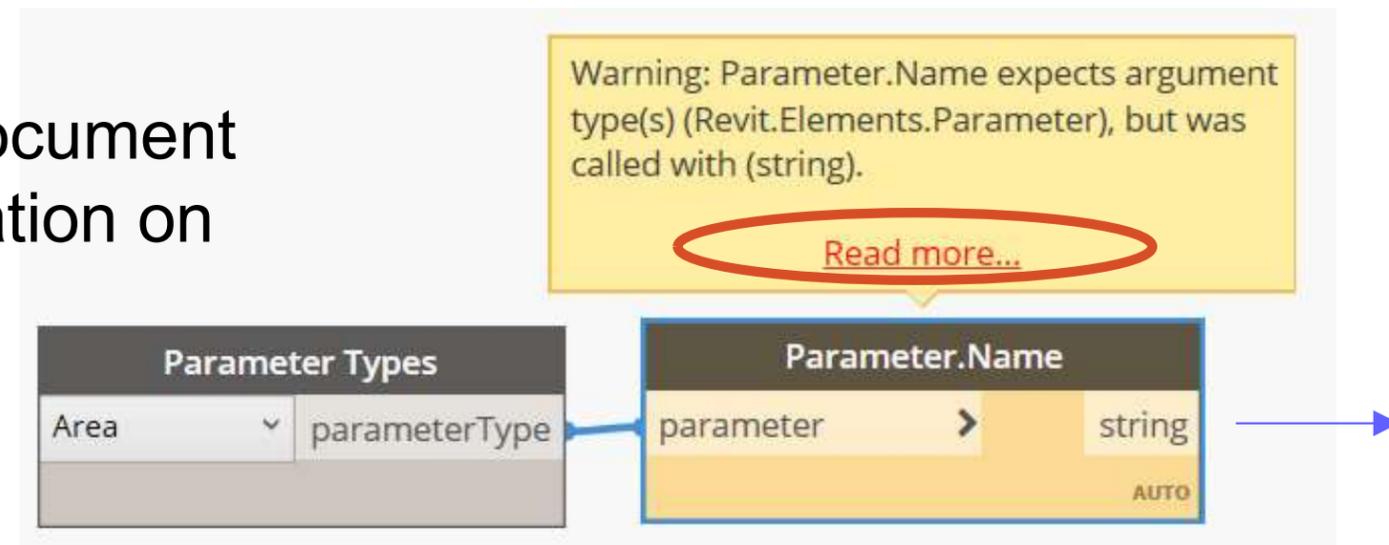
- Dynamo is very helpful!
- Samples Scripts
- Help > Samples > Script Category



# TIP

## Use the help files

- Context Menu
- You can hover over the warning and see a link
- That link can open the document browser for more information on your issue



Documentation Browser

### Expects argument type(s), but was called with

This error message indicates that the node you are using is expecting a certain type of input(s) but has received a type of input it cannot use. It is typically followed by additional information regarding what types were passed into the node you are using and what types the node expected to receive. Some of the most common operations that trigger this error are:

- `Element.SetParameterByName` - try using use the node `Element.Parameters` to check the parameters in the element. Read more [posts on the Dynamobim forum discussing "expects argument type setparameter"](#).
- `Geometry.BoundingBox` - try using `Element.BoundingBox` instead, as discussed [here](#). Read more [posts on the Dynamobim forum discussing "expects argument type geometry"](#).

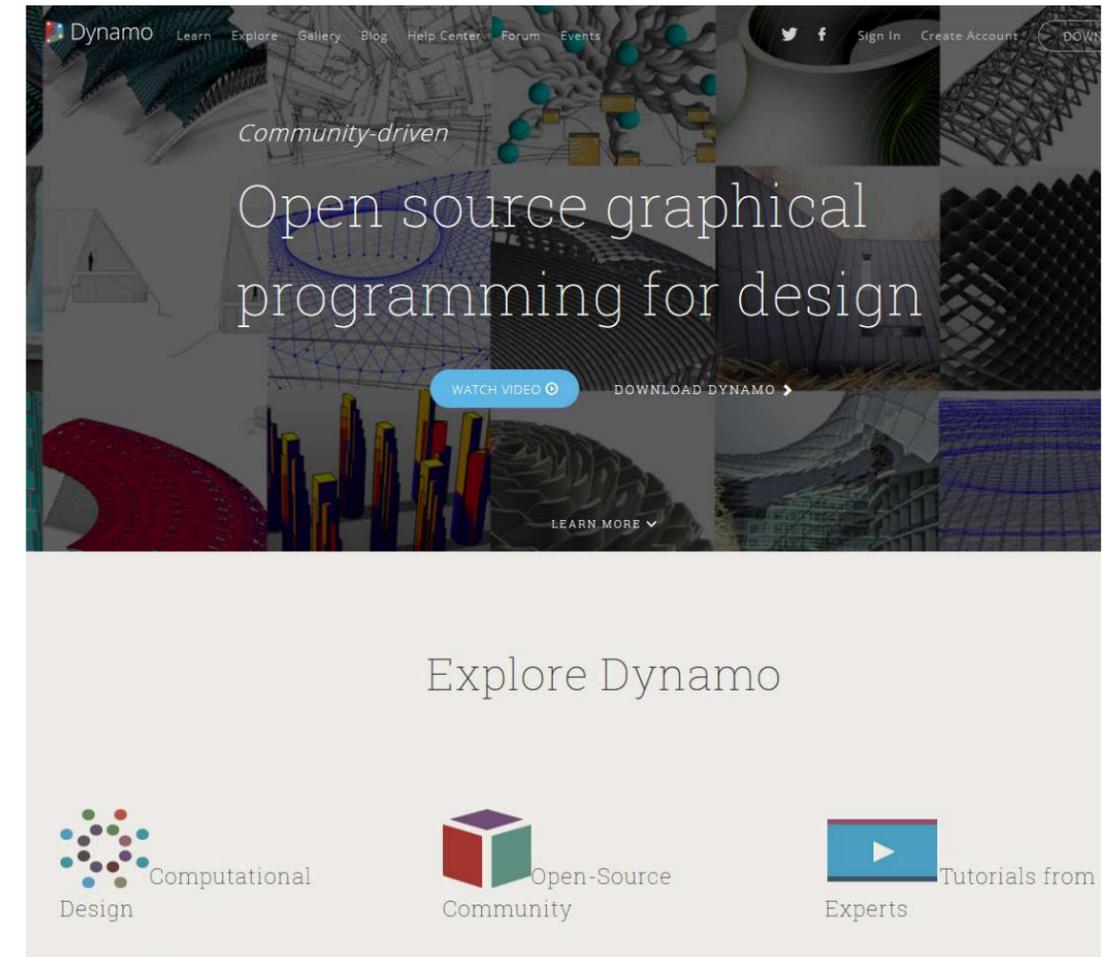
#### How to fix

The section above mentions some approaches you can take to recover from this error. In general, check what input types the node you are using expects. If possible, change the inputs passed into the node to their expected types or check to see if other nodes can be used to achieve the functionality you want. Note that input types can be checked using the [Object.Type](#) node.

# TIP

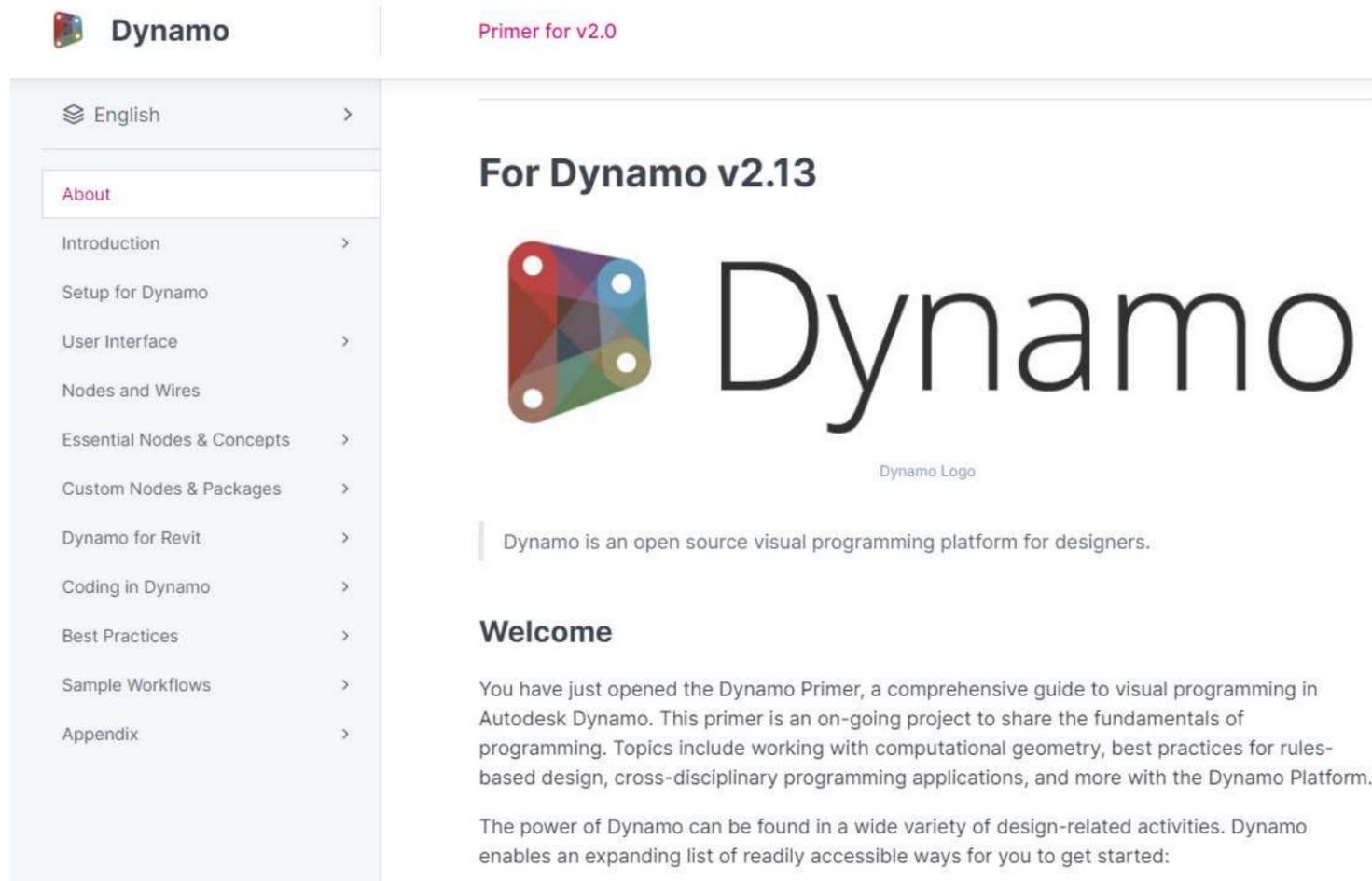
## Read the Primer

- If you are new to Dynamo or need a refresher then check out the official Primer
- Contains fundamentals and great examples
- Plus best practices and recommended methods to solve common workflow issues



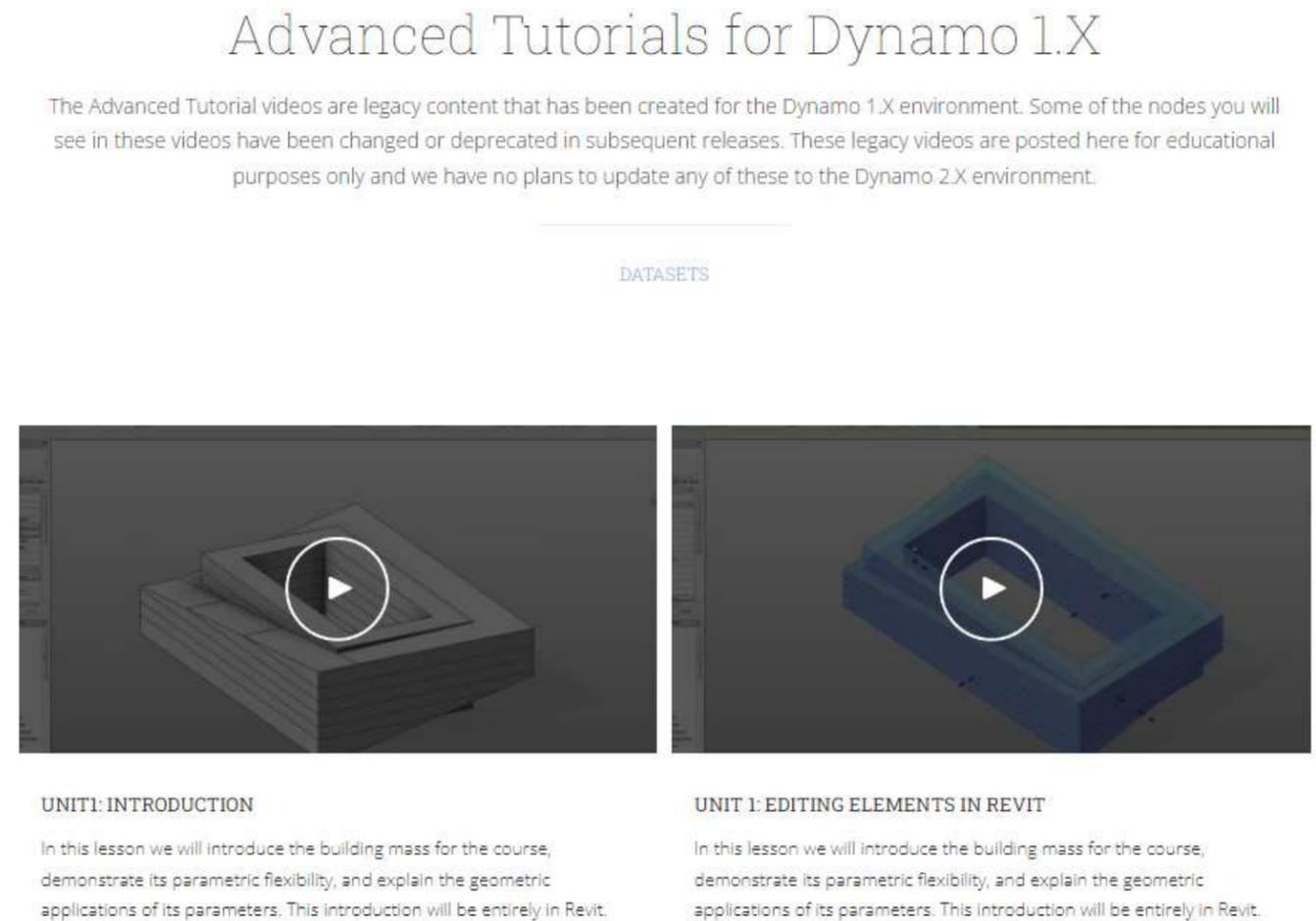
# TIP

There are is a new Primer and Videos by Dynamo Team, Check it out



The screenshot shows the Dynamo website interface. On the left is a navigation menu with the following items: English, About (highlighted), Introduction, Setup for Dynamo, User Interface, Nodes and Wires, Essential Nodes & Concepts, Custom Nodes & Packages, Dynamo for Revit, Coding in Dynamo, Best Practices, Sample Workflows, and Appendix. The main content area is titled "Primer for v2.0" and "For Dynamo v2.13". It features the Dynamo logo, which is a colorful geometric shape, and the word "Dynamo" in a large, sans-serif font. Below the logo, it says "Dynamo is an open source visual programming platform for designers." and "Welcome". The text continues: "You have just opened the Dynamo Primer, a comprehensive guide to visual programming in Autodesk Dynamo. 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 applications, and more with the Dynamo Platform." and "The power of Dynamo can be found in a wide variety of design-related activities. Dynamo enables an expanding list of readily accessible ways for you to get started:".

<https://primer2.dynamobim.org/>



The screenshot shows the "Advanced Tutorials for Dynamo 1.X" page. The title is "Advanced Tutorials for Dynamo 1.X". Below the title, there is a paragraph: "The Advanced Tutorial videos are legacy content that has been created for the Dynamo 1.X environment. Some of the nodes you will see in these videos have been changed or deprecated in subsequent releases. These legacy videos are posted here for educational purposes only and we have no plans to update any of these to the Dynamo 2.X environment." Below this text is a "DATASETS" section with two video thumbnails. The first thumbnail is titled "UNIT1: INTRODUCTION" and shows a 3D model of a building mass with a play button overlay. The second thumbnail is titled "UNIT 1: EDITING ELEMENTS IN REVIT" and shows a 3D model of a building mass with a play button overlay. Below each thumbnail is a short description of the video content.

<https://dynamobim.org/#videoTut>

# TIP

## Google it

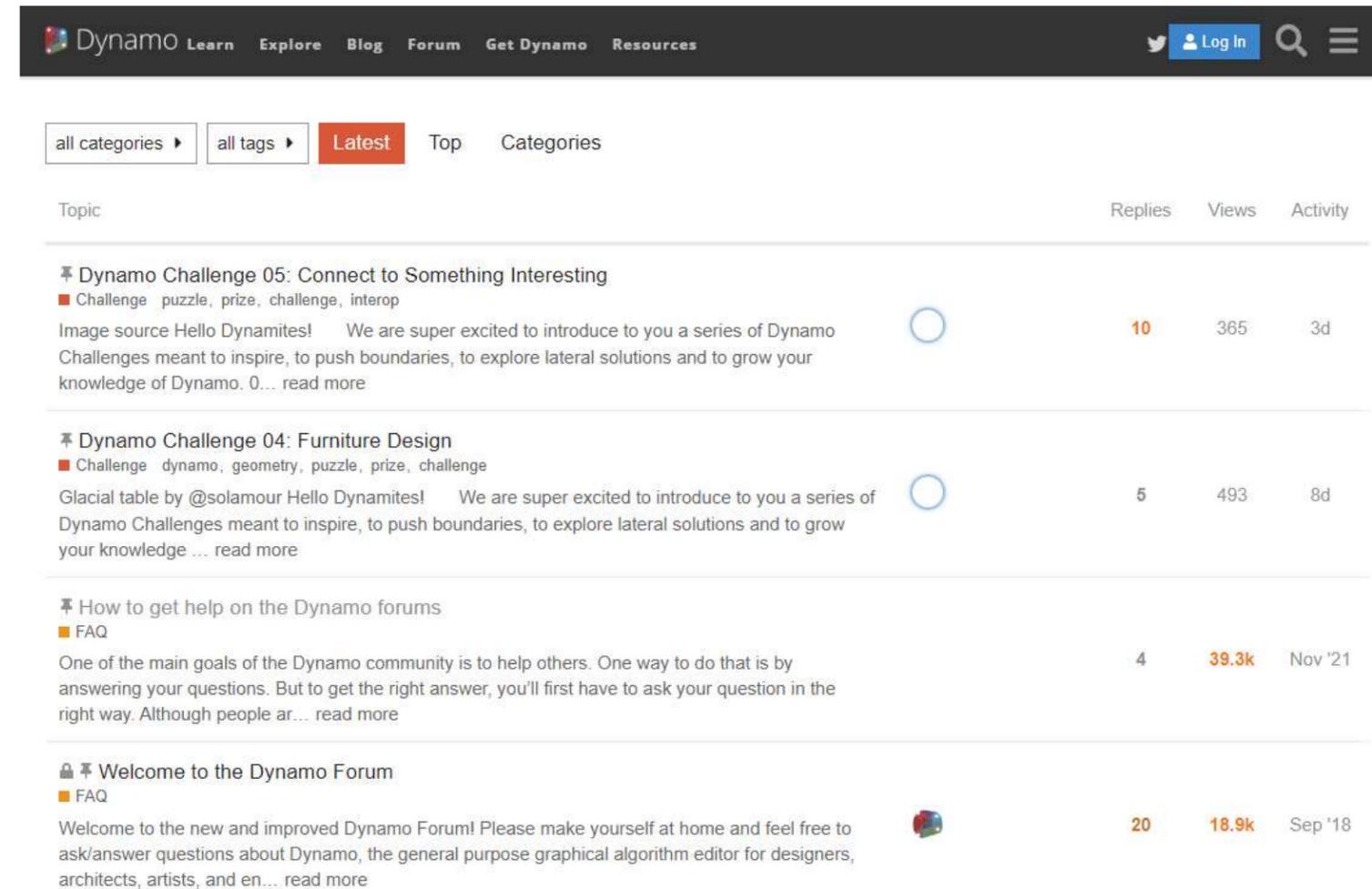
- Just ask the internet!
- It works like a charm
- Use search terms that are specific and can be extracted from your errors and warnings so you get good results
- “Revit Dynamo point conversion to number error” > “Dynamo Problem”



# TIP

## Ask for help on the forum

- Forum.dynamobim.org
- Lots of resources there
- Just do some research yourself first then go on there and ask for more support



The screenshot shows the Dynamo forum interface. At the top, there is a navigation bar with links for Learn, Explore, Blog, Forum, Get Dynamo, and Resources. A 'Log In' button and search icons are also present. Below the navigation bar, there are filters for 'all categories', 'all tags', and a 'Latest' button. The main content area displays a list of forum topics with columns for Topic, Replies, Views, and Activity. The topics listed are:

Topic	Replies	Views	Activity
<b>Dynamo Challenge 05: Connect to Something Interesting</b> Challenge puzzle, prize, challenge, interop Image source Hello Dynamites! We are super excited to introduce to you a series of Dynamo Challenges meant to inspire, to push boundaries, to explore lateral solutions and to grow your knowledge of Dynamo. 0... read more	10	365	3d
<b>Dynamo Challenge 04: Furniture Design</b> Challenge dynamo, geometry, puzzle, prize, challenge Glacial table by @solamour Hello Dynamites! We are super excited to introduce to you a series of Dynamo Challenges meant to inspire, to push boundaries, to explore lateral solutions and to grow your knowledge ... read more	5	493	8d
<b>How to get help on the Dynamo forums</b> FAQ One of the main goals of the Dynamo community is to help others. One way to do that is by answering your questions. But to get the right answer, you'll first have to ask your question in the right way. Although people ar... read more	4	39.3k	Nov '21
<b>Welcome to the Dynamo Forum</b> FAQ Welcome to the new and improved Dynamo Forum! Please make yourself at home and feel free to ask/answer questions about Dynamo, the general purpose graphical algorithm editor for designers, architects, artists, and en... read more	20	18.9k	Sep '18



# Dynamo

# TIP

## Expert Elite Community

- <https://knowledge.autodesk.com/community/groups#/overview?search=dynamo>
- Check out their groups and join in on their sessions

A screenshot of the Autodesk Knowledge Network website. The search bar at the top contains the word 'dynamo'. Below the search bar is a world map with several location pins. Below the map is a table of search results for 'dynamo' groups.

Group Name	Products	Connect
▶ 505 BIM User's Group Albuquerque, NM, USA		<a href="#">Visit group page</a>
▶ AEC Technology Collaborative LinkedIn Group		<a href="#">Visit group page</a>



# RECAP AND REVIEW

What we learned today

# THE 10

Here they are again

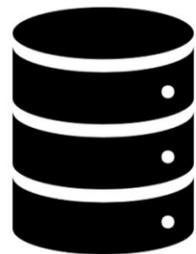
1. Revit Software Changes
2. Dynamo Software Updates
3. Custom Package Dependencies Missing
4. DLL files are not available
5. Your scripts are a mess and need standardization
6. No version control tracking of your scripts
7. Your Script is too big and inefficient
8. Your input category is wrong
9. Your datatypes aren't converted
10. When in doubt, reboot everything

# Fundamentals

How to get comfortable working in custom scripts

1010  
1010

Know Your Data Types



Have a convenient place for file storage



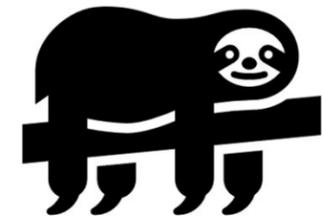
Keep the software updated



Get comfortable problem solving



Keep your files organized



Don't be lazy

# 4-step process diagram example



## Take a Break

Write Down your solution process on paper

Go outside for a bit

Chat to someone describing the steps you are going through to solve a problem

## Use Support Files

Look at the help files in Dynamo software

Search through the Dynamo primer

## Do Research

Do some research online like reading API docs and Autodesk University Presentations

## Ask for Help

Ask for help on the forums

(try the prior steps first to make the most of the help)

# SPECIAL THANKS

- John Pierson
- Dana De Filippi / Danamo
- Gavin Crump / Aussie BIM Guru
- Jeremy Tammik
- Carl Storms
- Sol Amour
- Jacob Small
- And Many More!



# REFERENCES

## More fundamentals to review

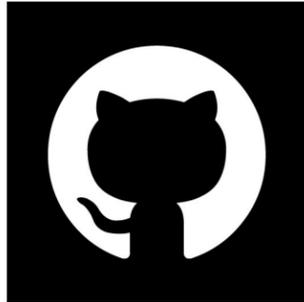
- 10 Dynamo mistakes to Avoid - <https://www.bimguru.com.au/post/dynamo-mistakes-to-avoid>
- Dynamo Data types - <https://www.autodesk.com/autodesk-university/class/Everyday-Dynamo-Automating-Simple-Solutions-Bridge-Workflow-Gaps-Within-Revit-2016#presentation>
- [Dynamo Baby Steps - https://www.autodesk.com/autodesk-university/class/Dynamo-Revit-More-Baby-Steps-Non-Genius-2020#presentation](https://www.autodesk.com/autodesk-university/class/Dynamo-Revit-More-Baby-Steps-Non-Genius-2020#presentation)
- Dynamo tips and trips 1 - <https://www.autodesk.com/autodesk-university/class/Dynamo-Isnt-Magic-These-Tips-and-Tricks-Might-Seem-Magical-2020#presentation>
- Dynamo operators explanation - <https://archi-lab.net/understanding-operators-in-dynamo/>

# MATRIX OF PROBLEMS, CAUSES, SOLUTIONS

## Quick Reference

Problem	Cause	Solution
Dynamo Behavior changes in different software	Revit Software Changes	Software Updates
Scripts won't open in Dynamo	Dynamo Software Updates	Use the latest version of Dynamo
A script won't run a specific node	Custom Package Dependencies Missing	Add notes
Script still won't run	Folder paths are wrong	Repath
Script is hard to read	You have no standards	Create and use a template
You can't find the right script file	No version control tracking of your scripts	Use a version control system
The script has a very long run time	Too many operations happening in one file	Refactor and split up your script
The nodes won't pass correct data	Inputs category is wrong	Hard code the input
The nodes won't pass any data	Your datatypes aren't converted	Use bridge nodes to convert values
Everything is slow without obvious fix	Memory cache can cause slowdown	When in doubt, reboot everything

# See you next time for more Dynamo Adventures!



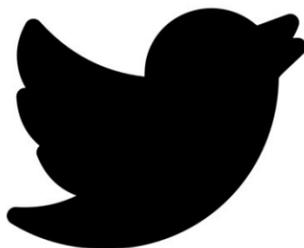
<https://github.com/thakopian>



@Tadeh Hakopian



<https://www.linkedin.com/in/thakopian/>



@tadeh\_hakopian

See You Next Time!





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