

SD501709

Dynamo Blues: 10 Things to Avoid in Your Script and how to fix them

Tadeh Hakopian
Program Manager – BIM & VDC

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.

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!

Speaker(s)

- (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

Disclaimer

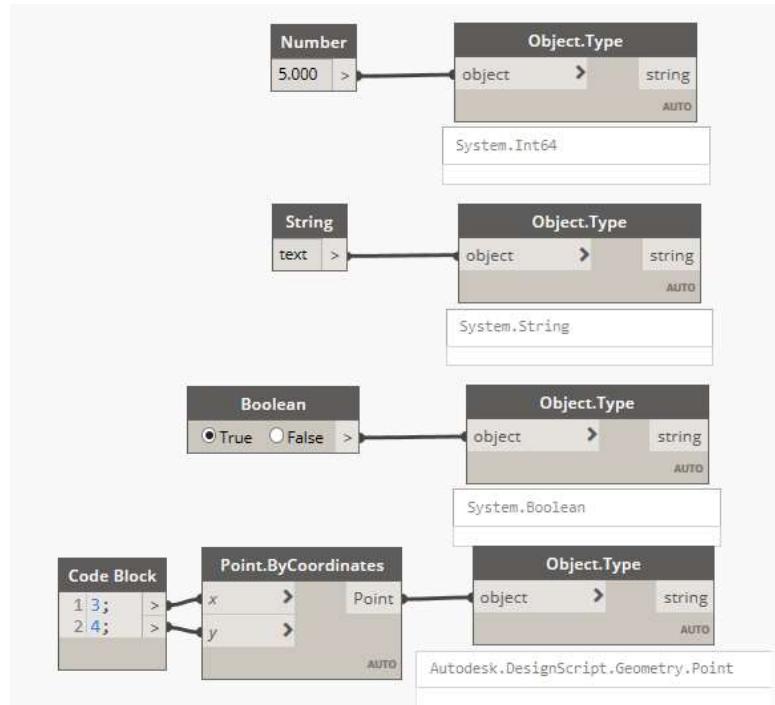
What to Expect

- 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

Basic Concepts

Terms and Concepts – Data Types

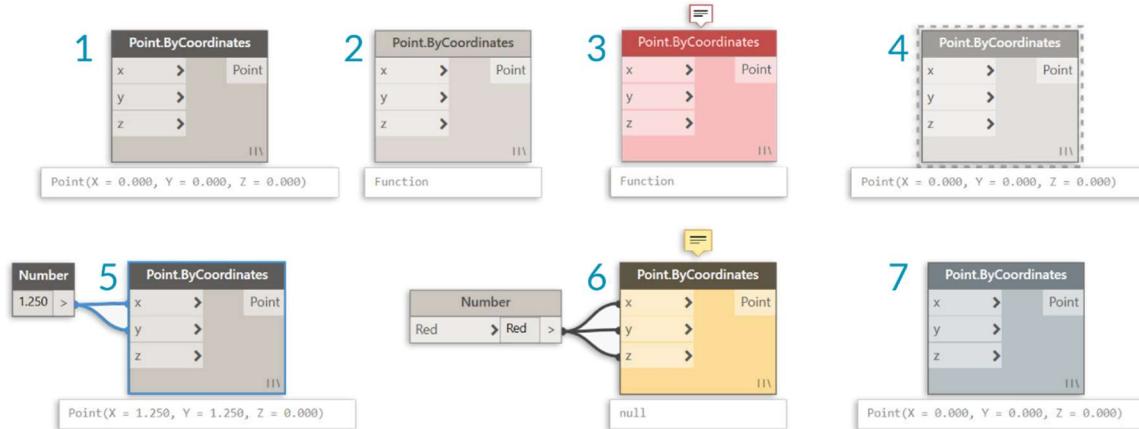
- String - Text
- Number – Number with Decimals
- Boolean – True/False
- Nulls - Nothing
- Lists – Sequence of Data
- Curve – Geometric Line



Terms and Concepts – Node States

- Active - Nodes with a Dark Grey Name background are well-connected and have all of their inputs successfully connected
- Inactive - Grey Nodes are inactive and need to be connected with Wires to be part of the Program Flow in the active Workspace
- Error State - Red indicates that the Node is in an Error State
- Freeze - A Transparent node has Freeze turned on, suspending the execution of the node
- Selected - Currently selected Nodes have an Aqua highlight on their border
- Warning - Yellow Nodes are in an Warning state, meaning they may have incorrect data types
- Background Preview - Dark Grey indicates that the geometry preview is turned off

Node states vary but are critical to know about



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/>

Basic terminology to work with.

Be mindful that you are stepping into coding world with Dynamo.

So some of these lessons will be applicable to coding and we'll talk about that.

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

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

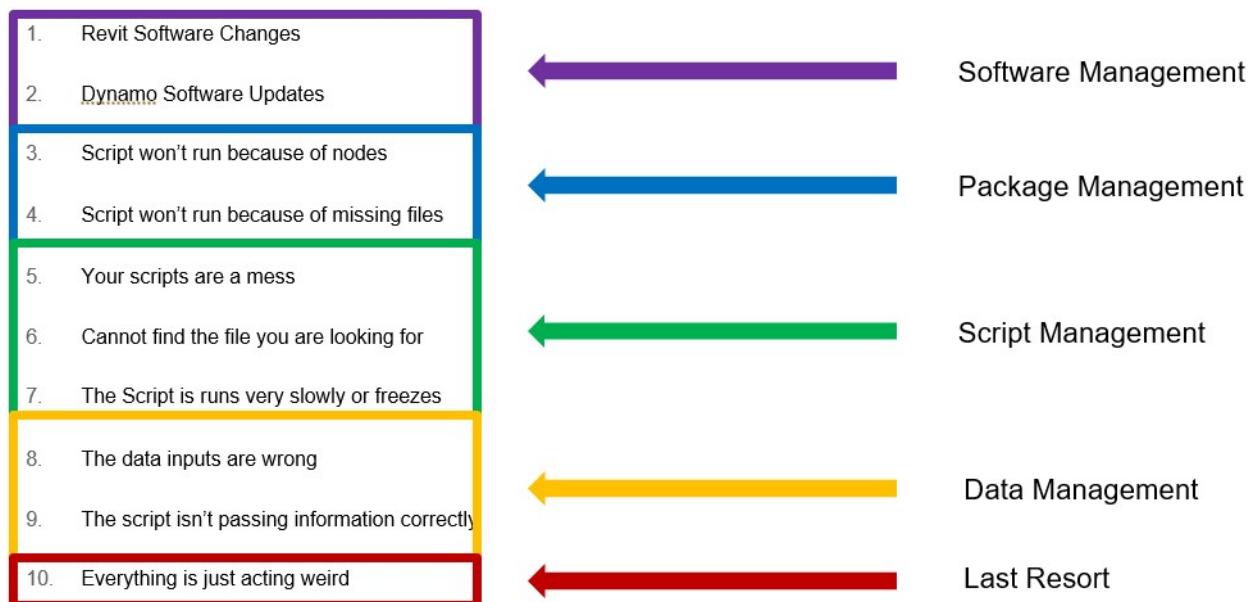
Here is the list we will explore.

Start with understanding the software better in the first few including the API and documentation changes.

Then more on the script management.

And after that better scripting methods.

Each item will have problem, cause, solution to review.



Let's get started!

1 – Revit Versions and Dynamo compatibility

Problem - Revit Versions and Dynamo compatibility

- Revit is version locked for its files
- That goes for plugins like Dynamo as well
- API changes with different Versions of Revit
- There's A LOT of stuff in the Revit API
- The same script can behave differently with different versions of Revit

Cause – Revit Software is out of date

- The Revit API also has a lot of stuff in it
- That is great but it also kinda sucks
- Because things can change over time

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

Protip - Read the API of the software you use

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

2 – Dynamo and Compatibility

Problem - Dynamo isn't backward compatible

- 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

Cause – Revit Software is out of date

- XML to JSON switch is the big cause of this issue
- <http://dynamobim.org/to-dynamo-2-0-and-beyond/>

Solution - Don't get out of date, Again!

- Check your version history of Dynamo and make sure you stay up to date
- Remove all 1x versions of Dynamo to avoid clicking on the wrong prompt when you are working
- 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/>

Protip – Limited backwards compatibility in 2X

- 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 – Managing 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 – Your packages are out of date

- 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
- If you have a lot of customized scripts with 3rd party packages then you have to account for everything you added in the file
- Limitation of visual scripting is that there's no good way to track packages but there are ways to get better at this

Solution – Keep it simple and Write down notes on your scripts

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

Protip – Use the Dynamo Note properties pane

- 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 - 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

- It's possible in this case the DLL path has been switched
- 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
- You can check in Dynamo
- Check under preferences > package manager > library search paths
 - Dynamo Built-In packages
 - Roaming
 - Program Data

Solution - Options

- Option 1 - Uninstall then Reinstall Dynamo, 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, You 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>

5 – Keeping your graphs in order

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

Solution - Use a Template file with Standardized layout

- Create a simple standard with notes and groups
- Apply it to all your scripts even while you are writing them in the fly
- Much easier to follow and understand the data flow quickly
- Don't forget you can also add a recent template DYN file that has everything pre-loaded into it so you don't have to do this every time

Protip – Use extensions to help organize your space

- 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 system

- You use or 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 – Get a Repo!

- Remember that programming part we talked about earlier? Well version control is part of that
- If you have a collection of useful scripts then make it easy to track them and update them over time with GitHub
- Use Git - <https://about.gitlab.com/topics/version-control/what-is-git-version-control/>
- Also try GitHub for free – Github.com
- Load your saved scripts to GitHub which is free and can track changes
- Even Dynamo has a link to its GitHub if you want to see what it looks like and get some inspiration

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 through Dynamo
- <https://www.autodesk.com/autodesk-university/class/Dynamo-GitHub-DynaHub-Adopting-New-innovative-Repository-Dynamo-Content-2019#handout>

7 – Long Script run times

Problem – Scripts take a long time to run

- 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 – Monolith Script

- 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 into multiple parts

- Breaking up a script can help organize your QAQC and reduce run time
- Consider the computational load of running your script through Dynamo to Revit to your CPU and getting a result
- It is a very slow process and it is an art to refactor and make your code more efficient
- Don't settle for good enough – remember not every computer can handle the load the same so make it accessible for all

Protip - Be careful of lacing options

- Shortest – Only the matching pairs between two lists
- Longest – Everything matches at least once between two lists
- Cross-Product – Everything matches everything else between two lists
- The XXX cross product lacing option can get you into sticky situations
- It's basically maximum matching which is a lot of computational power
- If you want to do this more efficiently then consider the Python Nodes
- <https://www.autodesk.com/autodesk-university/class/Exploring-Python-Nodes-Dynamo-2019#presentation>
-

8 – Inputs and Outputs of Data Types

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

- Explicit naming will help a lot
- 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.ByCategory' node with a code block to maintain that relationship
- Find opportunities like this to control your scripts and avoid breaks

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>

9 – Data Conversions

Problem - Your nodes don't pass data to the next node

- Data is not converted
- Remember those data types we talked about earlier?
- Most of getting the script to work is just data types and list management
- 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

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 node is one example
- String to Number node is another example
- Or you can use custom solutions like designscript or Python code to do the conversions

Solution - Convert Data Types with Bridge Nodes

- Convert Lists of one data type into another with a 'bridge' nodes
- Review the datatypes
- Get comfortable with datatypes
- Get used to converting lists of datatypes

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
- Lists - https://primer.dynamobim.org/06_Designing-with-Lists/6_designing-with-lists.html

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 Many things

- 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 – Just Reboot

- Sometimes you just need to flip the switch off on your computer
- Don't forget that not everything is software or coding best practices
- Your computer is only a machine and has its limits
- The memory usage cache can screw things up

Protip – Take a break

- Get some coffee

Problem Solving Process

Tips - When in doubt, sketch it out

- If you hit a wall then write things down on a paper
- Or take a break, They are also great for problem solving
- Getting away from the screen is a good way to figure out what you are doing right or wrong
- Usually following the problem solving tips on a fundamental level helps a lot in figuring out your bugs

Tips - Use the built-in Dynamo help files

- Dynamo is very helpful!
- Samples Scripts are loaded with every Dynamo install
- Dynamo > Help > Samples > Script Category
- Context Menu in your nodes are great too
- You can hover over the node warning and see a link for more information
- That link can open the document browser for more information on your issue

Tips – 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
- Primer 2 is out - <https://primer2.dynamobim.org/>
- Also video tutorial - <https://dynamobim.org/#videoTut>

Tips – Google It

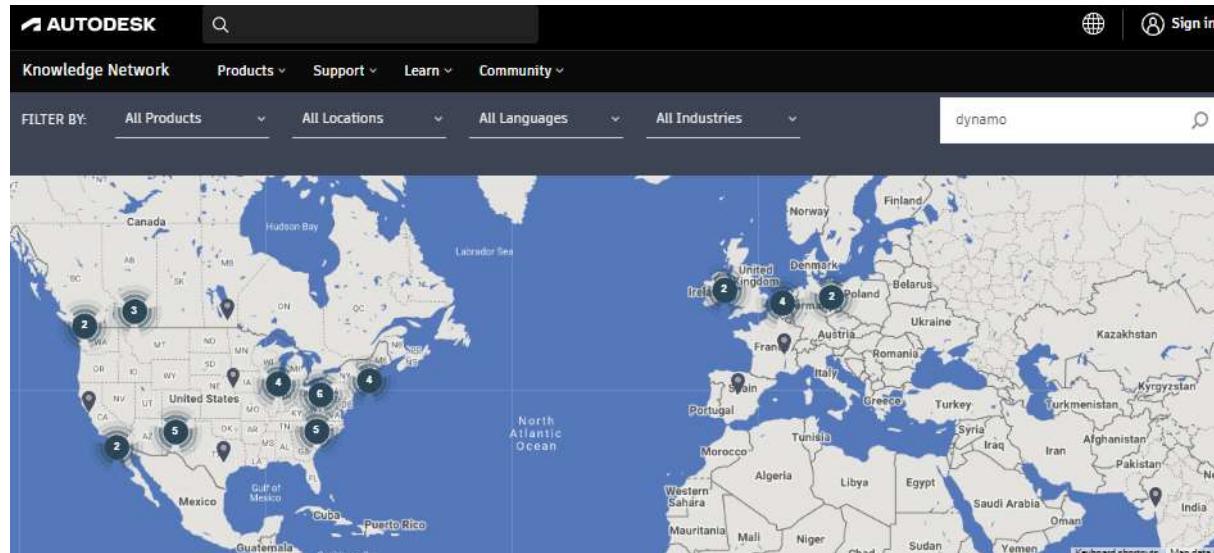
- Just ask the internet!
- It works like a charm
- Use search terms that are specific and can be extracted from your errors and warnings so you get good results
- “Revit Dynamo point conversion to number error” > “Dynamo Problem”

Tips - Ask for help on the forum

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

Tips – Join the Expert Elite community and Groups

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



The screenshot shows the Autodesk Knowledge Network interface. At the top, there's a navigation bar with links for 'Knowledge Network', 'Products', 'Support', 'Learn', and 'Community'. On the right side of the header are 'Sign in' and a search icon. Below the header, there are four filter dropdowns: 'FILTER BY: All Products', 'All Locations', 'All Languages', and 'All Industries'. A search bar contains the word 'dynamo'. The main content area features two maps: one of North America and one of Europe, both with circular markers indicating group locations. Below the maps is a table with two rows of data:

Group Name	Products	Connect
505 BIM User's Group Albuquerque, NM, USA	R B D	Visit group page
AEC Technology Collaborative LinkedIn Group	R D	Visit group page

Recap and Review

The 10

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

- Know Your Data Types
- Keep the Software updated
- Keep your files organized
- Have a convenient place for file storage
- Get comfortable with problem solving
- Don't be lazy

4 step process

1. 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
2. Use Support Files
 - Look at the help files in Dynamo software
 - Search through the Dynamo primer
3. Do Research
 - Do some research online like reading API docs and Autodesk University Presentations
4. Ask for Help
 - Ask for help on the forums
 - (try the prior steps first to make the most of the help)



Resources

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>

More Dynamo 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>
- 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/>



Special Thanks

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

Contact information

- <https://github.com/thakopian>
- [@tadeh_hakopian](https://www.linkedin.com/in/thakopian/)
- <https://www.linkedin.com/in/thakopian/>