Unlock the Hidden Super Powers of Dynamo

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INTRODUCTION
About the speaker

Tadeh (Todd-A) Hakopian

Tadeh leverages BIM, VDC and Design Technology to provide his teams with impactful tools for project success. He has over 8 years of experience in the AEC field developing methods and practices to enhance project outcomes. With a background in Architecture he has worked with designers, engineers and contractors in all phases of building design and construction. Over the years he has been a part of large, complex projects in Commercial, Sports, Education, Healthcare and Residential sectors. His current focus is on design automation, data insights in projects and comprehensive workflows that come full circle in planning project life cycles. He is an active speaker at conferences and his local community meetups. Current Professional Goals Help move the AEC profession into new horizons using value driven solutions and innovative research.
About HMC Digital Practice

HMC Architects internal group of innovators and subject matter experts for digital technology

Mission is to support the designers in our company by using new tools and methods

Group operates company wide to support and improve performance of project teams

Main focus areas – Data Analytics, Process Automation, Integrated software workflows
DYNAMO’S SECRET IDENTITY
Learning Objectives

• Learn how Dynamo can use machine learning and generative design.
• Learn how to connect your Dynamo script to web APIs and access information for online databases.
• Learn how to create specialized geometry formations with packages to expand modeling capability.
• Learn how to document your scripts by exporting your files to GitHub for anyone to use online with special nodes.

Description

Dynamo for a long time has been the go-to tool of Revit users to quickly script solutions to time-consuming routine problems. However, there is much more that Dynamo can do beyond scripting. There is a whole world to explore with packages and integrations which you may not be aware of. See what is possible with AI, geometry manipulation, coding, generative design in Autodesk software, and document updates, as well as accessing web APIs with Dynamo. If you think you know Dynamo, then you’ve only scratched the surface. Check out this class to see the true potential of Dynamo and visual scripting.
WHAT WE WILL COVER

Disclaimer:
This is a starting off point to learn more
For more information please check out the referenced links

Sections:

• Geometry
• GIS / Maps
• Coding in Dynamo
• Data Science / Machine Learning
• Github docs
• External software integration
• Cross platform integration
WHAT IS IT REALLY ABOUT?

Packages – Custom nodes from external developers to expand upon what Dynamo can do

View Extensions – Additional window tools in the Dynamo UI that can launch additional services and connections to external software without having to use nodes

Imports – Bringing content into Dynamo from an external source

Open Source – Revealing the source code for anyone to access and edit, Dynamo itself is an example of this
GEOMETRY & TRANSFORMATIONS
**DynaShape**

**WHAT IS IT**

Open-source Dynamo plugin for constraint-based form finding, optimization and physics simulation.

**ORIGIN**

Long Nguyen

**REPO**

https://github.com/LongNguyenDynaShape

**USE CASE**

DynaShape is a Dynamo package for constraint-based form finding, optimization and physics simulation. The core algorithm is based on ShapeUp 85. This provides an important theoretical foundation by formally describing how different geometric constraints can be defined in a unified and extensible framework, how they can be solved/optimized simultaneously and under what conditions the solution can be guaranteed.

**MORE INFORMATION**

https://forum.dynamobim.com/t/dynashape/11666
Topologic

**WHAT IS IT**

Topologic is a software modelling library enabling hierarchical and topological representations of architectural spaces, buildings and artefacts through non-manifold topology.

**ORIGIN**

Dr. Wassim Jabi and the Topologic Team

**REPO**

https://github.com/NonManifoldTopology/Topologic

**USE CASE**

Topologic can be used to support energy modelling—say dimensioning the windows on different sides of a hospital to avoid summer overheating. Topologic can be used to plot paths such as fire egress routes, the least disruptive route for a new service pipe or the most congested location in a city layout.

**MORE INFORMATION**

https://topologic.app/learning/
Project Refinery

WHAT IS IT

An Autodesk generative design beta for the architecture, engineering and construction industry that gives users the power to quickly explore and optimize their Dynamo designs.

ORIGIN

Autodesk

REPO

https://www.autodesk.com/campaigns/refinery-beta
https://dynamo.bim.org/refinery-toolkit/

USE CASE

Generative design is used to provide practitioners the ability to quickly explore, optimize, and make informed decisions to complex design problems. Think of generative design software as an assistant that helps with creating, testing, and evaluating options. This approach is especially useful when you have many variations to consider in order to access a few optimized results. Refinery can accelerate design exploration providing a selection of optimized results based on the user input and preferences.

MORE INFORMATION

https://www.youtube.com/watch?v=F3dYANY4zo&feature=youtube&ab_channel=SwissDataScienceCenter
https://www.generative design.org/
DynaMaps

WHAT IS IT

View extension and node package which provides the most straightforward workflow to get site data into Dynamo

ORIGIN

Mostafa El Ayubi

REPO

https://github.com/MostafaELAyubi/Data-shapes

USE CASE

Placing site content like buildings and topography into your Revit model with the DynaMaps package nodes. Load and create site model data into Revit without having to link files and rebuild content yourself.

MORE INFORMATION

https://dynamobim.org/dynamaps/
**TITLE**

GIS2BIM

**WHAT IS IT**

Access GIS content from online database and load them into your Revit model with Dynamo nodes.

**ORIGIN**

Maarten Vroegindeweij

**REPO**

https://github.com/DutchSalonGIS2BIM

**USE CASE**

GIS2BIM is a collection of custom nodes for the Dynamo visual programming environment. It imports 2D and 3D GIS-information to Autodesk Revit models.

**MORE INFORMATION**

https://github.com/DutchSalonGIS2BIM/wiki/Workflows

http://dutch-revitblog.blogspot.com/
Google Maps in Dynamo

**WHAT IS IT**

Add Google map images into your documents

**ORIGIN**

Konrad Sobon

**REPO**

https://github.com/ksobon/archilab

**USE CASE**

Take the Google maps API and get it into your model with a special node package from Archilab. Clause usage of Dynamo that cuts down time and complexity of a task with a simple script and information that can be immediately used on your projects.

**MORE INFORMATION**

https://archilab.net/google-maps-static-api-in-dynamos
CODING
Title

Design Script

What is it

Design Script is a novel language for exploratory design useful for compacting scripts and customizing functions in Dynamo.

Origin

Dynamo Team

Repo

https://github.com/DynamoDS/design-script-archive

Use Case

Design Script enables a 'soft transition' between visual data flow programming and text based scripting by implementing a series of intermediate programming techniques. This provides a gentle learning curve which allows the gradual introduction of more advanced programming concepts and notation. Design Script enables the pragmatic world of design automation and production to be connected to the world of computer science and algorithmic thinking.

More Information

https://primer.dynamobim.org/07_Code-Blocks/7-2_Design-Script-syntax.html
http://www.designscript.io/
Zero Touch Nodes

WHAT IS IT

Using C# code directly into your Dynamo Scripts

ORIGIN

Dynamo Team

REPO

https://github.com/DynamoDS

USE CASE

Zero-Touch Importing refers to a simple point-and-click method for importing C# libraries. Dynamo will read the public methods of a dll file and convert them to Dynamo nodes. You can use Zero-Touch to develop your own custom nodes and packages, and to import external libraries into the Dynamo environment.

MORE INFORMATION

https://developer.dynamobim.org/03-Development_Options/03-4-ZeroTouch-nodes.html
https://github.com/DynamoDS/DynamoWiki/Zero-Touch-Plugin-Development
Python Node

WHAT IS IT

Using Python code directly into your Dynamo Scripts

ORIGIN

Dynamo Team

REPO

https://github.com/DynamoDG

USE CASE

The plan behind the Dynamo Project is to widen the scope of platform implementation. As Dynamo adds more programs to the platform, users will gain access to platform-specific APIs from the Python scripting environment. While Revit is the case study for this section, we can anticipate more chapters in the future which offer comprehensive tutorials on scripting in other platforms. Additionally, there are many IronPython libraries accessible now which can be imported into Dynamo!

MORE INFORMATION

https://primer.dynamobim.org/10_Custom-Nodes/10-5_Python-Revit.html
https://github.com/Amourso/dynamoPython
The use of algorithms provides a number of benefits. One of these benefits is in the development of the procedure itself, which involves identification of the processes, major decision points, and variables necessary to solve the problem. Developing an algorithm allows even forces examination of the solution process in a rational manner. Identification of the processes and decision points reduces the task into a series of smaller steps of more manageable size. Problems that would be difficult or impossible to solve otherwise can be approached as a series of small, solvable subproblems. The required specification aids in the identification and reduction of subconscious biases. By using an algorithm, decision-making becomes a more rational process.
WebClient

WHAT IS IT

package providing support for interaction with the internet

ORIGIN

Radu Gidei

REPO

https://github.com/radumg/DynaWeb

USE CASE

DynaWeb was designed as a package to make other packages enabling you to build Dynamics integrations with just about any web service out there. After making DynaStack & DynAsana, it became clear that writing a ZeroTouch-based package for every web service is not something the community would want to integrate with was simply not scalable or sustainable, no matter how much code was re-used. DynAsana is an abstracted DynaStack and DynaWeb is an even more abstracted & modularised DynAsana.

MORE INFORMATION

https://radumg.github.io/DynaWeb/
https://www.bim42.com/202007/dynaweb-1

{ "id": "rec0S7zDsa8rWLXb4", "fields": { "Code": "201", "Material": "Steel", "Width": 915, "Height": 2134, "Fire Rating": "3/4 Hours", "Level": "02 - Floor", "Frame Finish": "Polyester powder coated", "Doorstop": "Floor mounted door stop" }, "createdTime": "2020-06-26T14:50:25.000Z" }
OR AS THE LEADER OF THE WORLD'S MIGHTIEST HEROES, THAT HAD BEEN A ROLE WHICH HAD SUITED HIM WELL.

HE HAD CONTINUALLY REFINED HIS WEAPONRY, UNIL AT LAST HE HAD PERFECTED AN ARMOR OF SOLAR-POWERED, DIAMOND-HARD MICRO-ENGAGED CIRCUITED MESH.

AND HE, HIMSELF, HAD CHANGED AS WELL. THE DARPANEL HAD BEEN REMOVED, THE DAMAGED ISSUE REPLACED SYNTHETIC WHICH, IF NOT AS STRONG AS THE ORIGINAL, AT LEAST ELIMINATED THE NECESSITY OF CONTANT BOOSTING FROM HIS ELECTRONIC MEST PLATE.
**Title**

Dynamo 2.8 And Beyond!

**What Is It**

New improvements to the Dynamo Core software expanding the future of the software.

**Origin**

Dynamo Team

**Repo**

https://github.com/DynamoDS/Dynamo/releases

**Use Case**

A slew of new features to improve and streamline the Python 3 experience, including better messaging, a migration assistant, more in-product help, whitespace characters, the ability to print to the Dynamo console, recognition of any potential missing IronPython 2.7 engine native inside the Workspace Reference extension, a few targeted improvements to Geometry that allow greater control for the graph author on PolyCurves and NURBS Curves, as well as a respectable amount of bug and crash fixes that all make a much more stable and consistent Dynamo.

**More Information**

https://dynamobim.org/dynamo-core-2-8-release/
Title: Data Science Packages with Cython

What is it:
Access popular python 3 libraries with the Cython interpreter

Origin:
Dynamo Team

Repo:
https://github.com/DynamoDS

Use Case:
Simplifying workflows requiring data extractions from a model to analysis

More Information:
https://dynamobim.org/dynamo-core-2.8-release/
https://jupyter.org/
https://numpy.org/
DynaHub

WHAT IS IT

Dynamo Extension to interact with GitHub. Enable Dynamo to pull graphs from GitHub + version control.

ORIGIN

Andrea Taessera

REPO

https://github.com/Dra-Tas/DynaHub

USE CASE

GitHub is widely used in software engineering for facilitating collaboration and consistency of code over time. However, it has never been applied in computational design. DynaHub—an open-source Dynamo extension that connects Dynamo to GitHub—bridges the gap by letting you push and pull automations and packages from a centralized and accessible repository. Any user or organization, through their GitHub account, can use the Dynamo scripts stored in their own repository, knowing that they are using the most recent and validated version.

MORE INFORMATION

ROGUE(S)
Hyper

WHAT IS IT

Platform for designing, generating, and sharing building systems

ORIGIN

Hyper Team

REPO

https://github.com/hyper-jo

USE CASE

Platform to generate, visualize and analyze buildings to make better decisions faster. You can easily add your own processes and expertise so you don't start from square one with each new project.

Quickly generate proposals by combining different building systems that intelligently interact. Include analysis and simulation tools created by industry experts to predict and drive performance. Take designs from concept to construction, system by system.

MORE INFORMATION

TITLE
Proving Grounds

WHAT IS IT
Enterprise customization with open-source tools

ORIGIN
Proving Grounds team

REPO
https://provingground.io/tools/

USE CASE
The plugins include new component nodes for managing data and geometry for activities such as generative form-making, paneling, rationalization, and interoperability.

MORE INFORMATION
https://provingground.io/tools/
TestFit IO

WHAT IS IT

A generative design and co-creation tool that allows a user to get a site TestFit in seconds for multifamily development.

ORIGIN

TestFit team

REPO

https://blog.testfit.io/testfit-home

USE CASE

TestFit users are architects, brokers, contractors, developers, or anyone wanting to do feasibility studies.

MORE INFORMATION

https://provingground.io/tools/
**TITLE**

PyRevit

**WHAT IS IT**

Rapid Application Development (RAD) Environment for Autodesk Revit

**ORIGIN**

Ehsan Iran-Nejad

**REPO**

https://github.com/eirannejad/pyRevit

**USE CASE**

pyRevit (with lowercase py) is a Rapid Application Prototyping (RAD) environment for Autodesk Revit. It helps you quickly sketch out your automation and add ideas, in whichever language that you are most comfortable with, inside the Revit environment and using its APIs. It also ships with an extensive set of powerful tools that showcase its capabilities as a development environment.

**MORE INFORMATION**

https://www.youtube.com/c/pyRevit/playlists

https://www.notion.so/pyRevit/bd007d62922ed4ce097c46e84b6ef67a0

pyRevit uses some fine tools made by very talented people:

- [rpw](https://github.com/rpw)
- [Python](https://www.python.org)
- [LibGit2](https://libgit2.org)
- [Bitbucket](https://bitbucket.org)
- [Eモジワン](https://emojione.com)
NEW HEROES
WHAT IS AVAILABLE NOW

Dynamo Sandbox

Revit

Civil 3D

Alias Design

More coming soon!
WHAT MIGHT BE POSSIBLE... TO BE CONTINUED
SPECIAL THANKS
EVERYDAY HEROES – PACKAGE MAKERS

All the workhorse packages, Contributors and the Dynamo team who are the real heroes!

- Archi-lab
- Bang!
- Parametric Monkey
- Clockwork
- Data-Shapes
- Juggernaut
- Lunchbox
- Monocle
- Rhythm
- Springs
- Simplex
- And Many More!

List of packages
https://www.autodesk.com/autodesk-university/class/Dynamo-Packages-Have-You-Tried-These-Yet-2018#presentation
A very special thanks to the Dynamo Team at Autodesk for improving their product and supporting the community

Not all heroes wear capes
USE THE PRIMER!

- It's a great resource for learning Dynamo and covers just about everything
- Dynamo is a journey of a 1000 nodes that begins with your first step
- Learn more and try things out
- Create your own open source package and share them
- Improve the existing software available
- Share what you are doing and being supportive of others
- Spread the knowledge!
The next hero could be you!
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