## Session 212

# Developing Custom Health Dashboards (with Dynamo and Power BI)

James Feracor and Tieyi Yu, Thornton Tomasetti

### Session Outline

## ****Class Description****

'Model health' is a BIM buzzword that frequently lacks specific meaning or universal understanding – by nature, the concept is frequently specific to an organization, project, or even role. Consequently, it is vital that BIM data is ‘flexible’ as different project roles require different levels of data detail (or collection rates) to support decisions or be actionable. Dynamo and Power BI are one combination of easily accessible tools that empowers users to develop DIY model health dashboards. In this lab session, we will walk you through the process of creating those dashboards and underlying data models using Dynamo and Power BI. We will also discuss key considerations for scaling such workflows beyond individual models.

## ****About the Speakers:****

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| A person in a plaid shirt  Description automatically generated with low confidence | **James Feracor, Sr. Data Scientist (Primary Speaker)**  James is part of a cross-functional team that manages and delivers large data sets to various practices and corporate departments within TT. His goals include implementing and scaling workflow solutions, including the automation of data extraction, transformation, and visualization (dashboarding). Previously as a digital design technologist, he has assisted with the management and operation of TT’s BIM data infrastructure. James holds a PhD in Civil Engineering, from which he derived a background in data-driven processes in construction, energy analysis, sustainability, and R&D. |
|  | **Tieyi Yu, Digital Design Technologist (Co-Speaker)**  Tieyi’s role is to help TT produce high quality drawings with consistency and efficiency on an enterprise scale. One of her main focuses is to facilitate standardizing content. Tieyi Yu holds a bachelor's degree in integrated design and has previously worked as a CAD technician at Coughlin Porter Lundeen. She has contributed to a broad range of projects, including high-rise office buildings, multi-family apartments, high and elementary schools, and fire stations. Her expertise also extends to renovation projects and working with existing drawings. |

## Summary

The broad goal of model health metrics is to give modelers (and their collaborators) greater visibility of the factors which impact a model’s ‘performance.’ This can mean things that affect efficiency in work-shared environment, consistency with BIM/modelling standards, or data that simply adds contextual information when interpreting certain metrics.

There are many avenues to achieving this outcome. Dynamo and Power BI is one appealing combination: Dynamo is included with Revit, and Power BI desktop is free and fully featured except for collaboration/report publication (required Pro or higher). This lab session demonstrates how these tools can be used in combination to create informative model health reports intended for audiences with different technical needs.

For this demo, we will use a simplified version of a health scoring system developed by TT that is based on a sampling of best modelling practices. It is not comprehensive. Users are encouraged to further modify, adapt, or recreate the demonstrated workflows. Finally, we will also discuss considerations regarding scalability and workflow automation.

## Key Takeaways

This session hopes to empower users in reclaiming control and visibility of their models' health and highlight the values of centrally managing and reporting BIM data. While BIM tools and vendor solutions are becoming abundant, this session provides insight regarding what capabilities may already be available to you.

Our recipe for developing automated model health reports has two major components:

* Dynamo, a visual programming environment that allows us to create repeatable queries to interrogate Revit models and produce consistent outputs (i.e. spreadsheets).
* Power BI, a platform that allows us to create reusable data pipelines to power any number of reports, each tailored to a specific consumer. This tools shapes the user experience of consuming data from Dynamo and adds the possibility of automation.

More specifically, this lab will demonstrate 3 important skills vital to the workflow:

1. Identifying sources of model data and using Dynamo to programmatically (and consistently) extract this data to file(s)
2. Loading data into PowerBI and automate data extraction, transform, and loading (ETL) tasks.
3. Developing interactive, visually compelling reports and templates to automate your workflow as much as possible.

*Note: While you can develop your own health metrics, we provide one for the session.*

Dynamo-Power BI duo is a powerful combination: Dynamo gives individual modelers a precise and repeatable process for interrogating their Revit models. Power BI adds the potential to scale the workflow by adding automation and facilitating the process of sharing data and reports with others.   
  
However, scaling this process for wider consumption invokes several key considerations that will impact costs due to data storage and platform requirements:

* **Data Platform**: Regardless of which data visualization platform you prefer, all require a cost for publishing features and report management (including Power BI) as well as different pricing structures for user licenses and data storage.
* **Governance**: An axiom of BIM is that better models result in better data. Scaling a model health report requires an understanding of how a health report aligns with a company’s internal QA/QC program or routine reporting requirements. Moreover, different users may value certain metrics over others.
* **Scalability**: Power BI is an excellent platform to demonstrate the potential of model health workflows. However, this combination of tools may not be ideal on an enterprise scale. Identifying the optimal context for using this set of tools should be a key consideration when determining the degree of scaling (e.g. BIM support? By specific project criteria or practice?).
* **Development Resources**: Tools developed in-house require ownership and funding to survive beyond initial development. Without these resources or in-house expertise, vendor tools may offer more appealing enterprise solution. Vendors offer very different solutions with scopes that are commensurate to Dyanmo, Power BI, both, and potentially more. Thus, one must ensure that a Vendor’s development roadmap aligns with the specific and potentially modular needs of your company.

Regardless of how you proceed, this session should give viewers a stronger sense of how data is structured in Revit versus how it must be transformed to provide actionable intelligence. Resultingly, attendees can better articulate both the benefits and challenges of implementing model health into BIM workflows.

## Session Outline

1. **[5 min] Introduction**
   1. Speakers background
   2. Context + motivation for topic
2. **[15 min] Run a Dynamo Script on a Model**

*Goal: Extract enough data from Revit model to be actionable and minimize need for data processing in Power BI (Power Query)*

* 1. Naming and file storage
     1. Folder structure and file names are also usable data
     2. Use our sample folder structure (available in Repo)
  2. How to run a Dynamo script on a model
     1. Runtime is a function of model size and complexity (don’t do an airport)
     2. Use our modified sample Revit model, or bring your own
  3. Explanation of dynamo script
     1. General outline and goal of map (simplified diagram)
     2. Inputs and output files
     3. (or any subsequent analysis program)
     4. Map is heavily annotated to guide users through each component of the map at their own pace (or as needed)

1. **[12 min] Load the data in Power BI**

*Goal: Minimize amount of additional data processing in report (DAX)*

* 1. Use our Power BI template
     1. Input parameter values for file locations on first load
     2. Make optional modifications in Power Query
     3. Revisit folder structure and naming conventions
  2. Data model
     1. Review of table relationships, cardinality, and direction
     2. Hidden tables and meta data (optional)

1. **[12 min] Tour of the Model Health Report template**

*Goal: Provide users with actionable information regarding their models via an interactive and intuitive report*

* 1. Explanation of health score calculation, interpretation
  2. Purpose of each page in the template report
  3. Usability features of template (slicers, filters, interactivity)
  4. Power BI web service for collaboration (required Power BI Pro)

1. **[8 min] Considerations for process scaling and automation:**
   1. **Data Platform**: what options are there aside from Power BI and Dynamo?
   2. **Governance**: who manages development and/or data quality control?
   3. **Scalability**: how big must the workflow be scaled to become useful?
   4. **Development Resources**: what kind of solution will make the most out of in-house knowledge and available funding? can Dynamo and Power BI co-exist with vendor solutions?
2. **[8 min] Questions and Answers**