

Parametric Analysis is the new !

Mostapha [Sadeghipour] Roudsari | Thornton Tomasetti

12th International Radiance Workshop - 14 AUG 2013

STRUCTURE



SKIN



SUSTAINABILITY



Thornton Tomasetti



PERFORMANCE



CONSTRUCTION SUPPORT



PROPERTY LOSS



Robert Otani



Jonatan Schumacher



Justin Nardone



Ben Howes



Nick Mundell



Matt Naugle



Mostapha Roudsari



Kenny Tam



Alfonso Oliva



Anne Waelkens



Ashley Reed

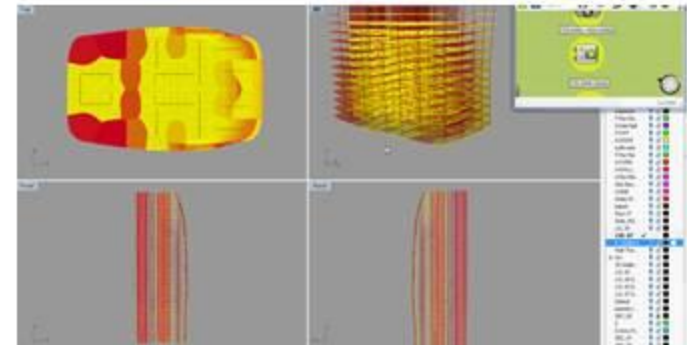
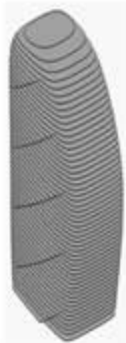


Hiram Rodriguez

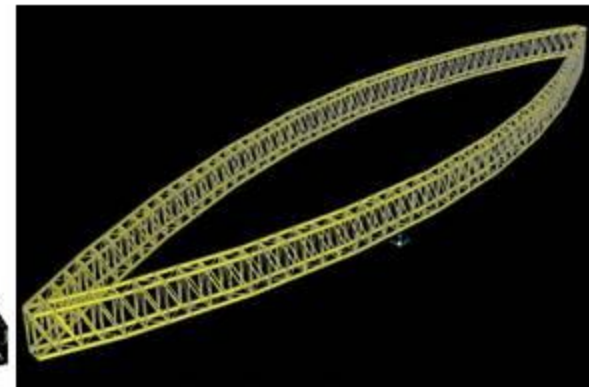
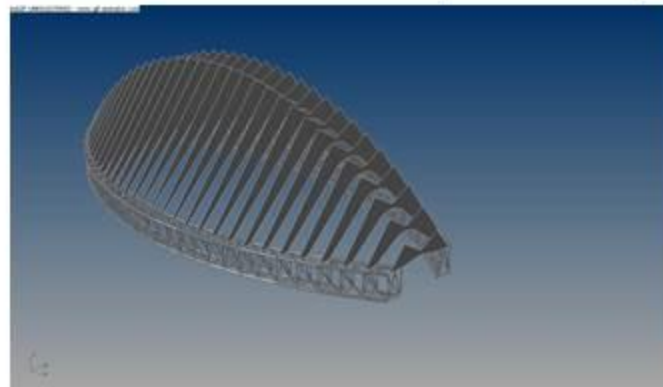


Elcin Ertugrul

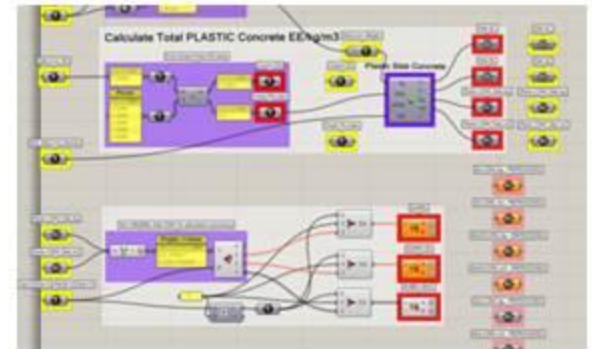
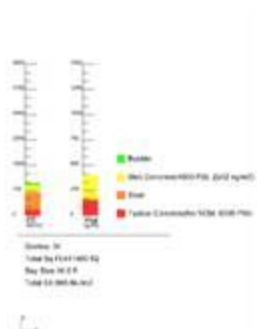
ADVANCED COMPUTATIONAL MODELING



Resorts World Miami Tower 1 | Oliva Alfonso | New York | Architectonica

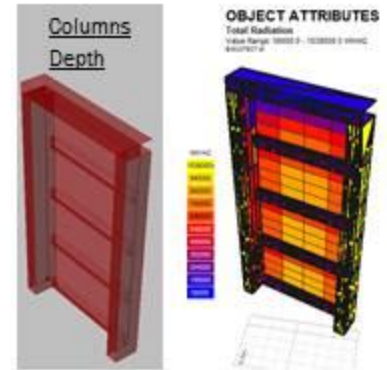
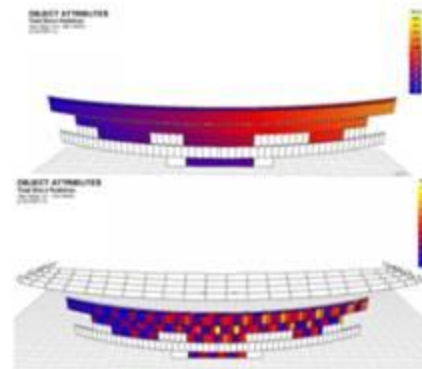
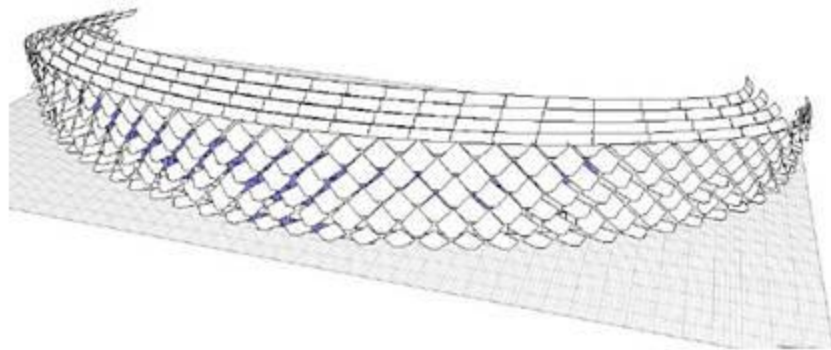


USF Roof | Jonatan Schumacher | New York | Calatrava

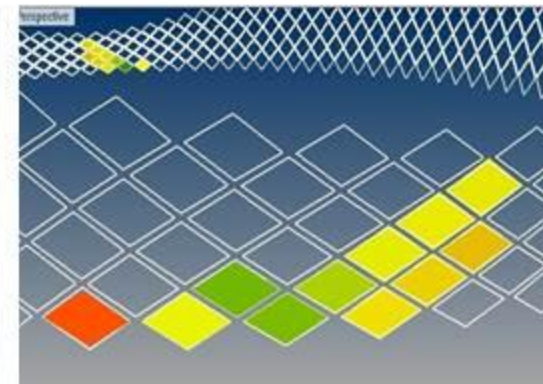
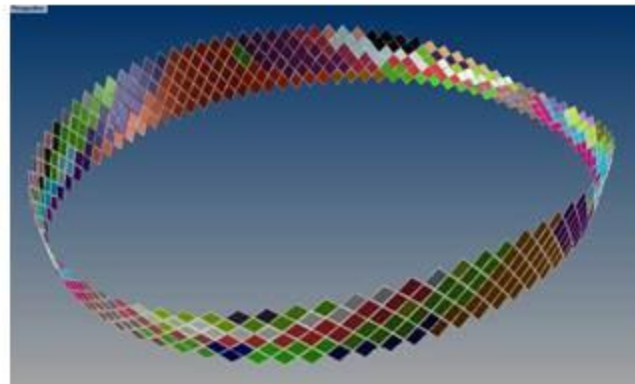
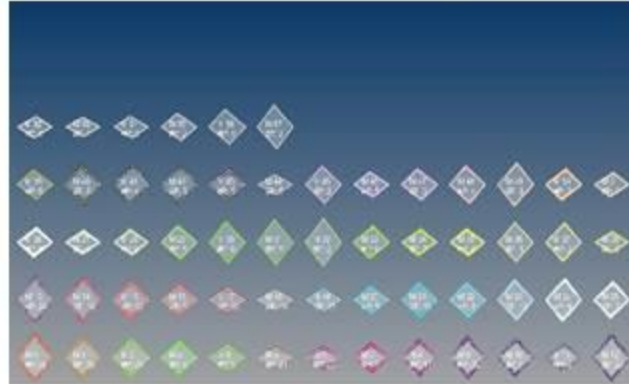


PAR: Waste-To-Building | Matthew Naugle | Philadelphia | PAR

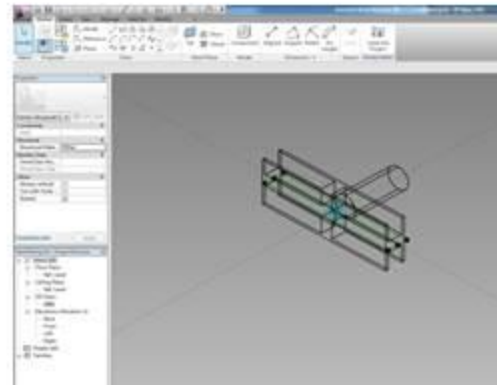
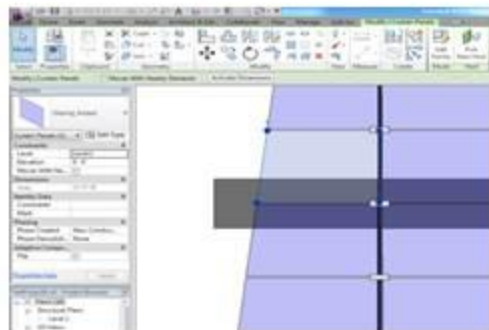
ADVANCED COMPUTATIONAL MODELING



Parametric Solar Radiation Analysis | S. Patrizi, J. Schumacher | New York

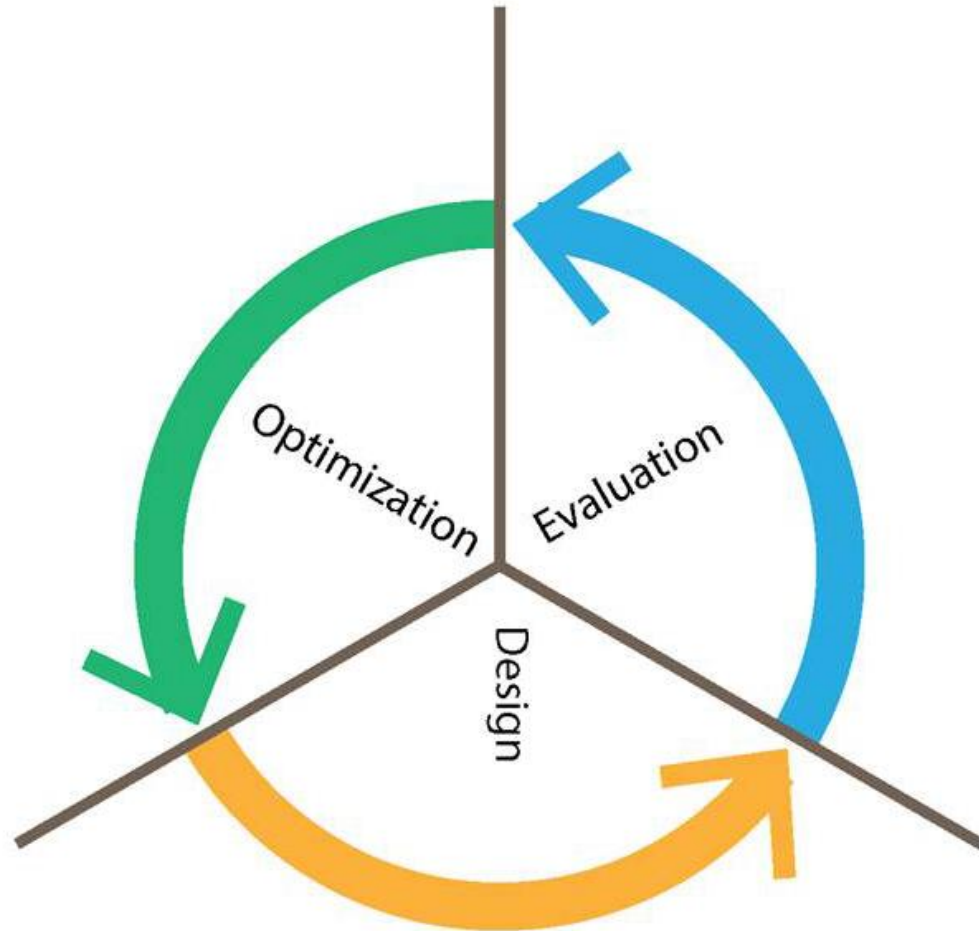


Mold Grouping Optimization | J. Schumacher | New York



Chameleon Revit-GH Test | Barry Beagen | New York

Iterative Process: Design - Evaluation- Optimization

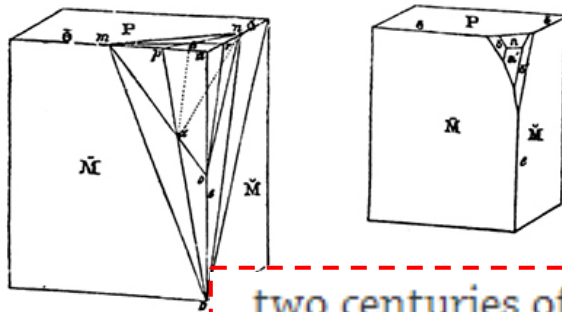


Parametric Design

- What is [the History of] Parametric Design?

Go read this link: <http://www.danieldavis.com/a-history-of-parametric/>

A History of Parametric



Daniel Davis – 6 August 2013

The first words I wrote in my thesis were deleted. A history of parametric design. The time before Grasshopper

Technology Corporation and Ivan Sutherland's Sketchpad, before the invention of the computer, and the birth of Gaudí. I assumed that I should start my thesis here in order to catch the reader up on the last

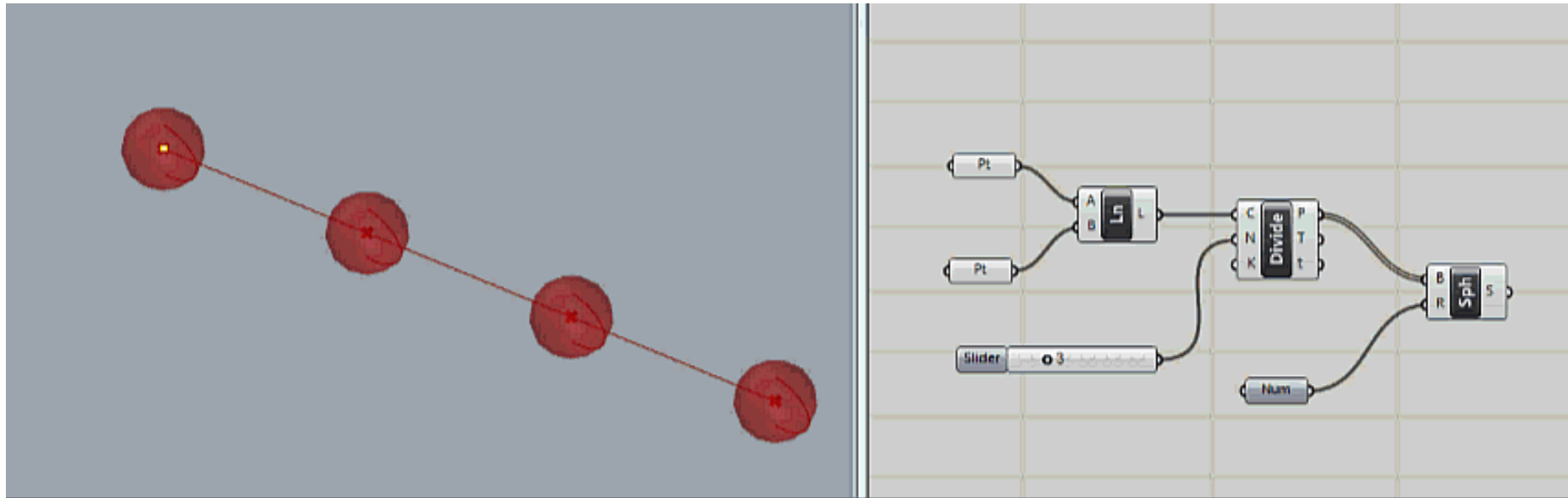
two centuries of developments. A fairly convoluted path that missed potholes of theory and architecture in order to idle past idolised technology. Ultimately this history wasn't scholarly enough and wasn't needed for the argument of my thesis. I deleted it.

two centuries of developments. A fairly convoluted path that missed potholes of theory and architecture in order to idle past idolised technology. Ultimately this history wasn't scholarly enough and wasn't needed for the argument of my thesis. I deleted it.



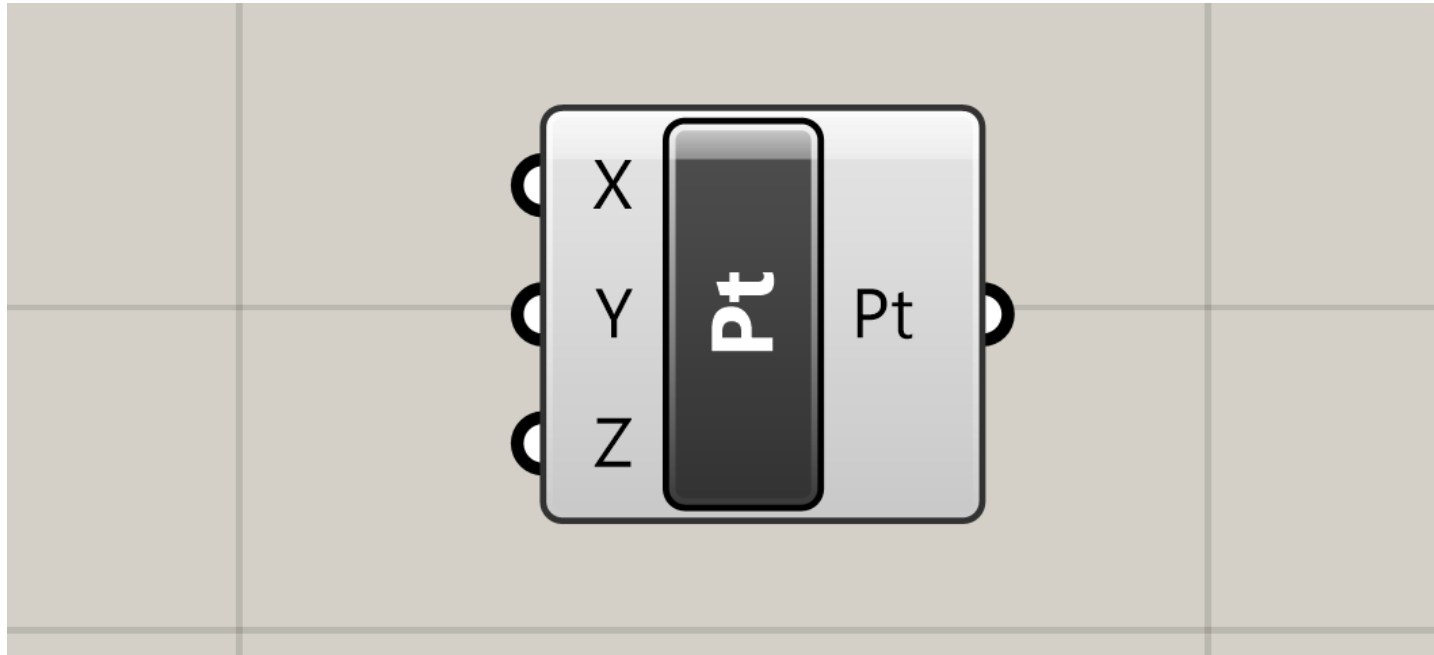
What is Grasshopper?

Why does it matter?



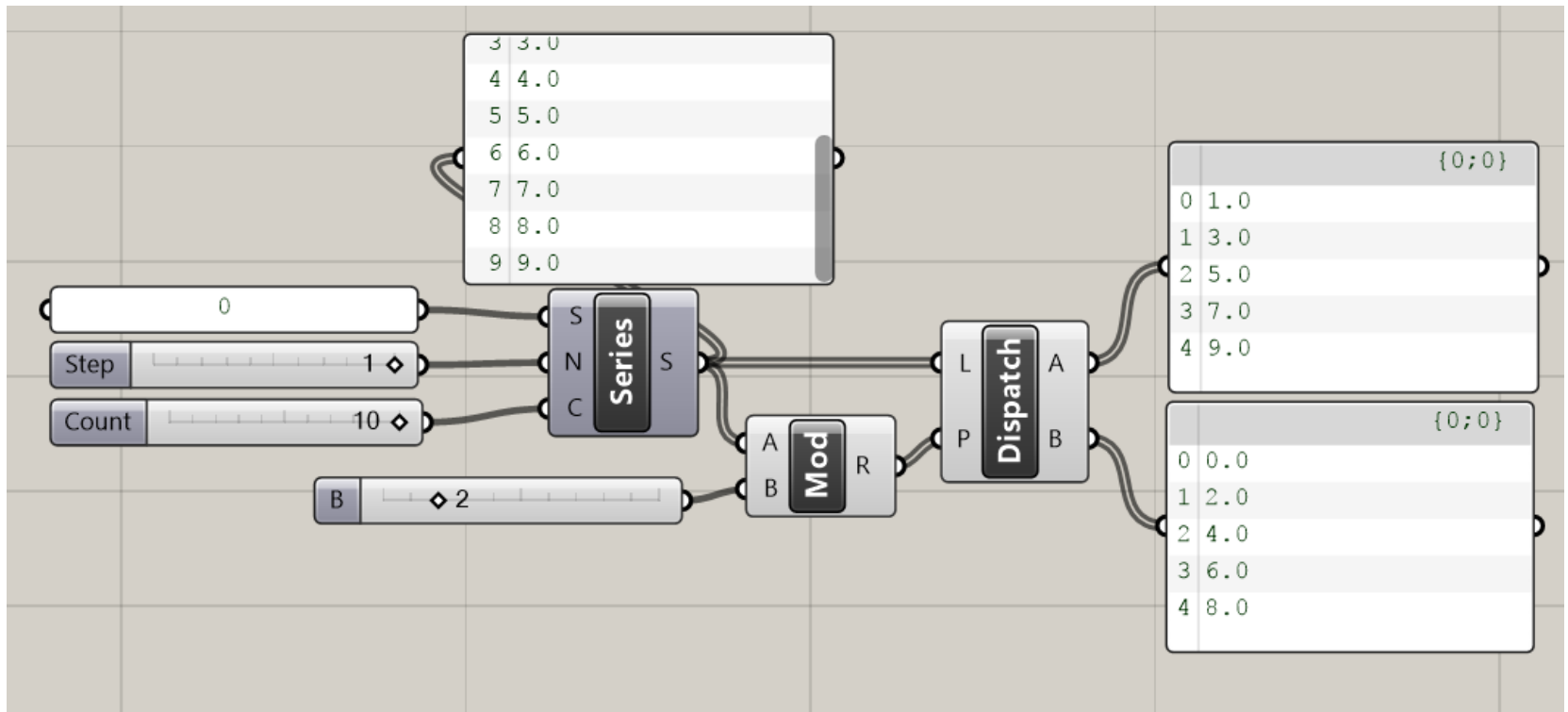
Visual Scripting

Pt = Rhino.Geometry.Point3D(X, Y, Z)

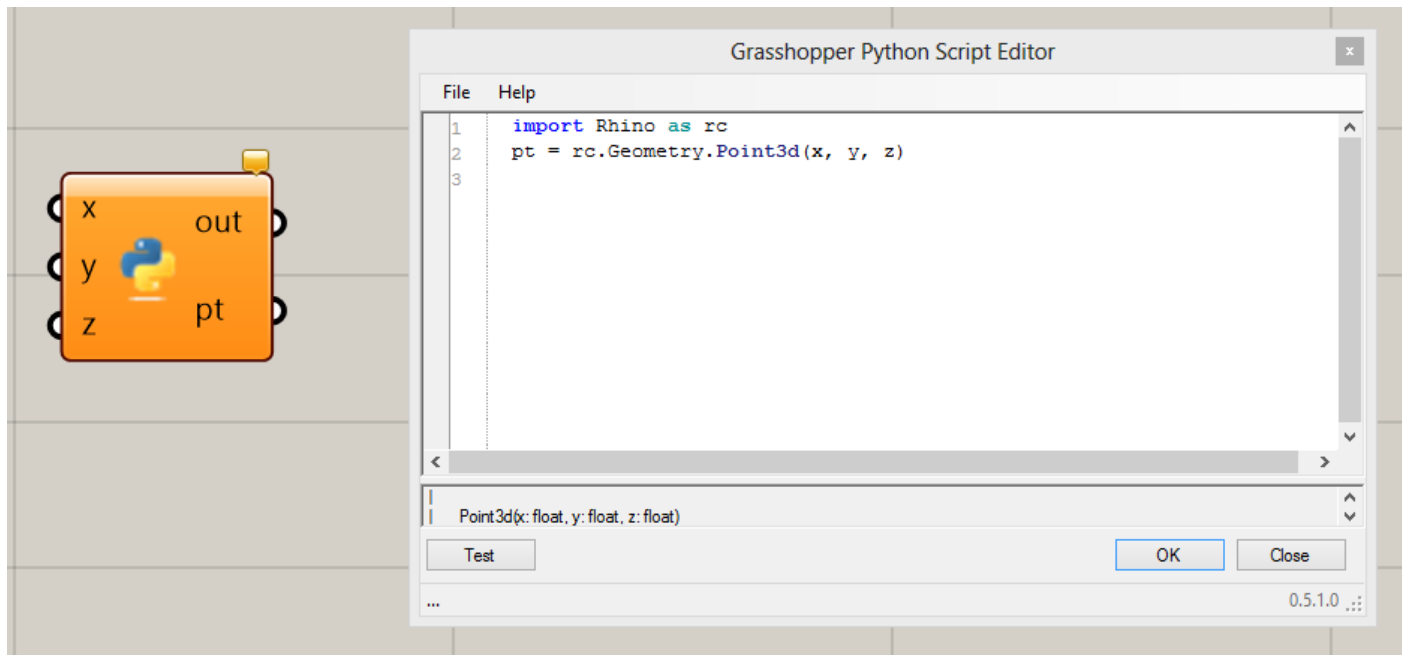
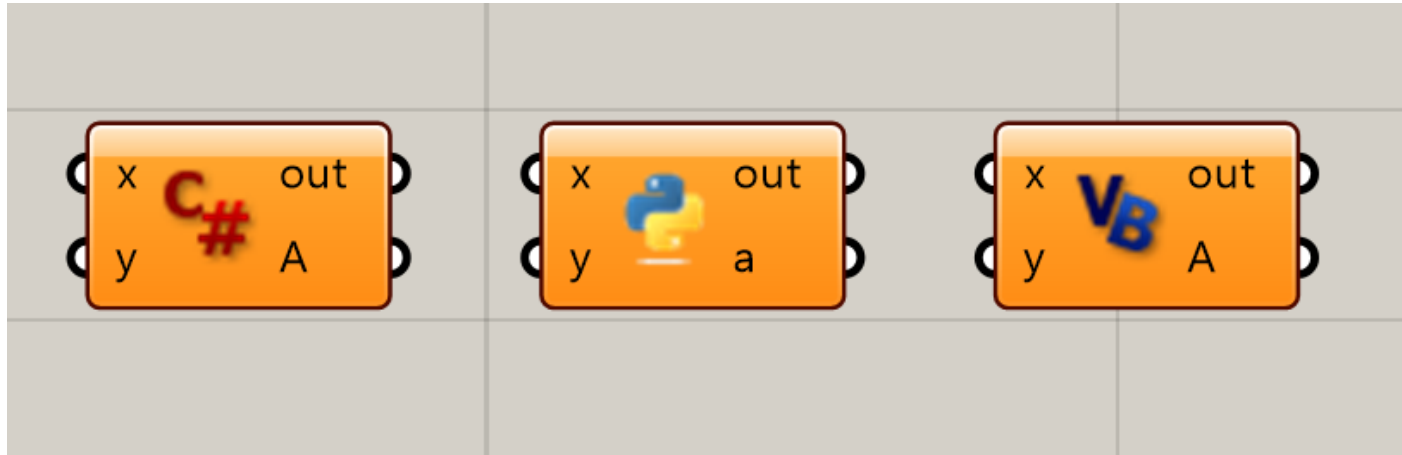


Visual Scripting

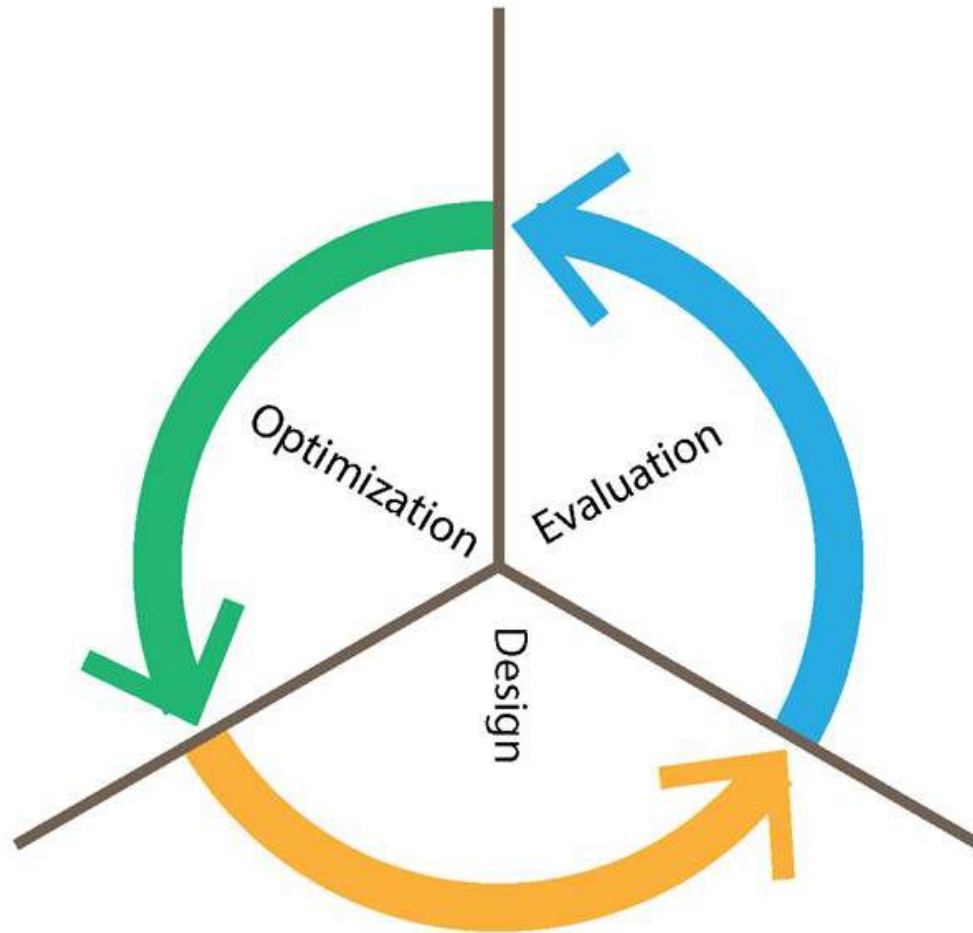
```
evenNum = []  
oddNum = []  
for i in range(10):  
    if i%2 == 0: even.append(i)  
    else: odd.append(i)
```



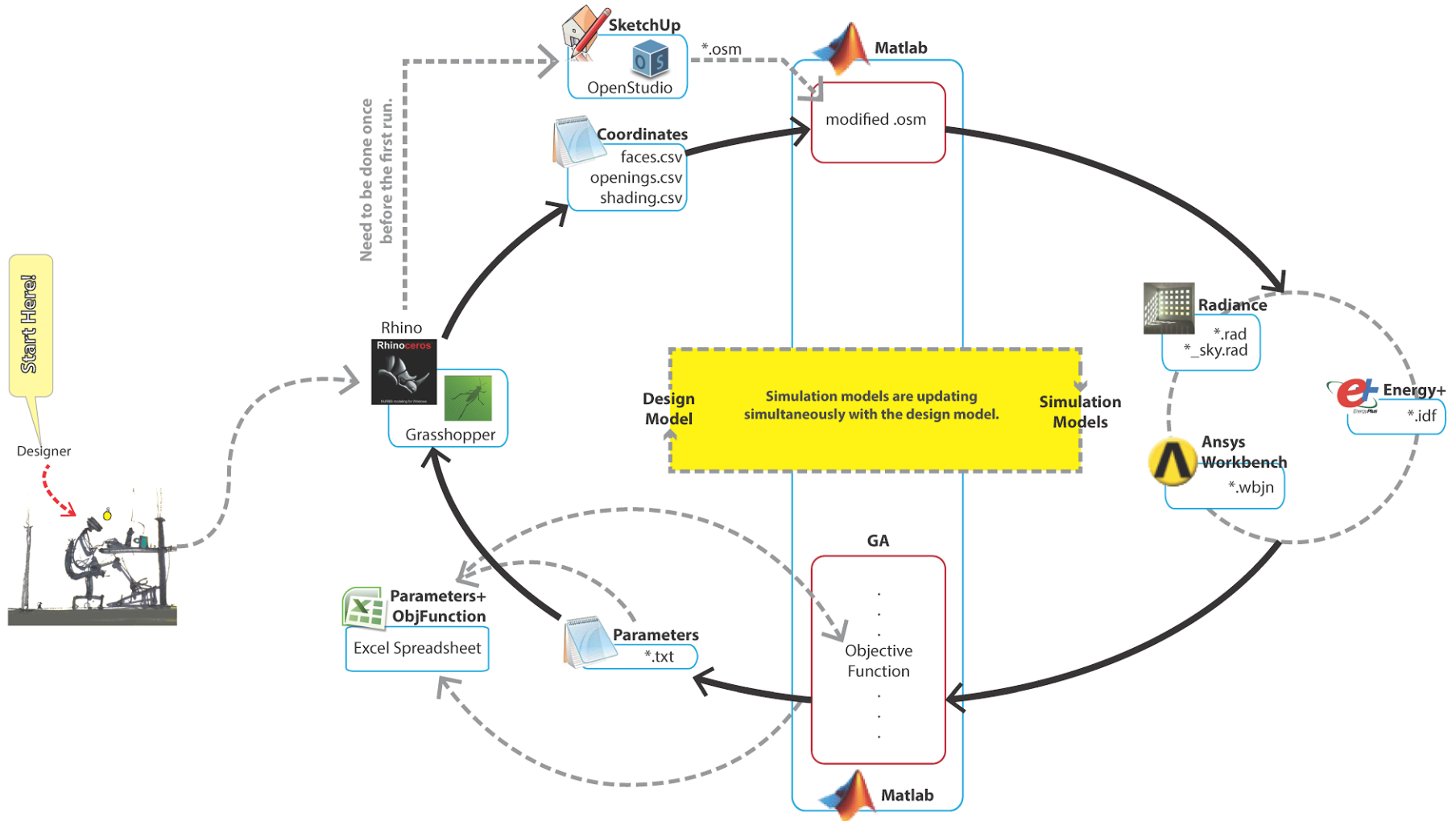
Make your own components!



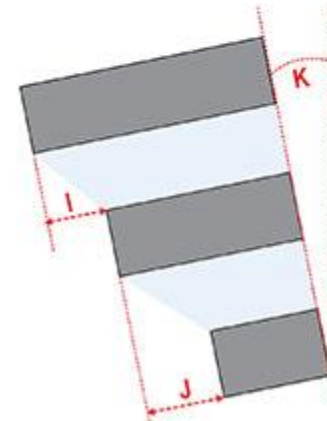
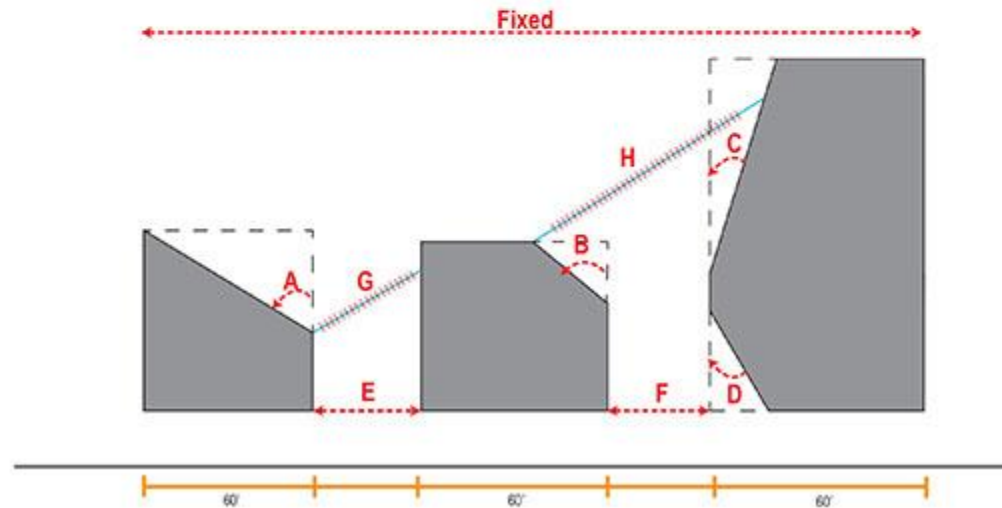
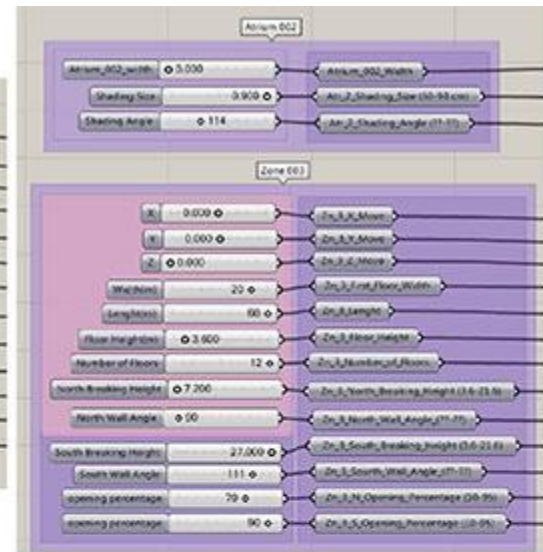
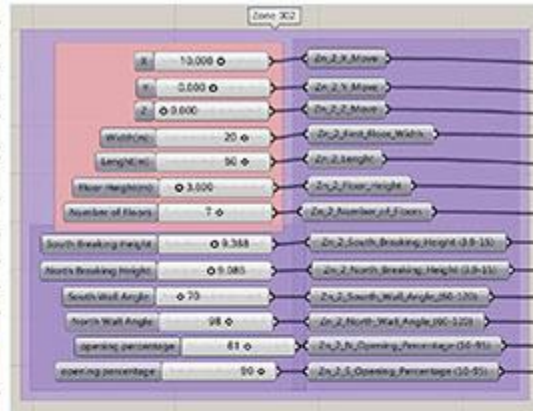
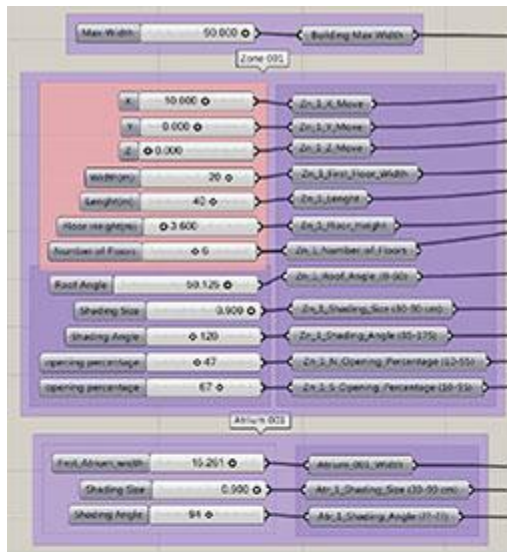
Let's Get Back to the Circle: Design - Evaluation- Optimization



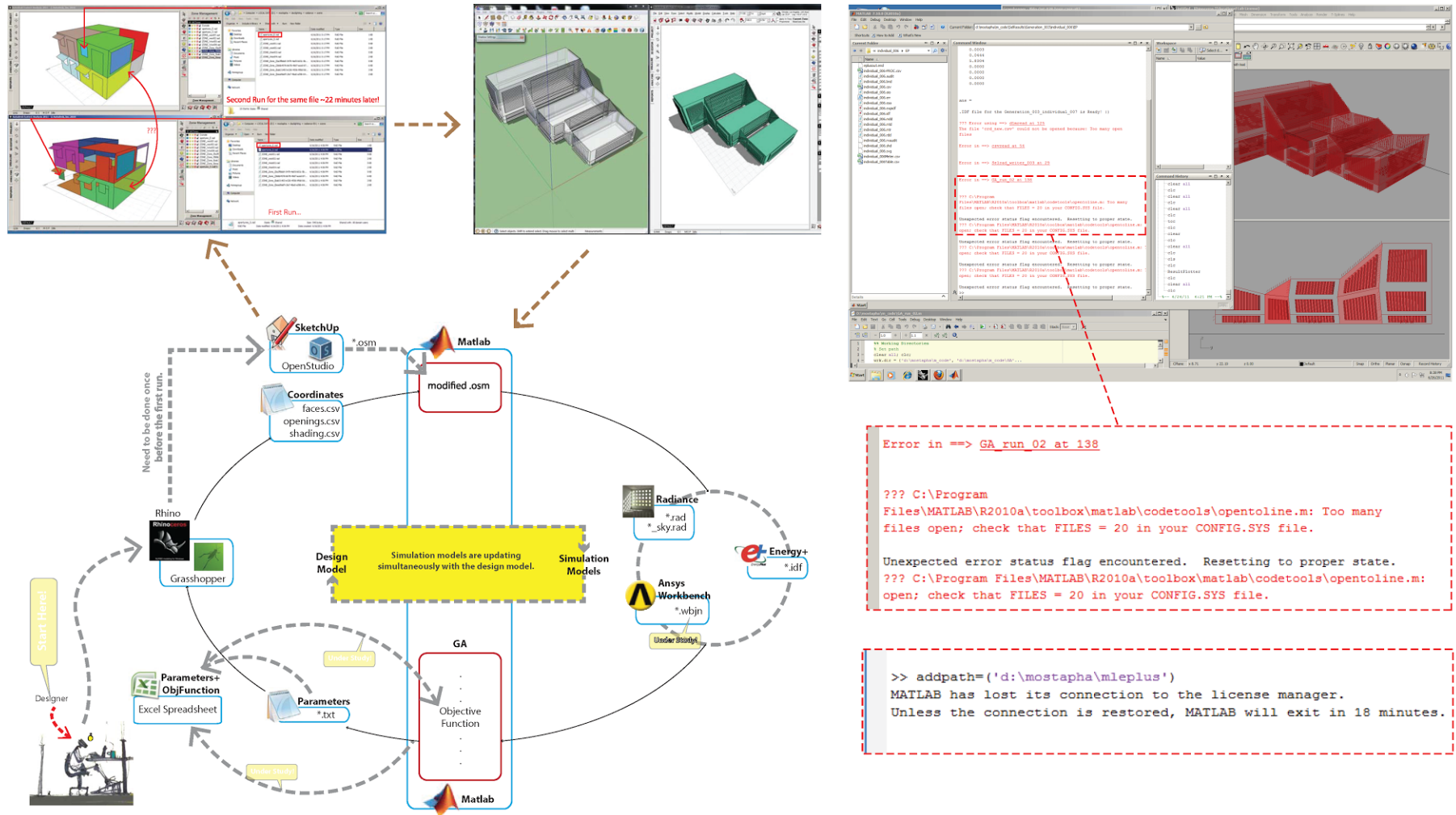
Design <> Evaluation <> Optimization Workflow - Idea



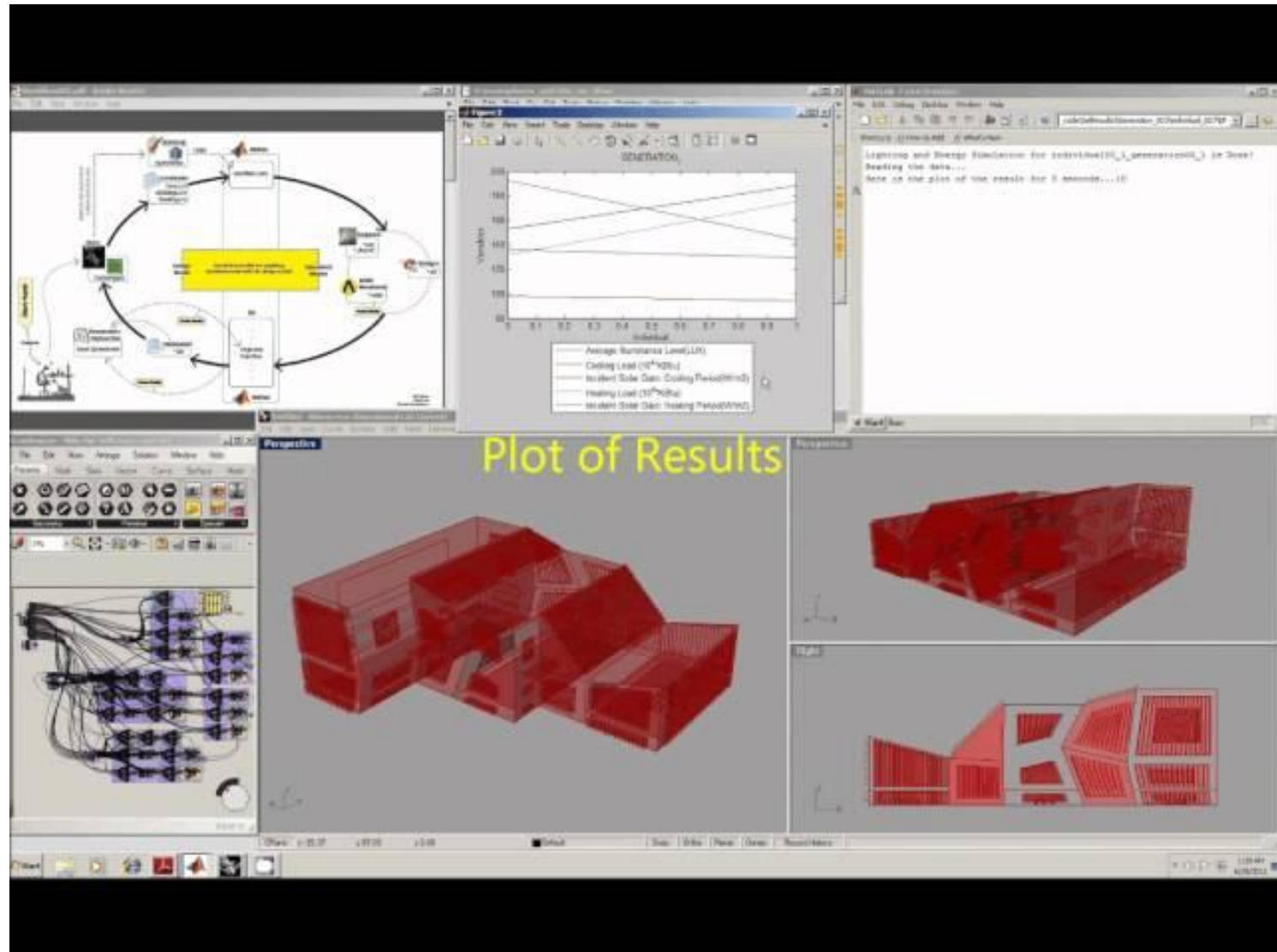
Design Parameters



Design <=> Evaluation <=> Optimization Workflow - Reality!



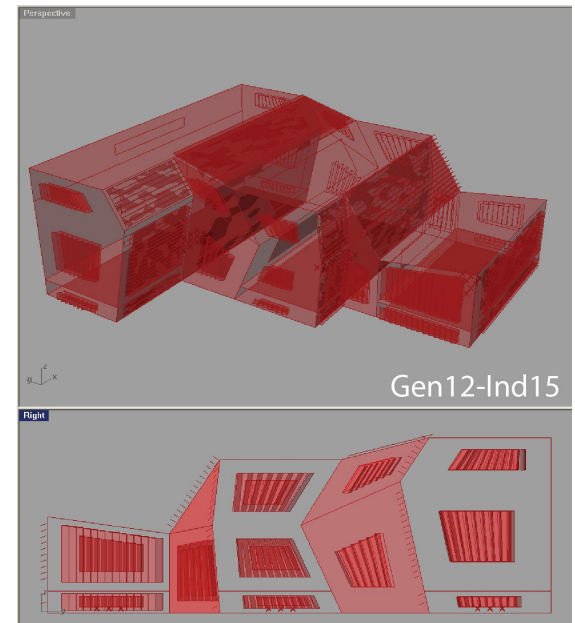
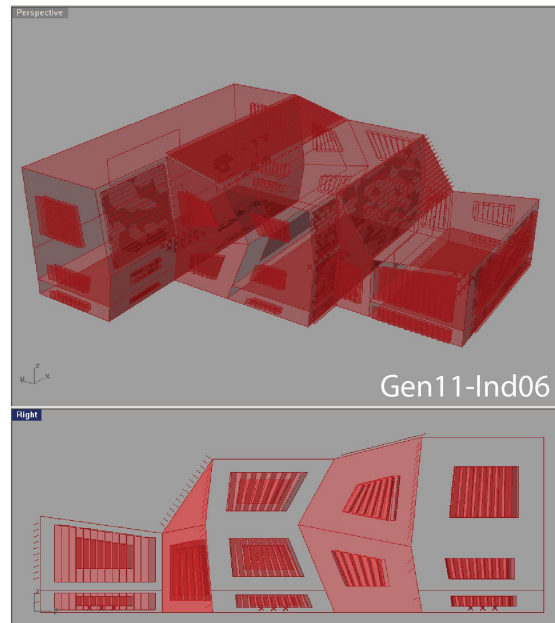
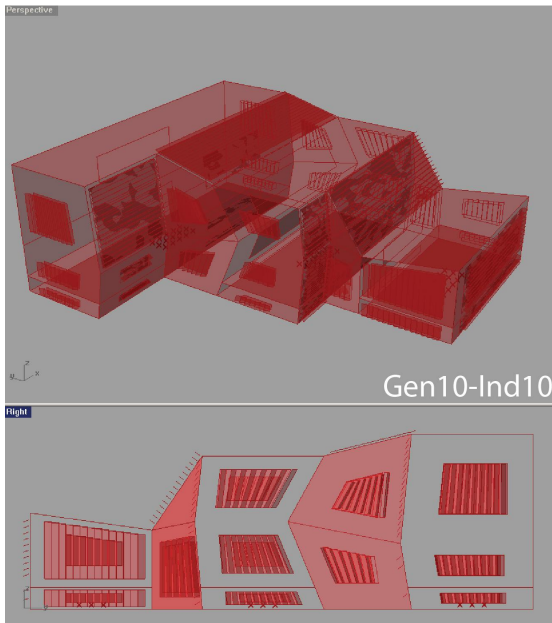
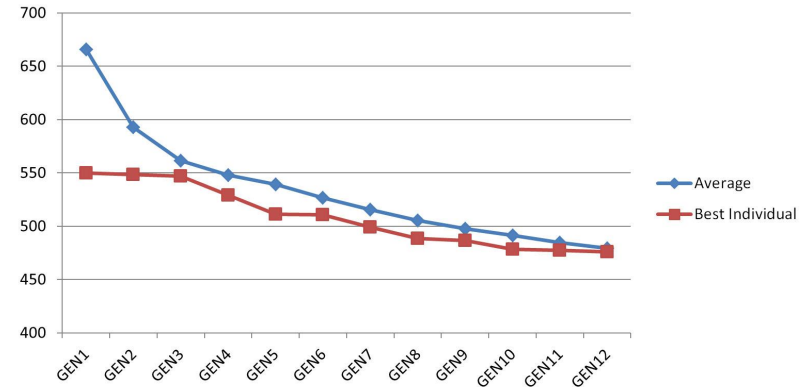
Design <> Evaluation <> Optimization Workflow - Result



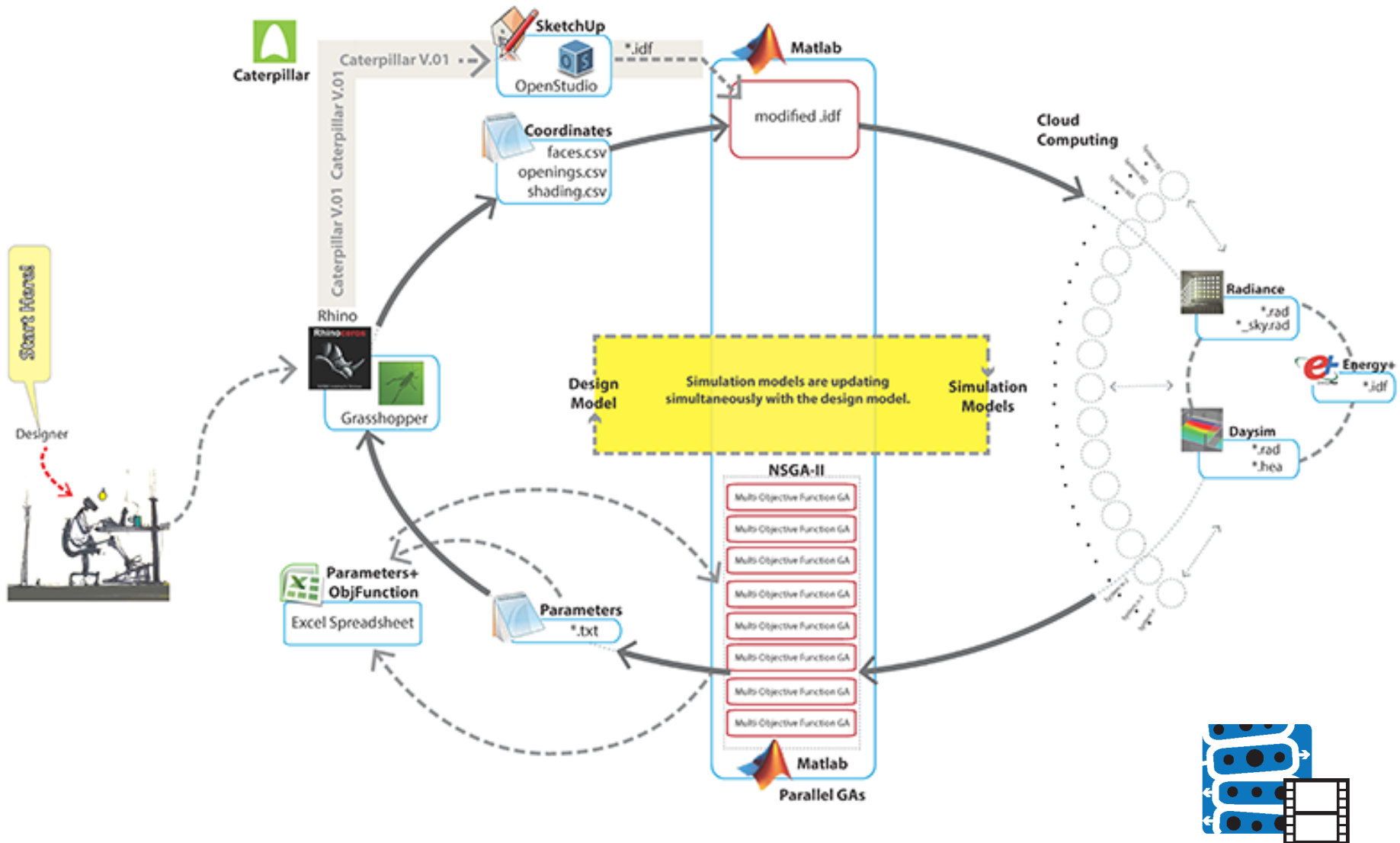
<http://www.youtube.com/watch?v=fYw7KexxThM>

Postpartum Depression

- Was it worth it?
- How long does it take to set up a similar workflow for the next project?
- Can I show to someone else how to do it?
- ...



Few Months later...

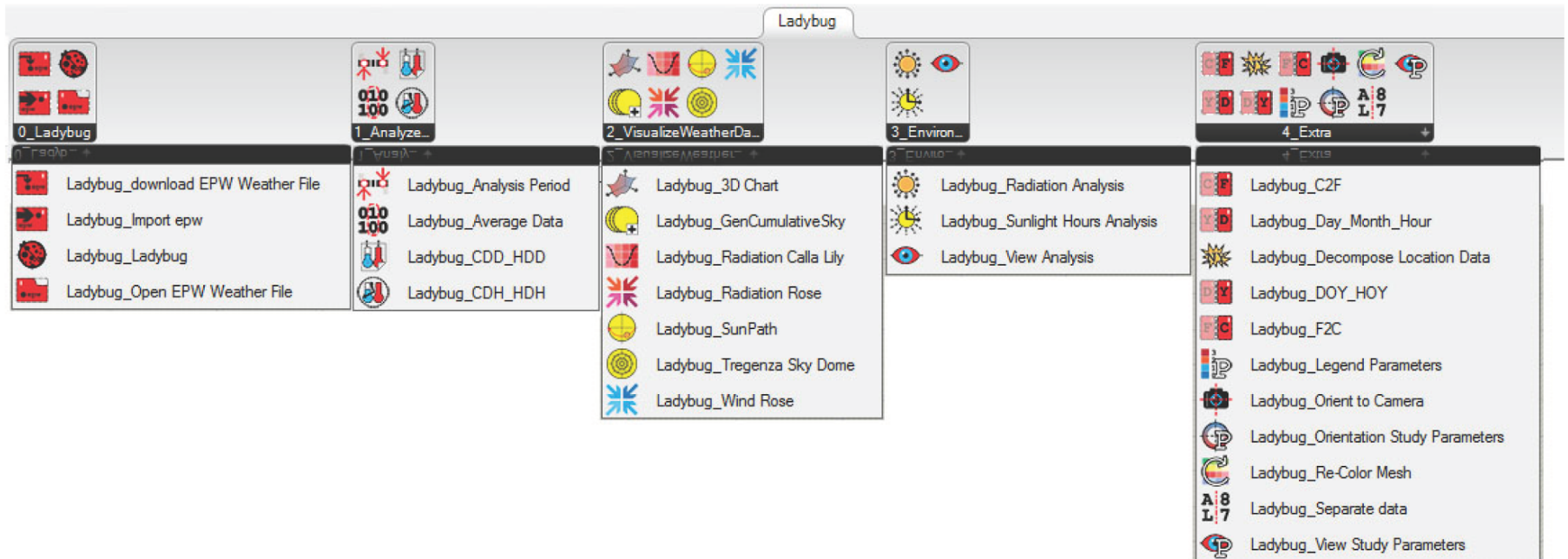


<http://www.youtube.com/watch?v=qdbo0uM9mj4>

Turning Point

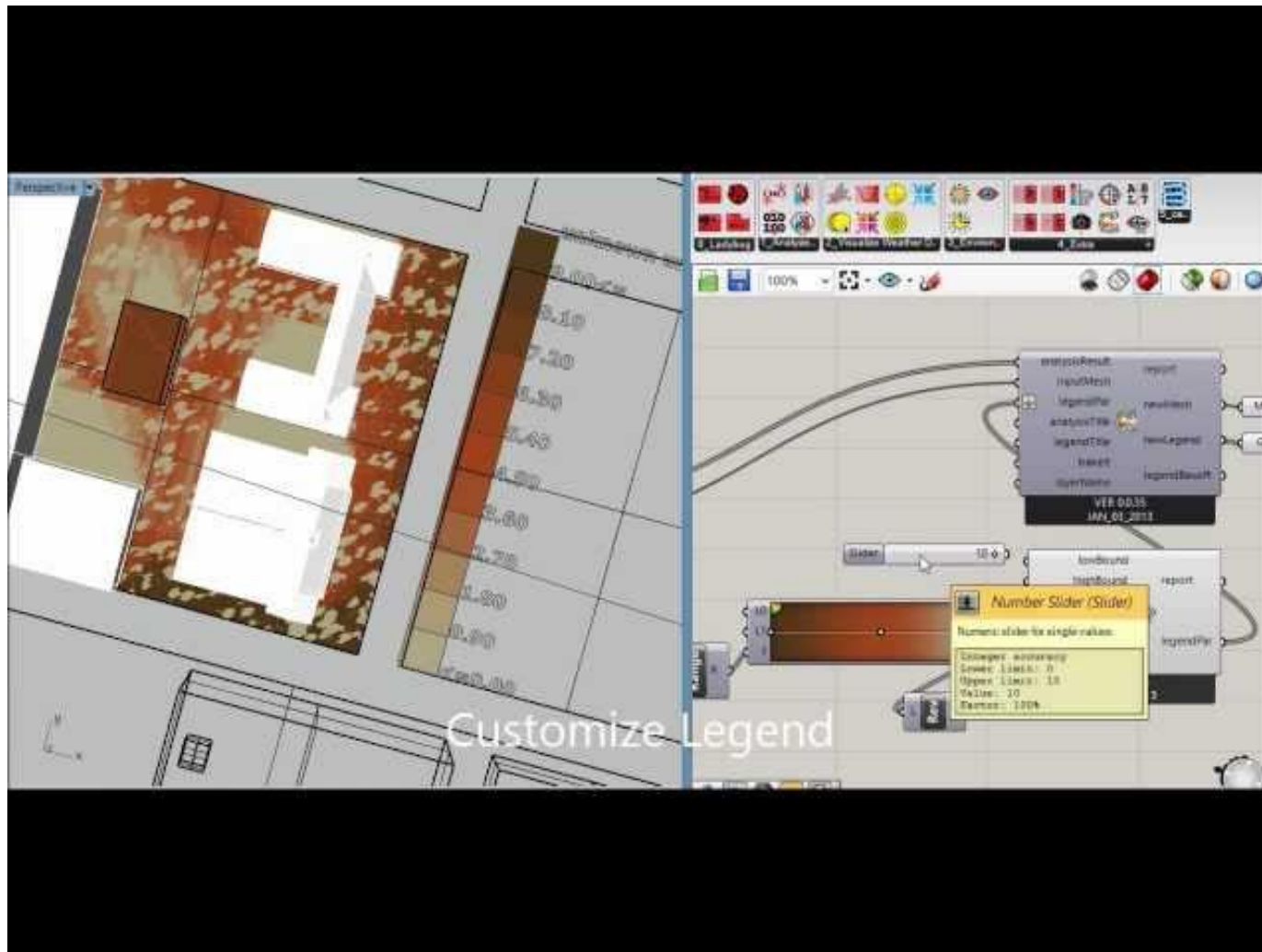
Keep It Simple **but not** **Stupid!**

Ladybug: Parametric [Weather Data] Analysis

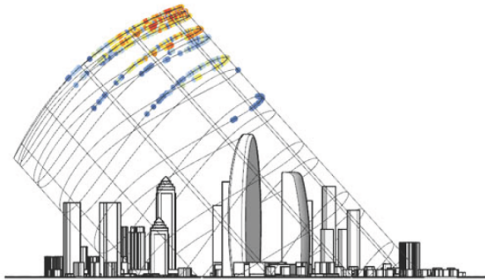


http://www.youtube.com/watch?v=OEjwAyC2I_0

Ladybug: Sun Path (Radiance)

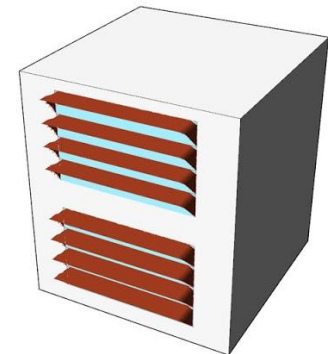
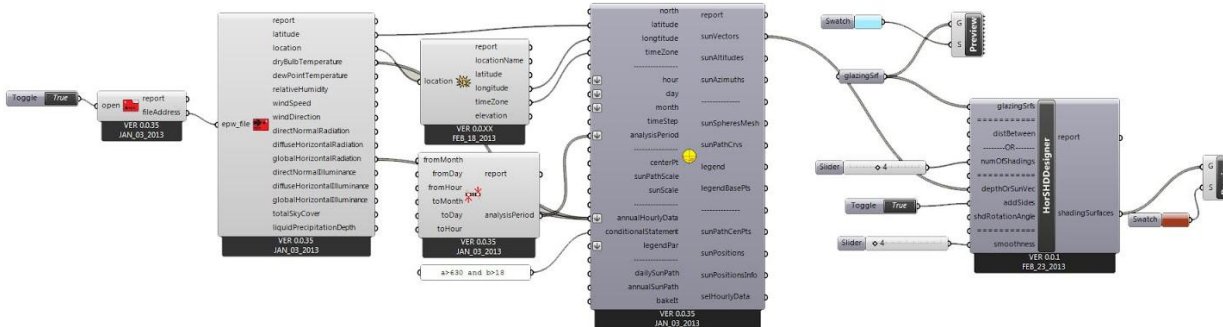
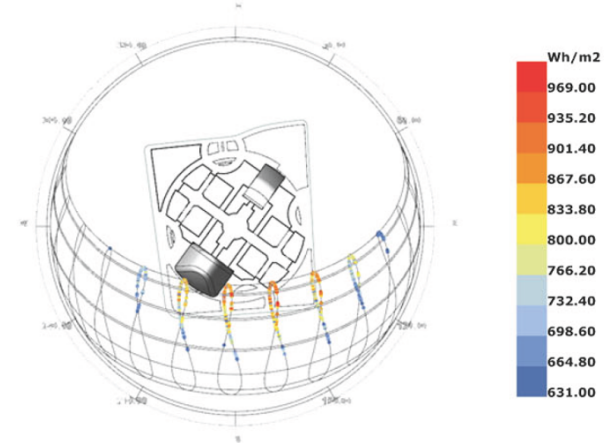
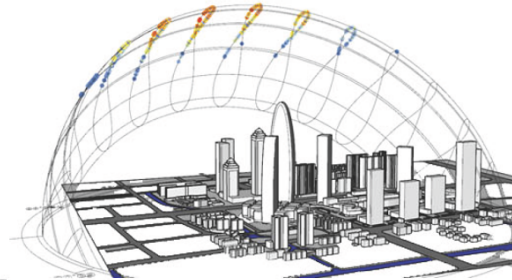


Ladybug: Sun Path (Radiance) + Hourly Weather Data

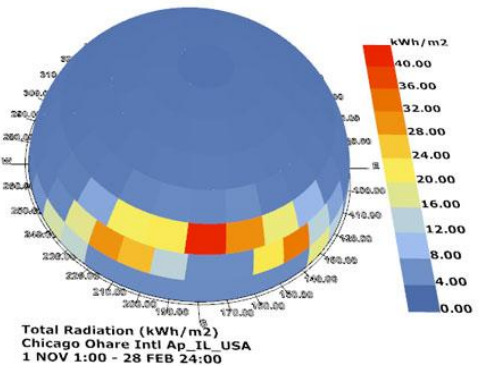
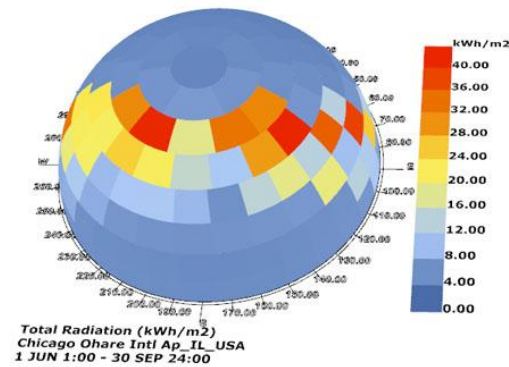
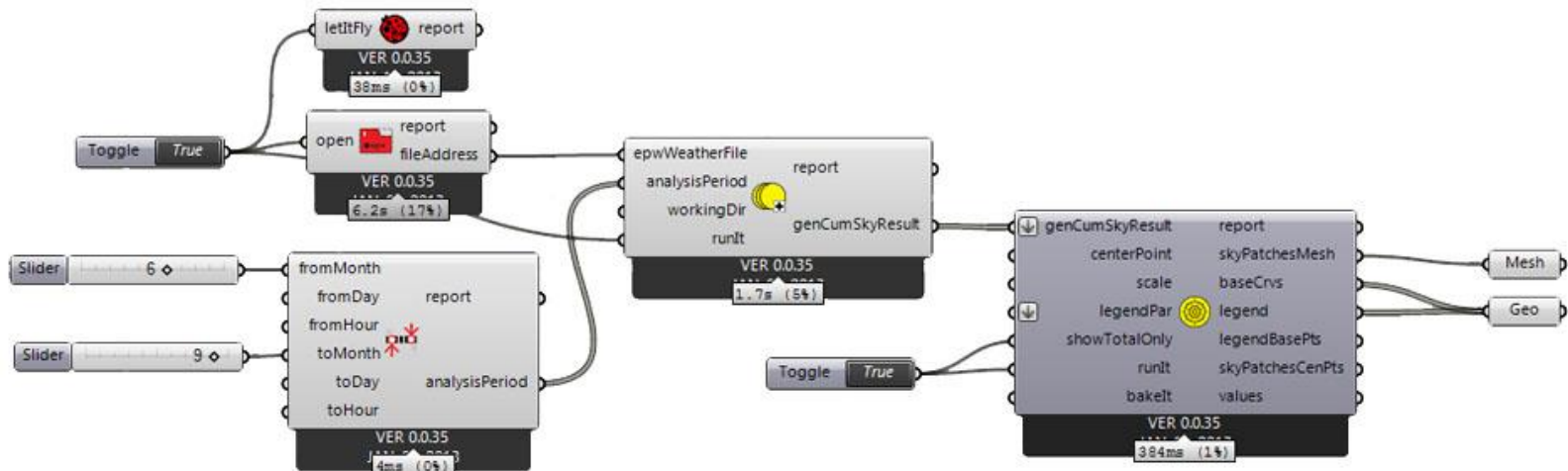


Sun-Path Diagram - Latitude: 41.98
Hourly Data: Global Horizontal Radiation (Wh/m2)
Chicago Ohare Intl Ap_IL_USA

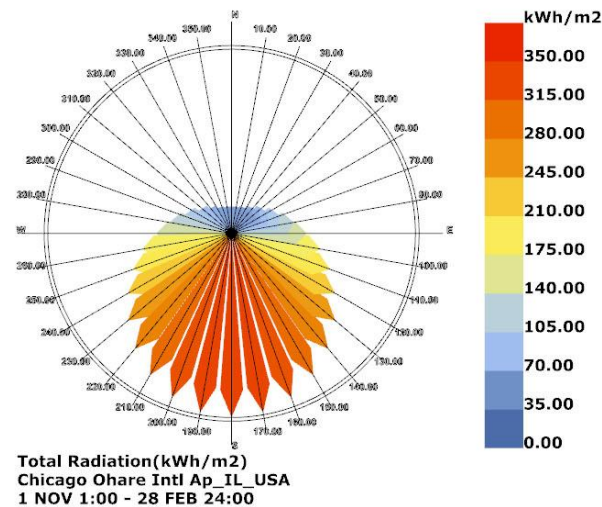
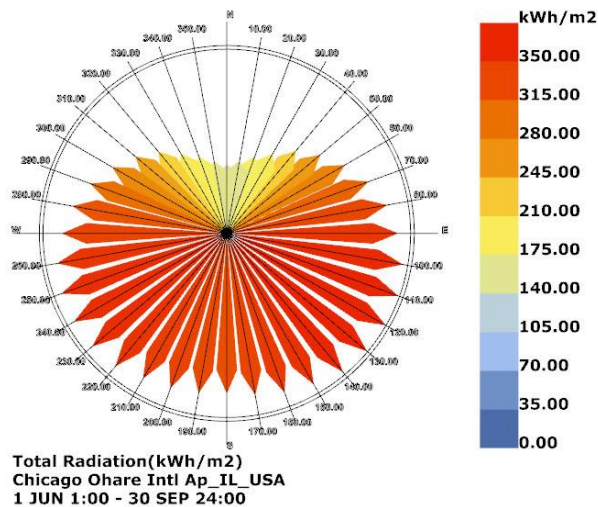
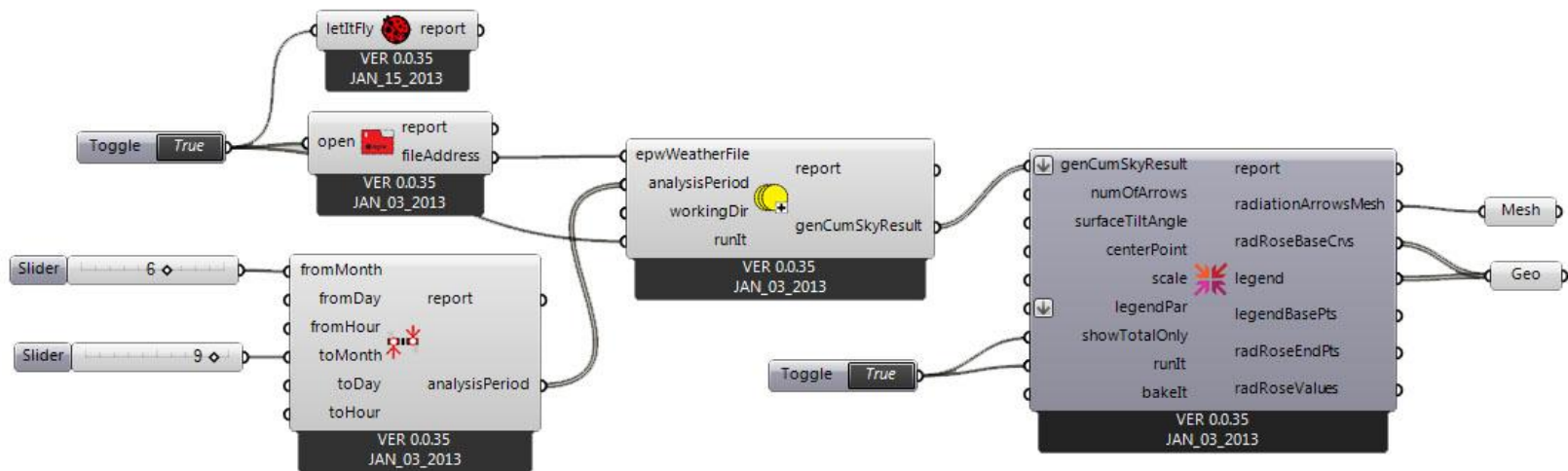
...
Conditional Selection Applied:
Global Horizontal Radiation > 630
and Dry Bulb Temperature > 18
556.0 hours of total 4616.0 sun up hours (12.05%).



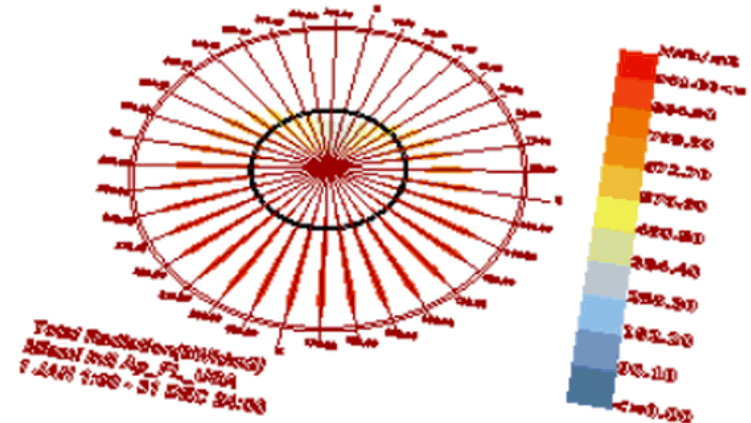
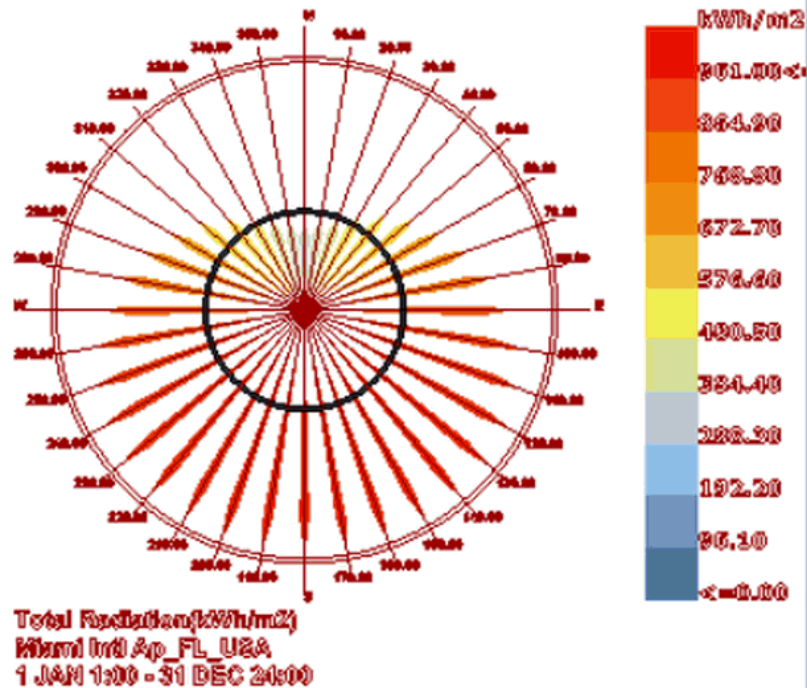
Ladybug: Tregenza Sky Dome (GenCumulativeSky)



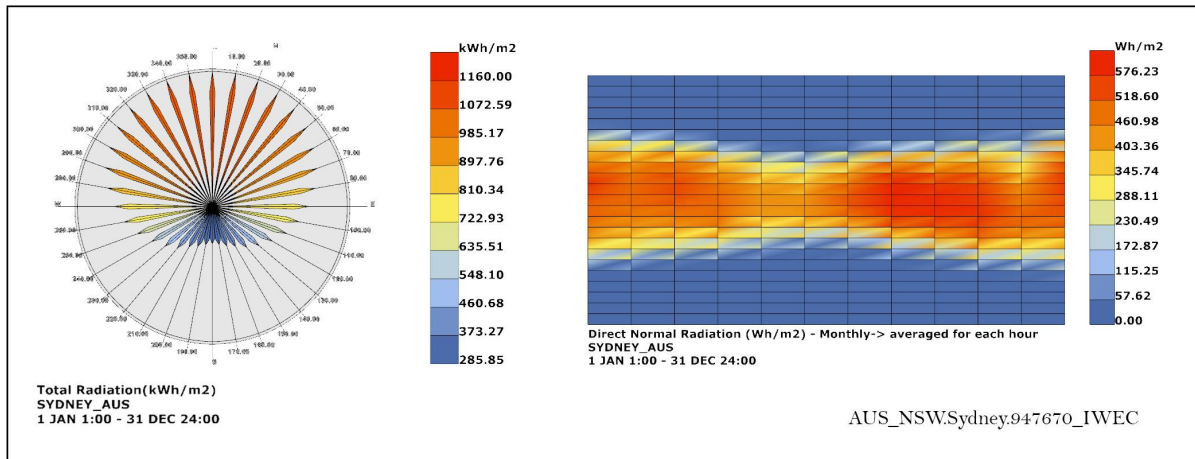
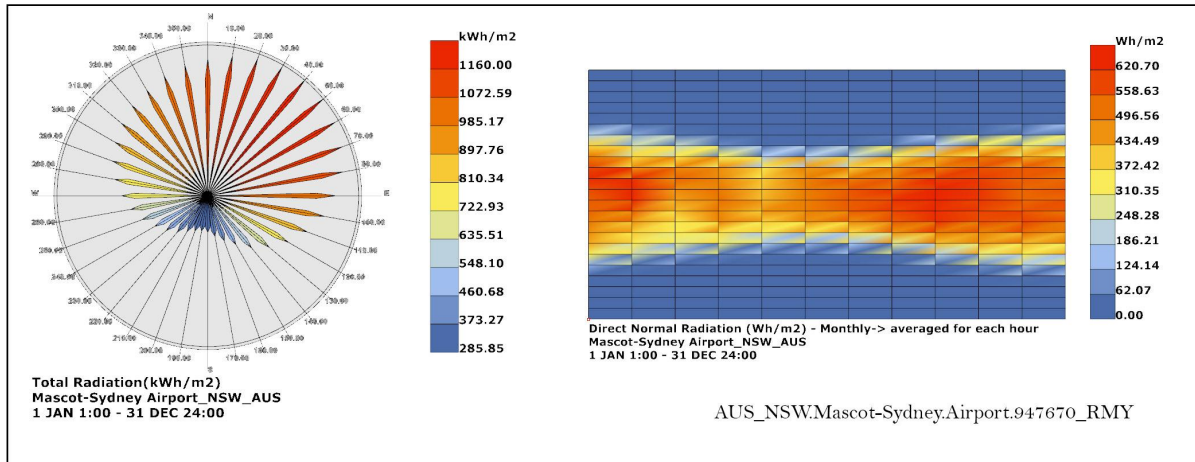
Ladybug: Radiation Rose (GenCumulativeSky)



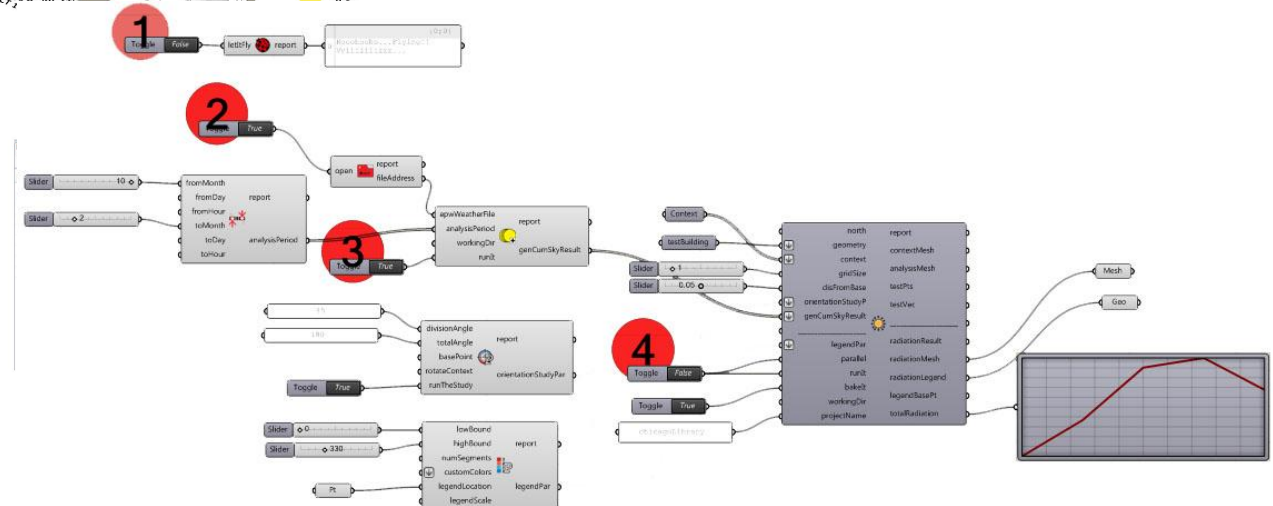
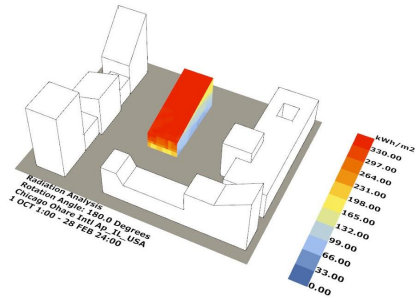
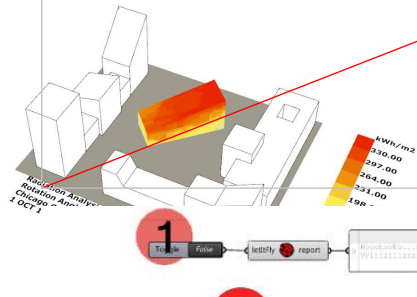
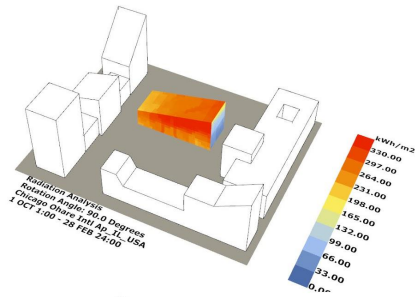
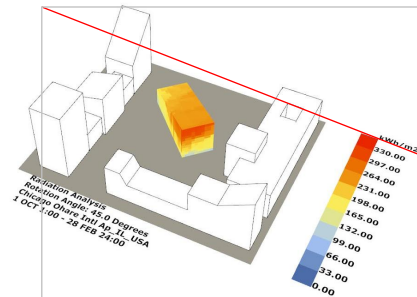
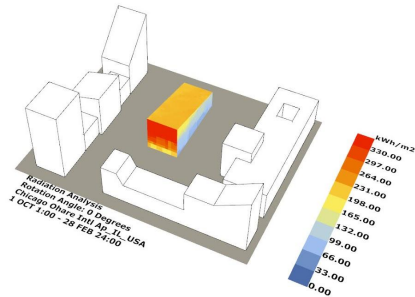
Ladybug: Interactive Radiation Rose (GenCumulativeSky)



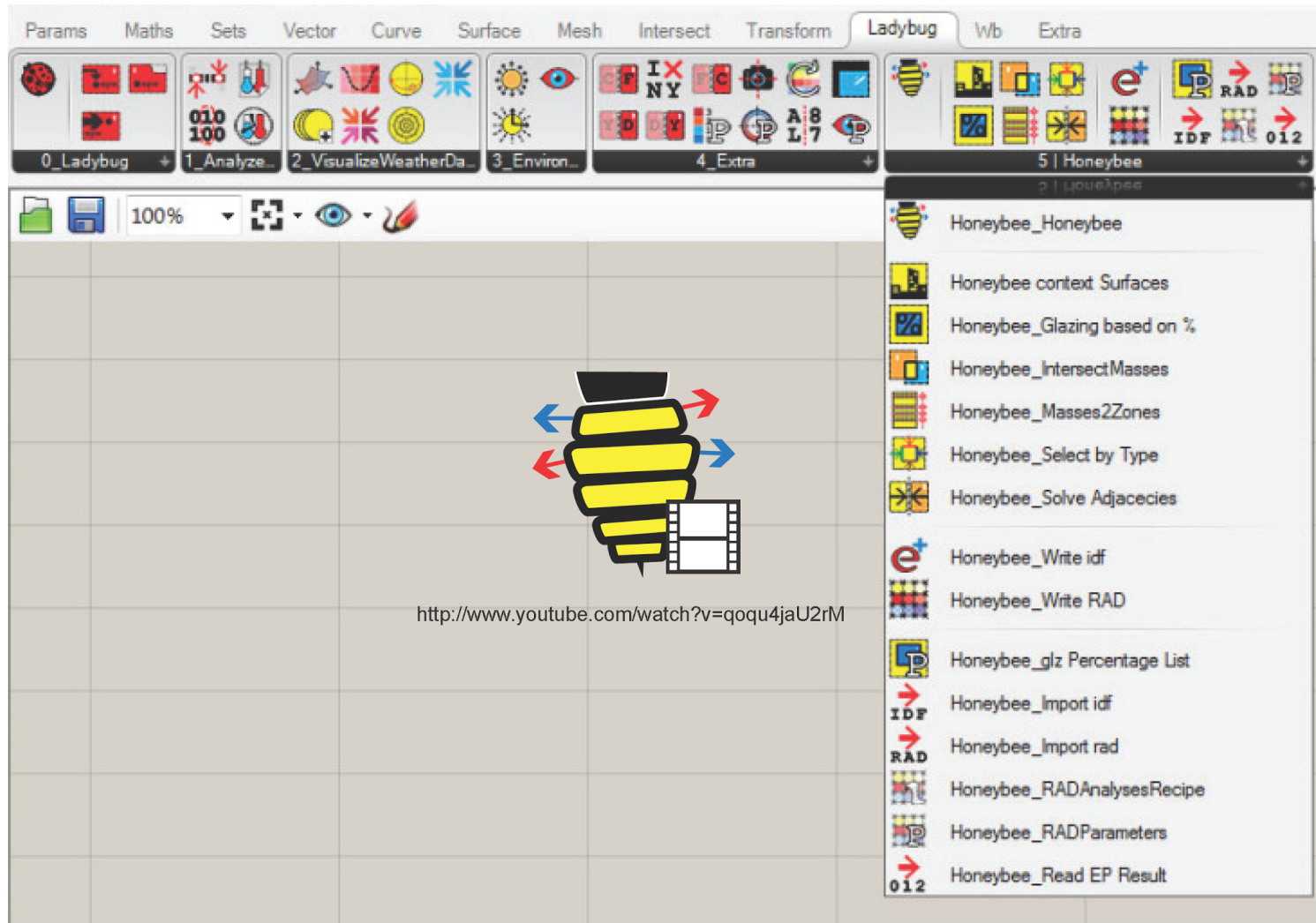
Ladybug: Weather Data Verification



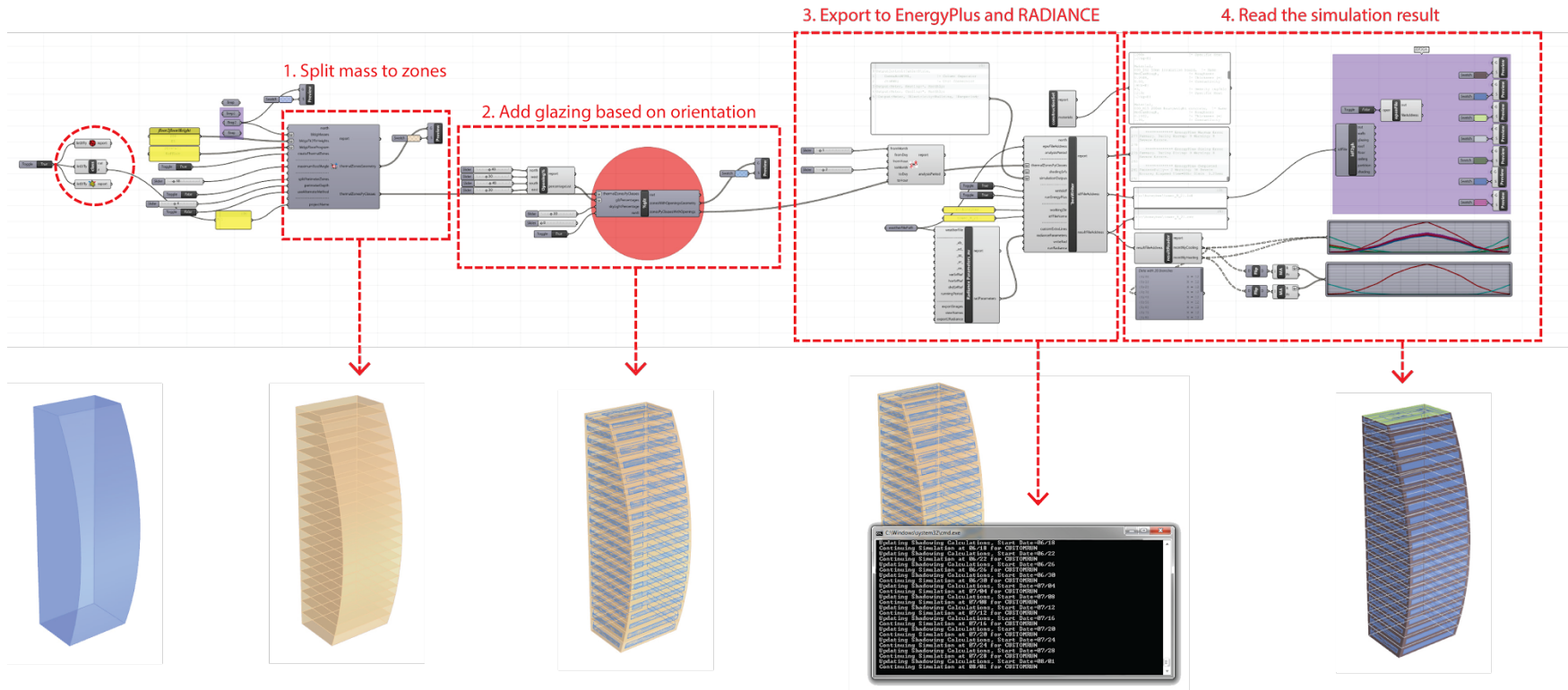
Ladybug: ~Realtime Radiation Studies (GenCumulativeSky + Parallel Raytracing)



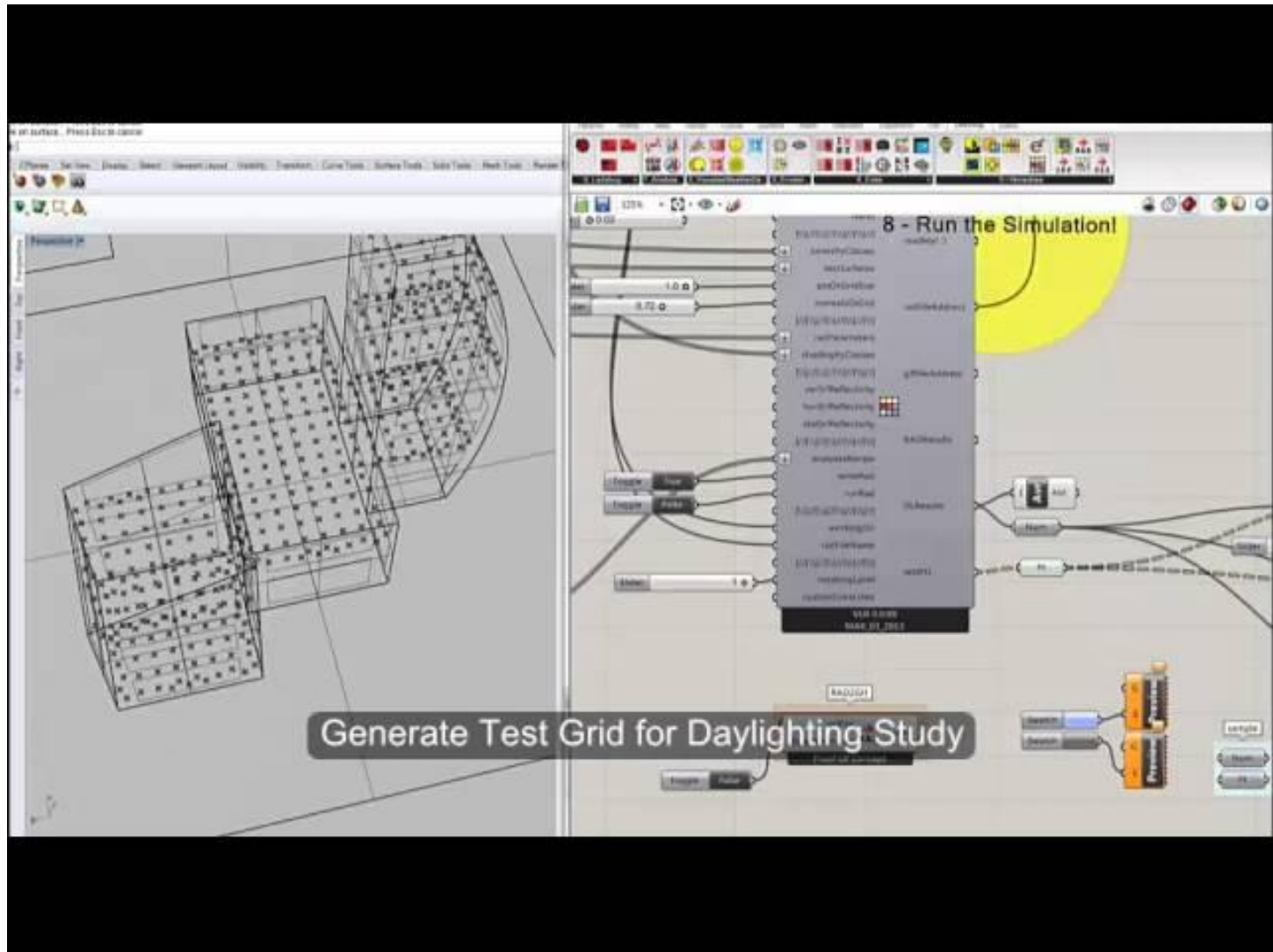
Honeybee: Grasshopper <> Radiance/Daysim/EnergyPlus



Honeybee: WorkFlow

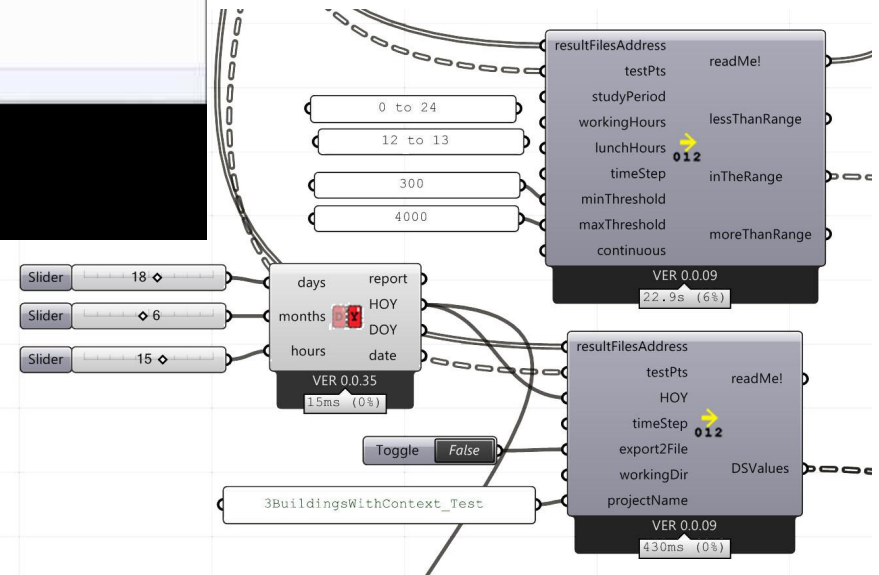
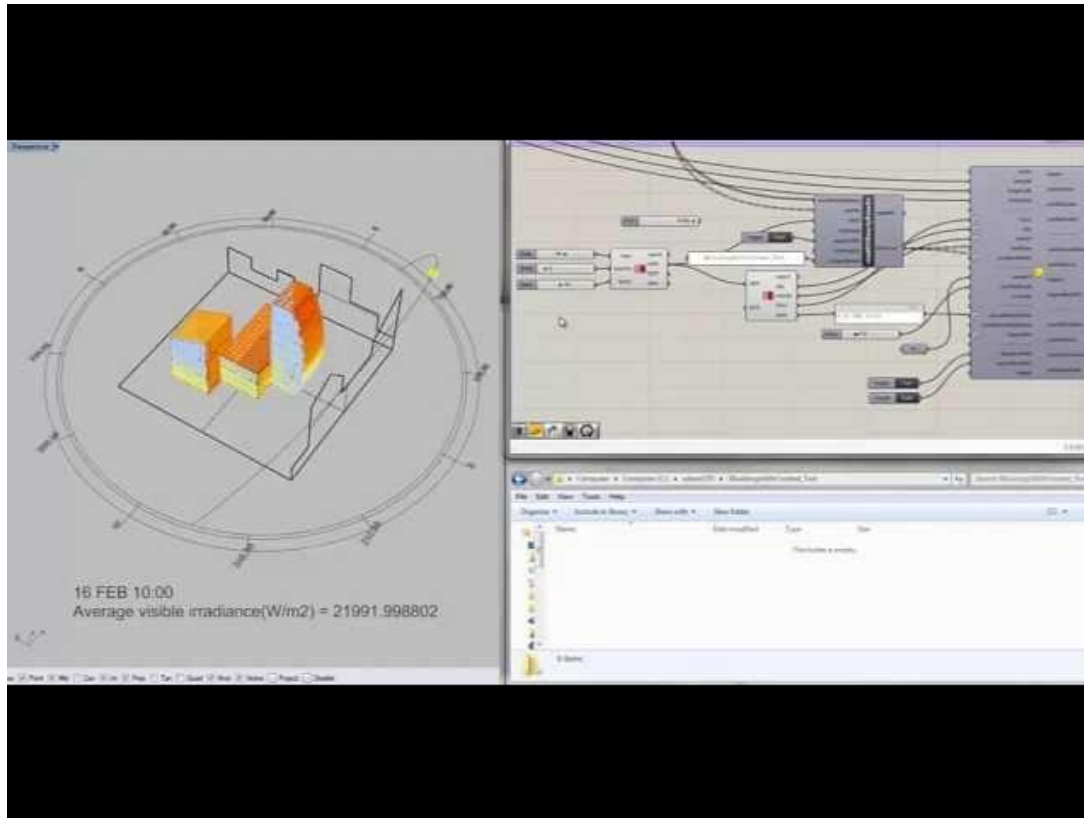


Honeybee: All in 2 Minutes!

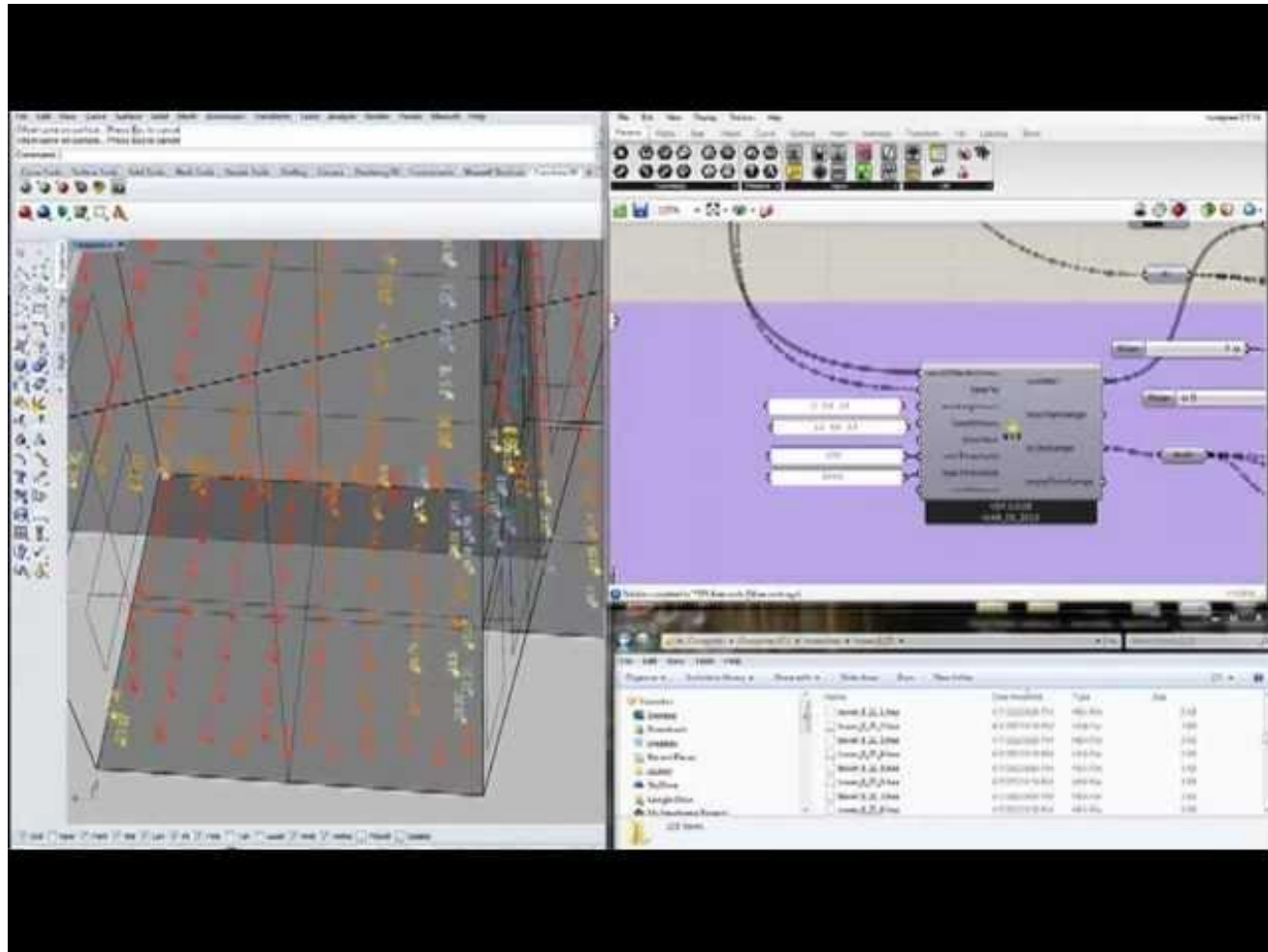


Watch the full length video here: <http://www.youtube.com/watch?v=aoMy4O3vN6g>

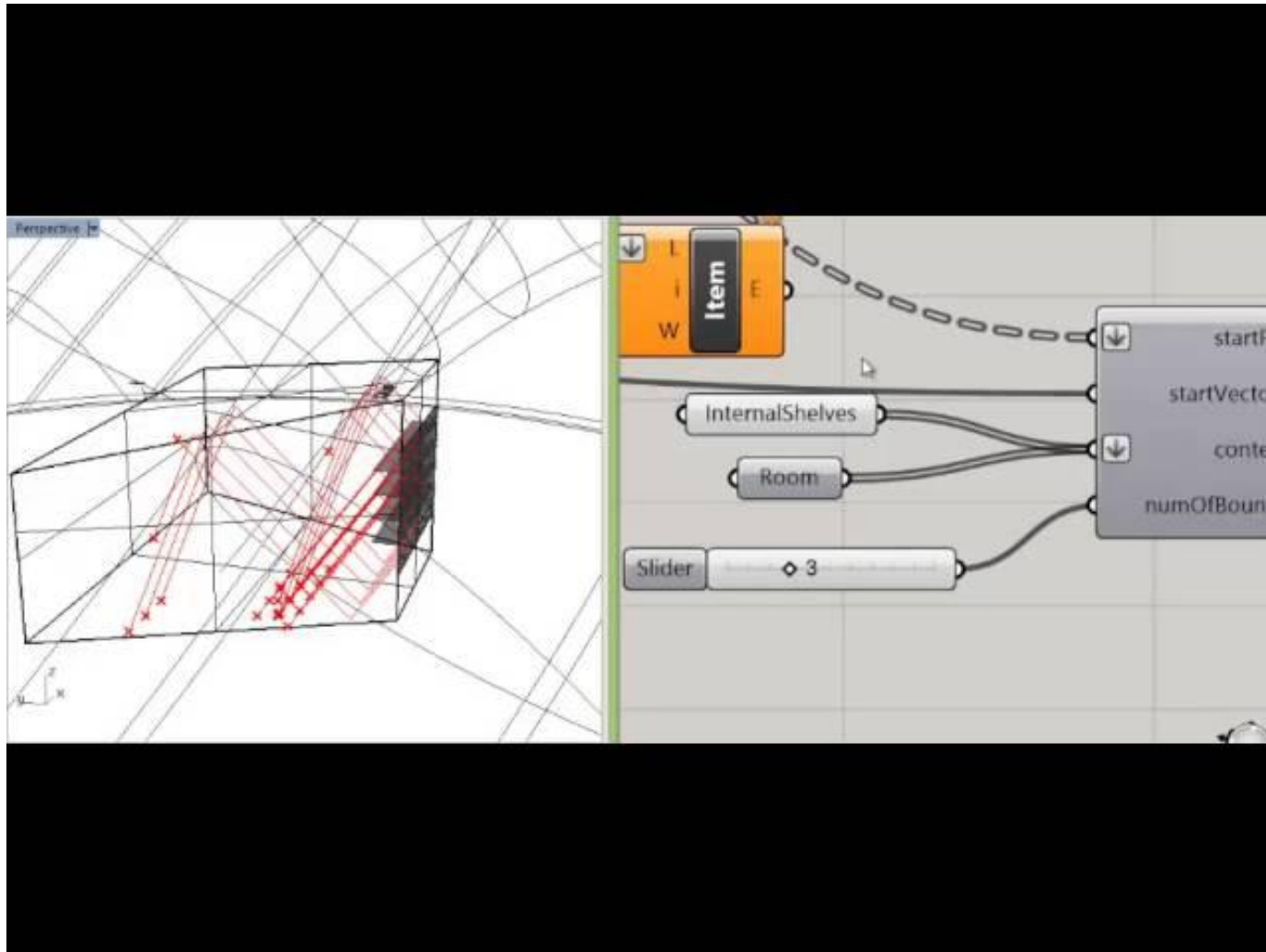
Honeybee: Make it faster and More Parametric Friendly!



Honeybee: Make it faster and More Parametric Friendly!



Honeybee: Make it faster and More Parametric Friendly!



Honeybee: Does it look right?

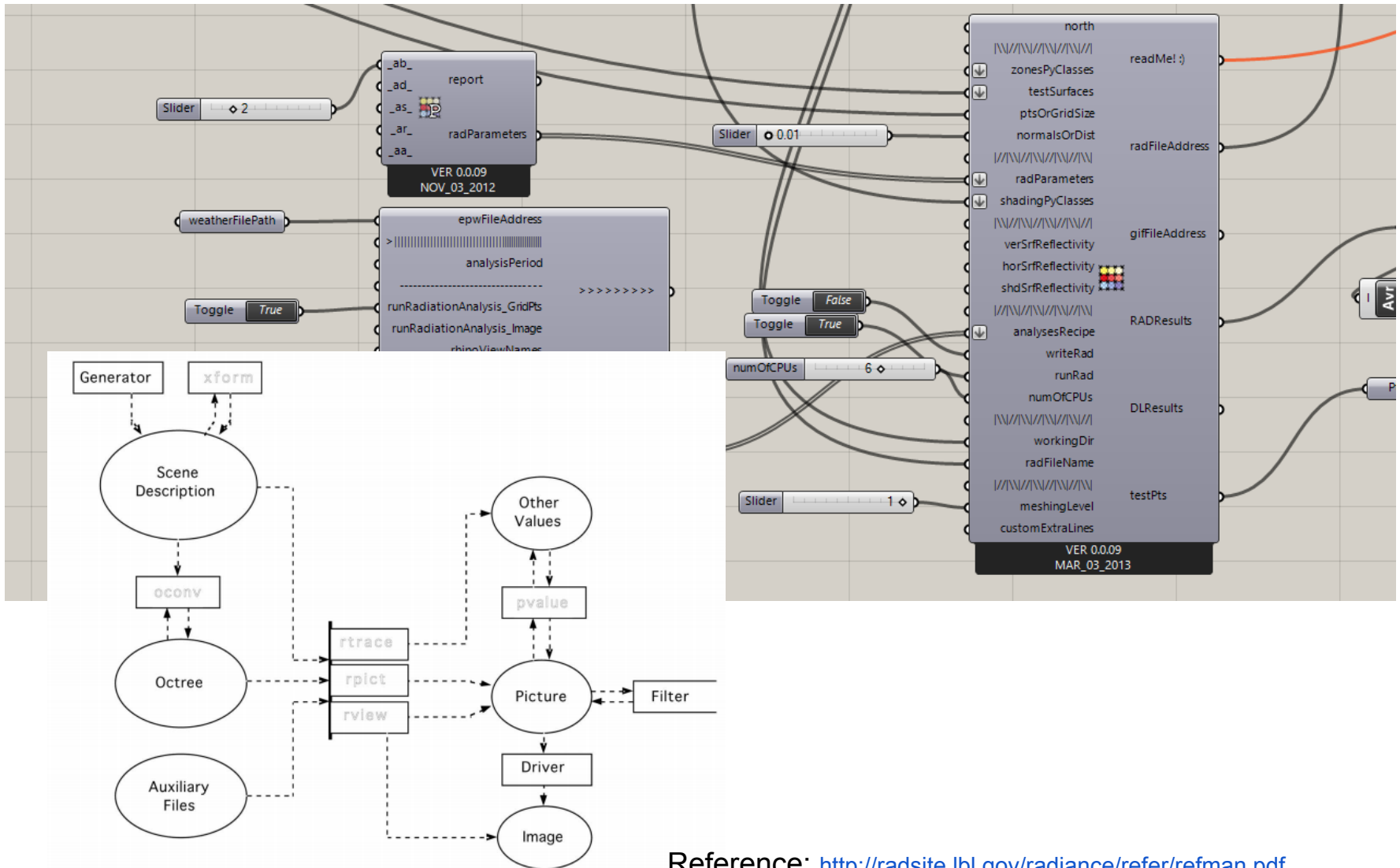
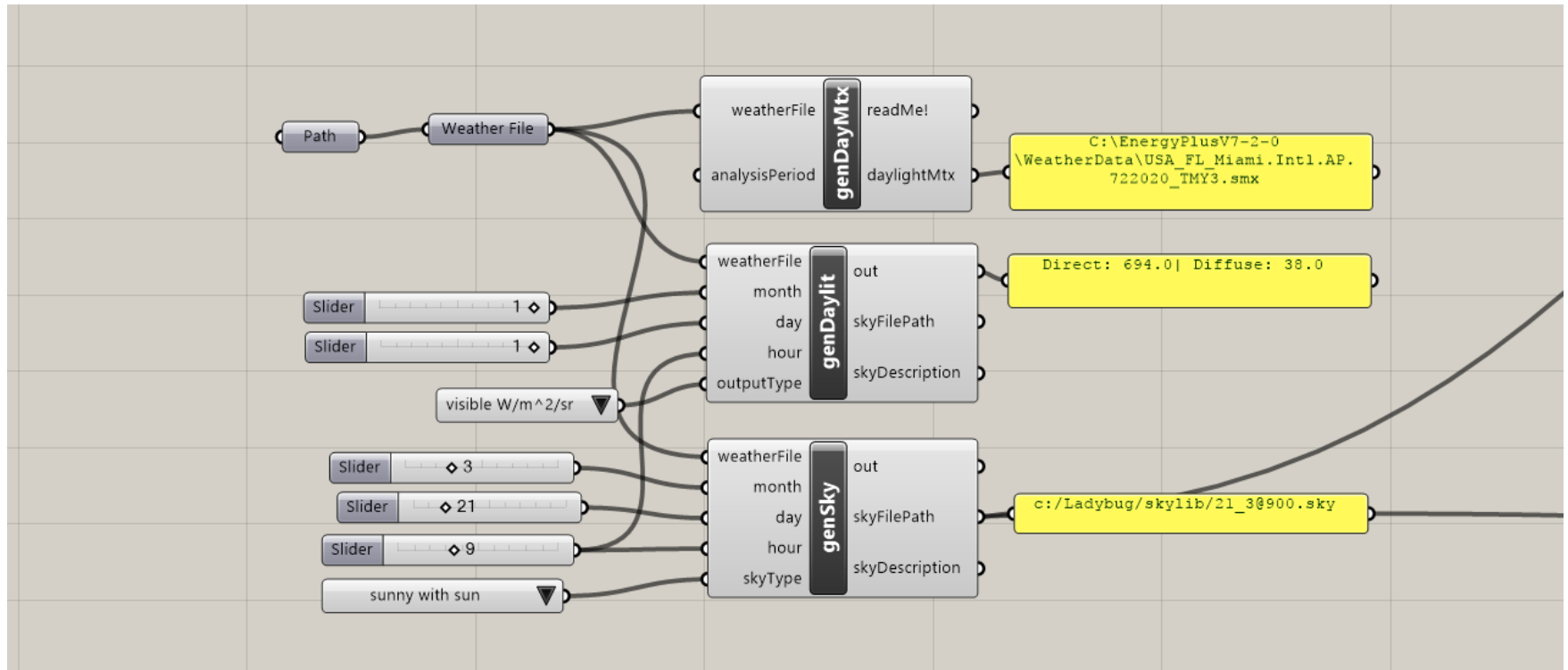


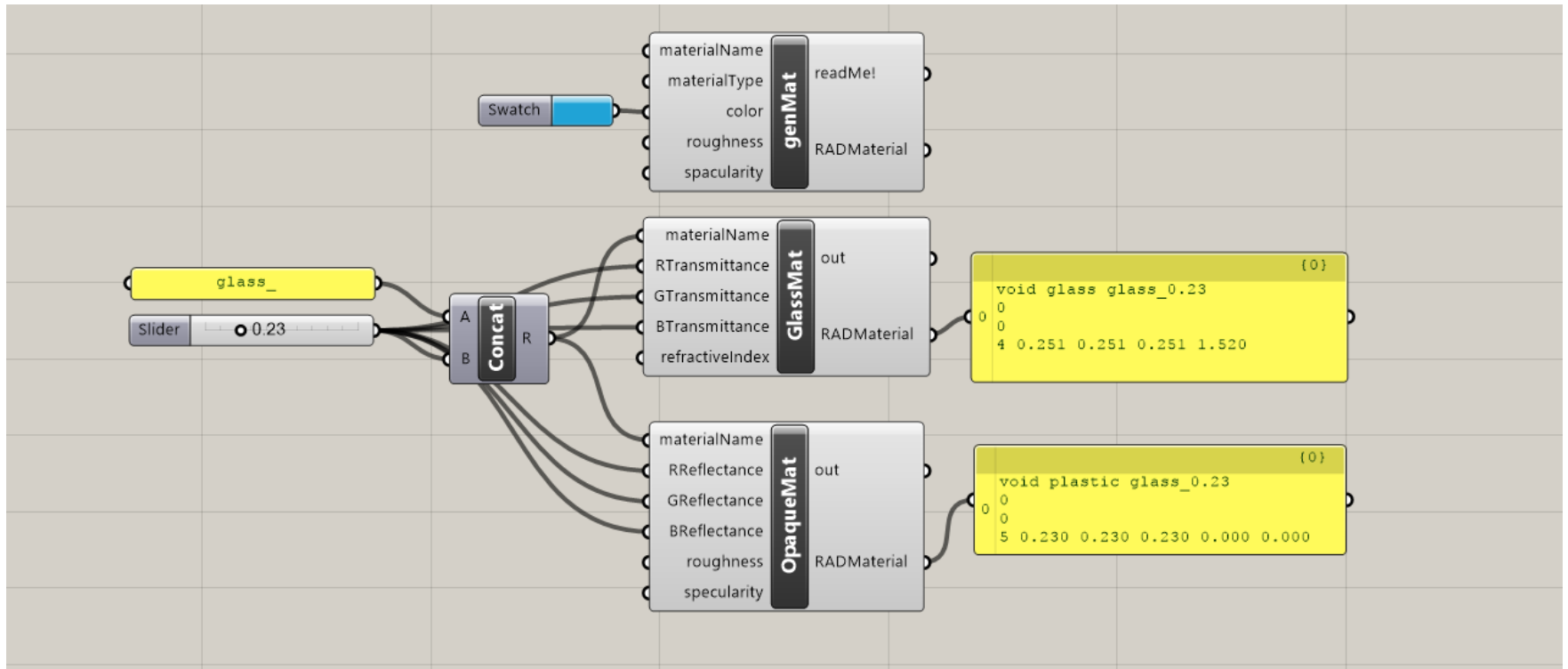
Figure 1.

Reference: <http://radsite.lbl.gov/radiance/refer/refman.pdf>

Honeybee: Multiple Sky Methods



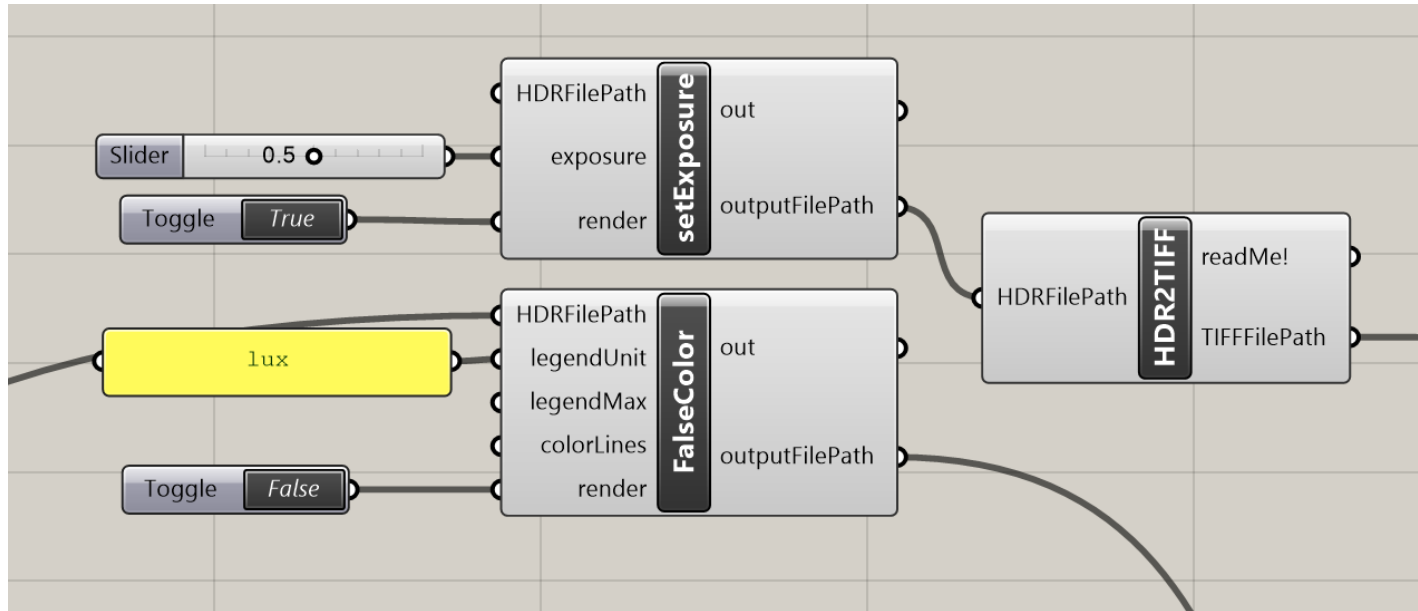
Honeybee: Multiple Material Components



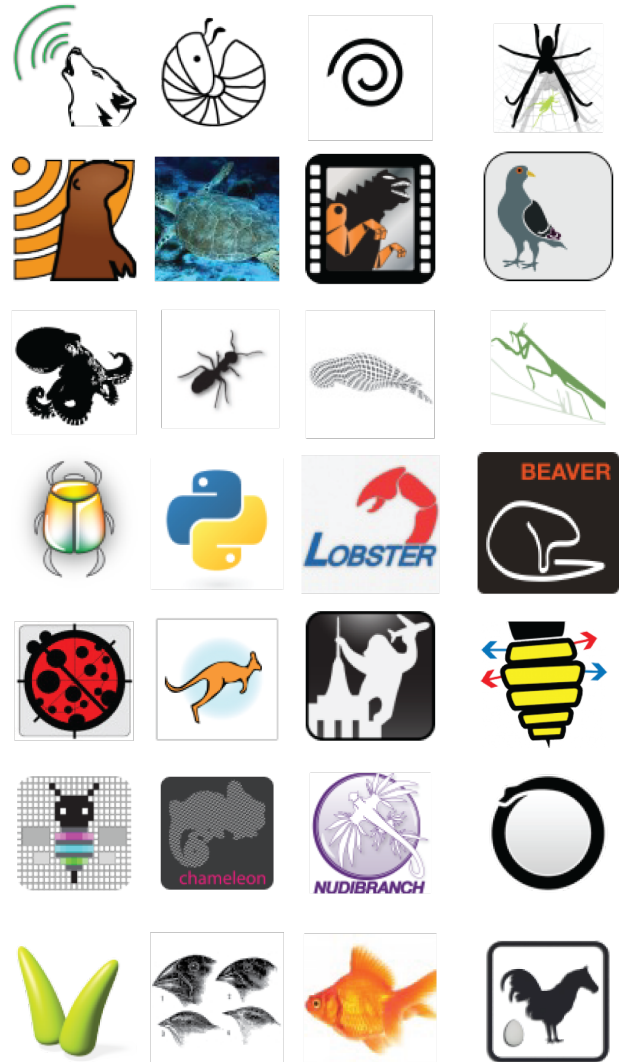
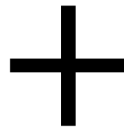
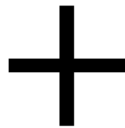
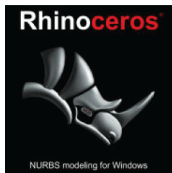
The image shows a Houdini 17.5.60 node network for rendering a scene. The network is organized as follows:

- Resource Loading:** Four yellow nodes provide file paths to a **RADScene** node:
 - `C:\ladybug\20130801_SunnySky\cultureShed.rad`
 - `C:\ladybug\20130801_SunnySky\outerETFE.rad`
 - `C:\ladybug\20130801_SunnySky\innerETFE.rad`
 - `C:\ladybug\CSHed_DL_01\context.rad`
 - `C:\ladybug\test\material_test.rad`
- RADScene Node:** A central node with inputs for `RADFilePath`, `materialPath`, `skyFilePath`, `_projectName`, and `run`. It has an `out` output.
- View and Scale:** A **View** node is connected to the `out` of the first **RADScene** node. It has a `scale` input (set to 1) and a `update` input (set to 1). A `Toggle` switch is set to `False`.
- Rendering:** A **RADRender** node is connected to the `out` of the **View** node. It has a `view` input and a `readMe` output. A `Toggle` switch is set to `False`.
- Parameters and Output:** A **RADScene** node is connected to the `view` of the **RADRender** node. It has a `parameters` input (set to 0), a `_projectName` input, and a `waitForRender` input. A `Toggle` switch is set to `True`. A `Toggle` switch is set to `False`.
- Report and Results:** A **report** node is connected to the `out` of the **RADScene** node. It has a `radParameters` input (set to 0) and a `VER` output (set to 0.009). A `Toggle` switch is set to `False`.
- rtance Node:** A **rtance** node is connected to the `out` of the **report** node. It has a `testPoints` input (set to 0), a `ptsNormal` input, a `parameters` input, a `numOfCPU` input, and a `_projectName` input. A `Toggle` switch is set to `False`.
- Command Line:** A yellow node at the bottom contains the command: `-ab 3 -aa .2 -ax 64 -ad 2048 -as 1024`.

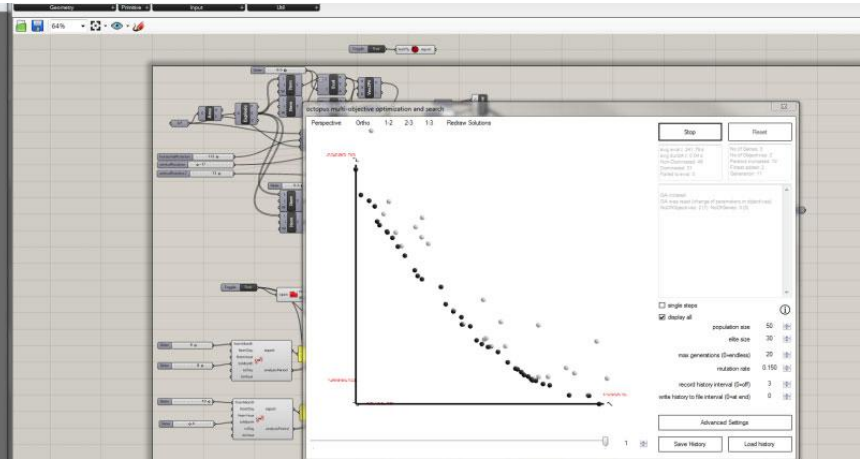
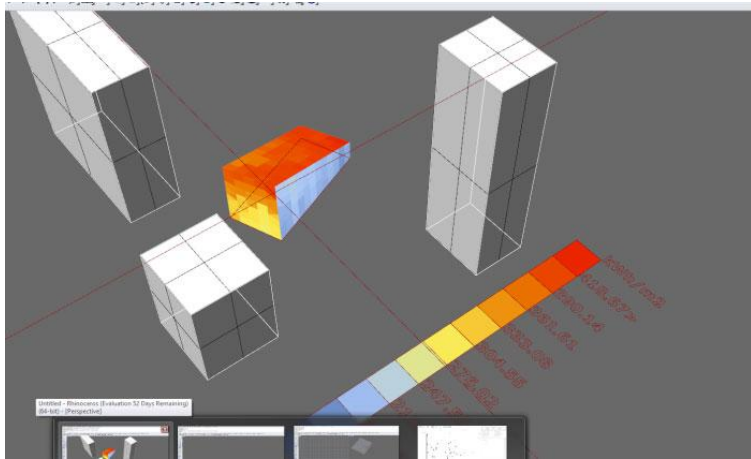
Honeybee: Result Modification



What's happening inside the zoo after Ladybug?



Multi-objective optimization study (Ladybug + Octopus)



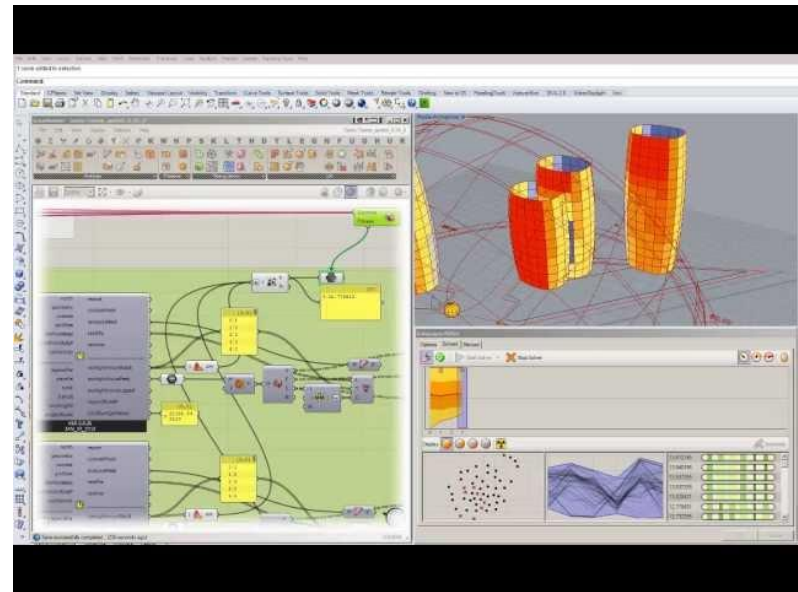
Check the video here:

(<http://www.youtube.com/watch?v=6c32kZN19FU>)

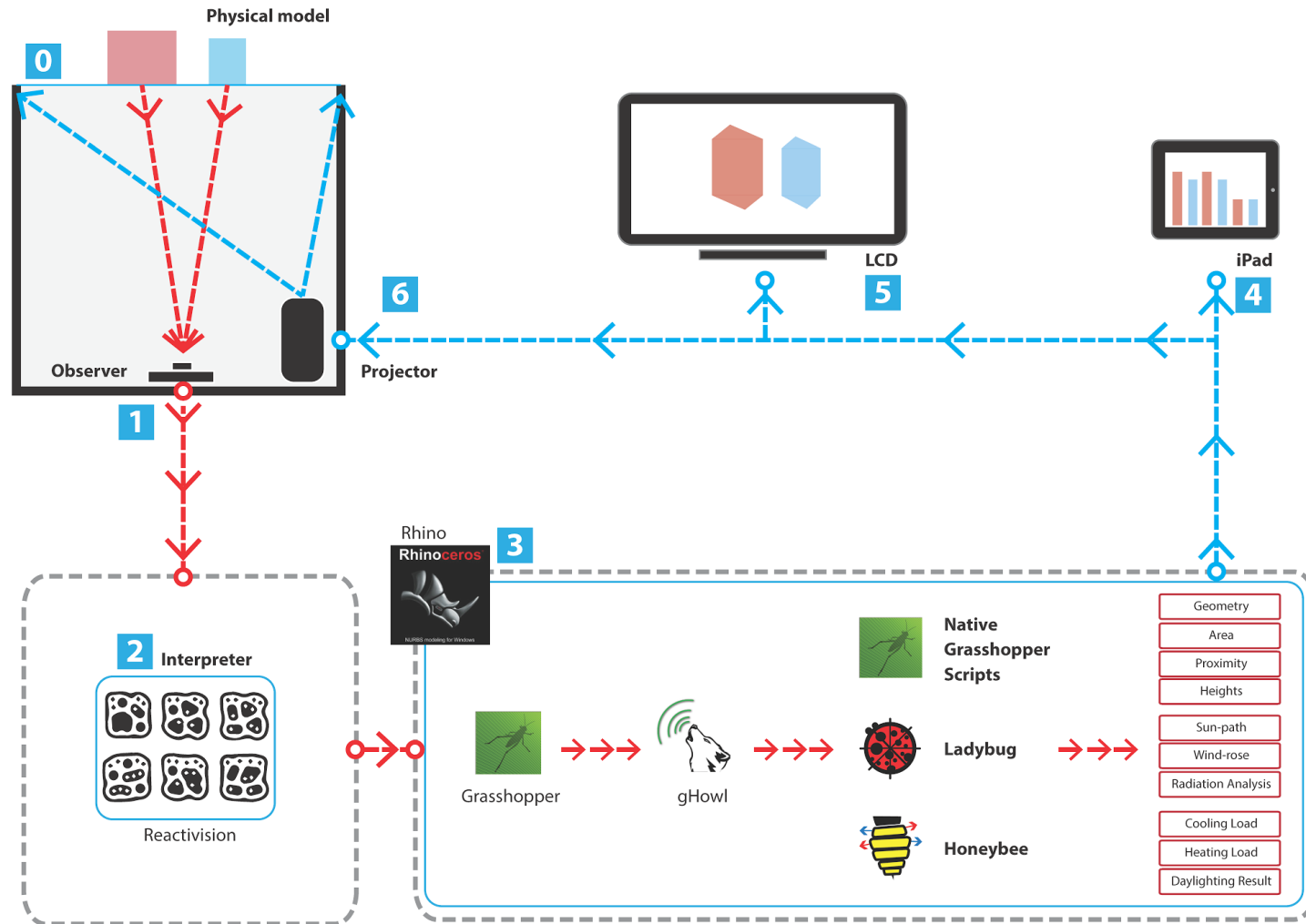
WIP by Francesco De Luca

(<http://www.youtube.com/watch?v=6c32kZN19FU>)

(Ladybug + Galapagos)

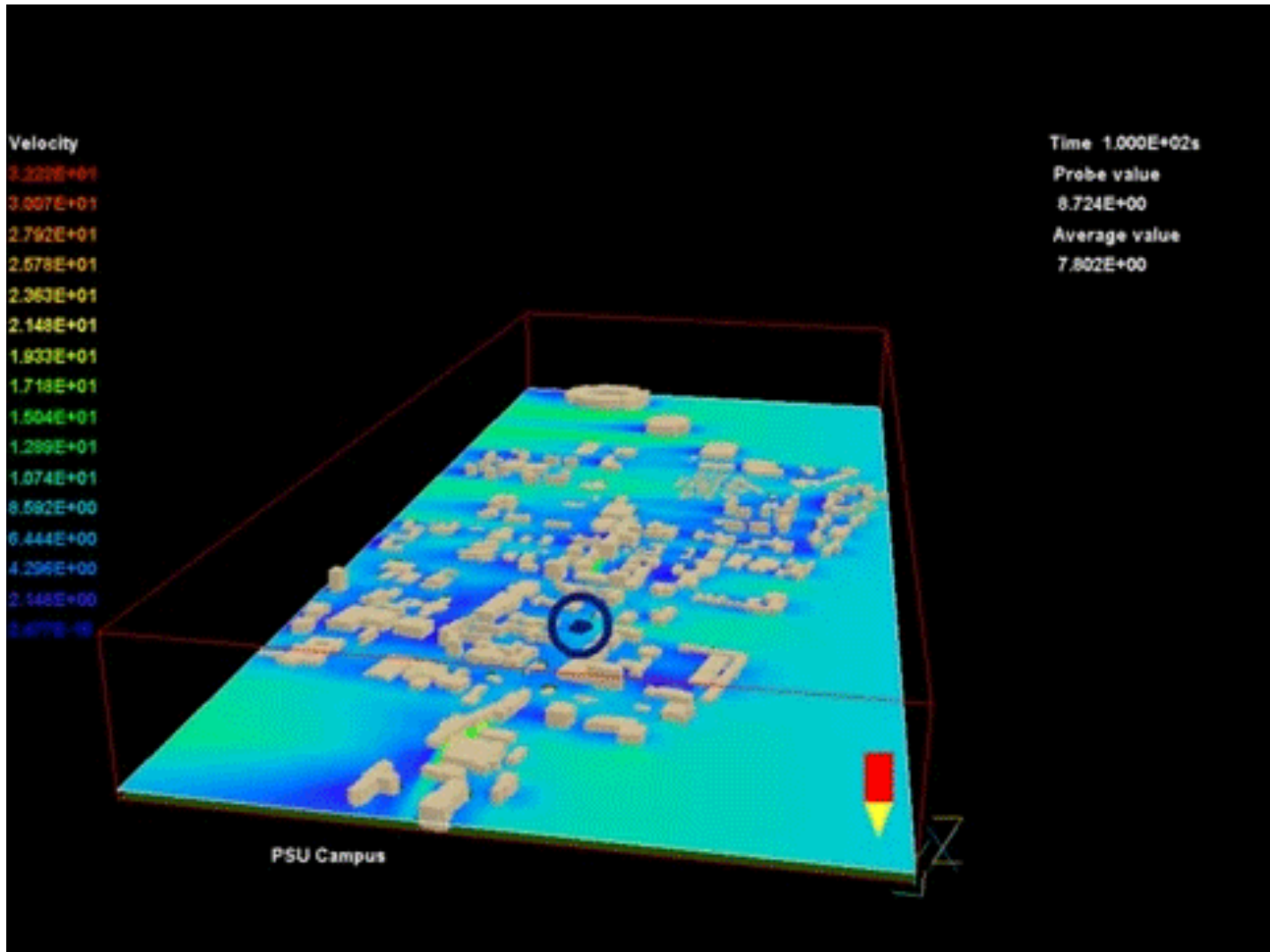


Tangible Design Interface (... + gHowl + Ladybug + Honeybee)



In collaboration with Anthony Viola (http://www.youtube.com/watch?v=cUqx8E3rk8_M)

Butterfly: Grasshopper + Radiance + OpenFoam (web-based)



In collaboration with EFRI-SEED project (<http://www.buildsci.us/efri-pulse.html>)

Grasshopper <> OpenStudio

python

File Home Share View

Computer > Computer (C:) > OpenStudioTrunk > build > OpenStudioCore-prefix > src > OpenStudioCore-build >

Name	Date modified	Type	Size
Release	6/20/2013 5:42 AM	File folder	
openstudioanalysis.py	6/20/2013 2:51 AM	Python File	964 KB
openstudioanalysisdriver.py	6/20/2013 3:48 AM	Python File	65 KB
openstudioenergyplus.py	6/20/2013 1:53 AM	Python File	16 KB
openstudiogbxml.py	6/20/2013 1:57 AM	Python File	10 KB
openstudiolib.py	6/20/2013 5:41 AM	Python File	17 KB
openstudiomodel.py	6/20/2013 12:19 AM	Python File	7 KB
openstudiomodelcore.py	6/20/2013 12:23 AM	Python File	377 KB
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openstudiomodelgeometry.py	6/20/2013 12:29 AM	Python File	695 KB
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openstudiomodelresources.py	6/20/2013 12:43 AM	Python File	1,478 KB
openstudiomodelsimulation.py	6/20/2013 12:51 AM	Python File	385 KB
openstudioosversion.py	6/20/2013 12:53 AM	Python File	10 KB
openstudioplugin.py	6/20/2013 5:41 AM	Python File	18 KB
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openstudioradiance.py	6/20/2013 1:01 AM	Python File	12 KB
openstudiorulesengine.py	6/20/2013 3:41 AM	Python File	15 KB
openstudioruleset.py	6/20/2013 1:23 AM	Python File	723 KB
openstudiorunmanager.py	6/20/2013 2:31 AM	Python File	340 KB
openstudiosdd.py	6/20/2013 2:03 AM	Python File	10 KB
openstudiostandardinterface.py	6/20/2013 1:01 AM	Python File	132 KB
openstudioutilities.py	6/19/2013 9:05 PM	Python File	7 KB

Thanks Daniel Macumber!

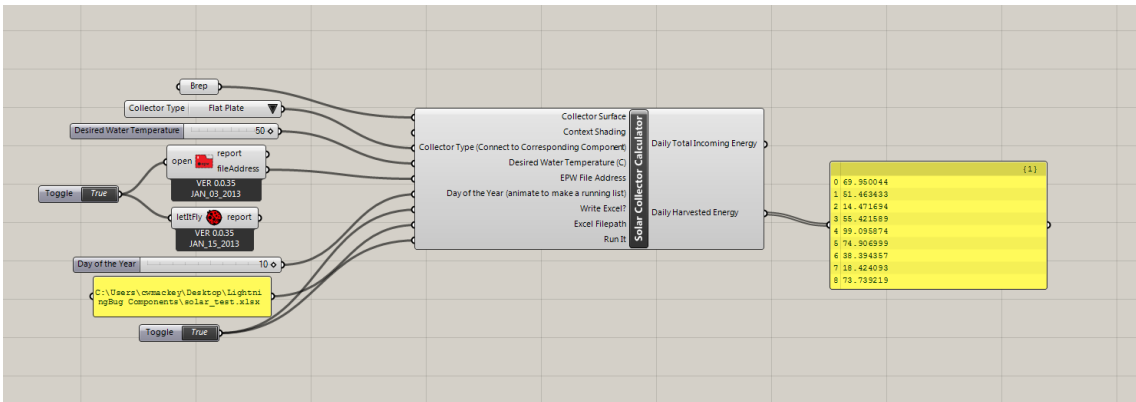
me, Daniel (70) Ladybug/Honeybee No luck to compile the python version yet! - Danie Jun 19

openstudioutilitiesdocument.py	6/19/2013 9:09 PM	Python File	130 KB
openstudioutilitieseconomics.py	6/19/2013 9:09 PM	Python File	21 KB
openstudioutilitiesfiletypes.py	6/19/2013 9:10 PM	Python File	38 KB
openstudioutilitiesgeometry.py	6/19/2013 9:11 PM	Python File	88 KB

36 items

Other developments...

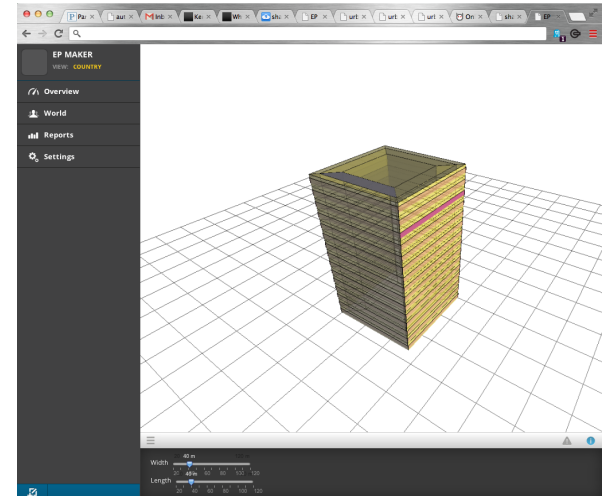
- Grasshopper/Rhino <-> Ladybug/Honeybee <-> GIS
- Web-based Applications for Parametric Environmental Analysis
- New components on top of the Ladybug
- There will be a new release pretty soon!
- ...



```

▼ THREE.Mesh {id: 84, name: "", parent: THREE.Object3D}
  ▼ DATA: Object
    BOUNDOBJ: ""
    CONSTRUCTION: "WindowNon-resFixed"
    FRAME: ""
    MAIN: "FenestrationSurface:Detailed"
    MULTI: "WINOFF[]"
    NAME: "E-WIN"
    SHADING: ""
    SURFACE: "E-EXT"
    TYPE: "Window"
    VERTICES: "autocalculate"
    VIEWFACTOR: "autocalculate"
    ► __proto__: Object
    __webglActive: true
    __webglInit: true
    ► modelViewMatrix: THREE.Matrix4

```



Thank you!

Questions? Suggestions? Comments? ...

<http://thorntontomasetti.com/blog/acm>

Advanced Computational Modeling

Thornton Tomasetti