Cole Hasquet
ARCH 565
Journal

Computational Portfolio

A display of skills and program knowledge to assist in creation and design within the architectural industry.

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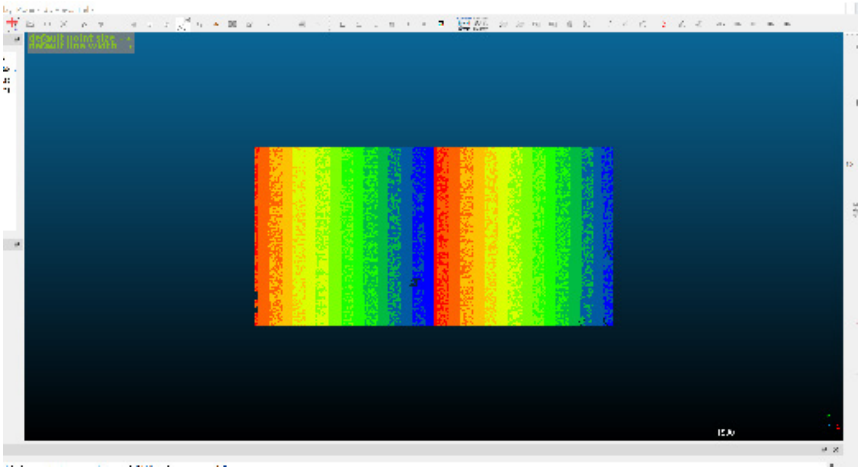
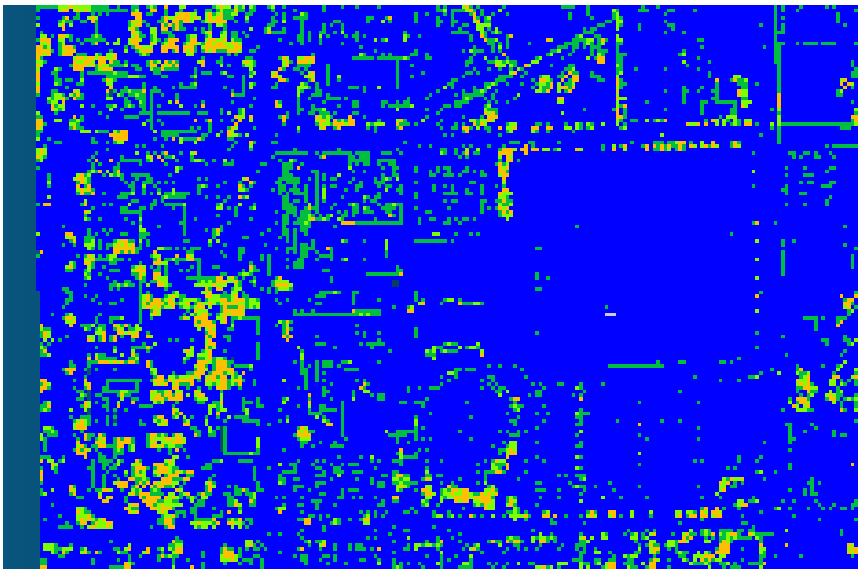
Gathering Site Information



Getting Site into Rhino - Attempt 1

Importing LiDAR file into Cloud Compare

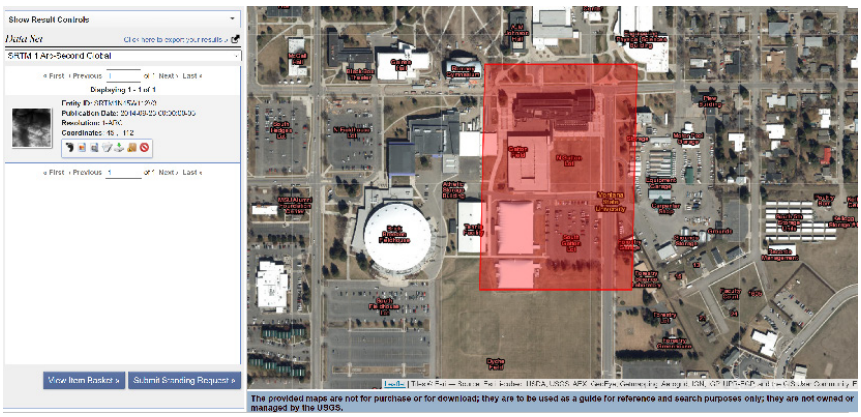
9/6/22



Converging tiles taken from LiDAR and discovering that my project site was a construction site at the time LiDAR was taken, and therefore many irregularities exist, rendering this file useless in assisting with studio project

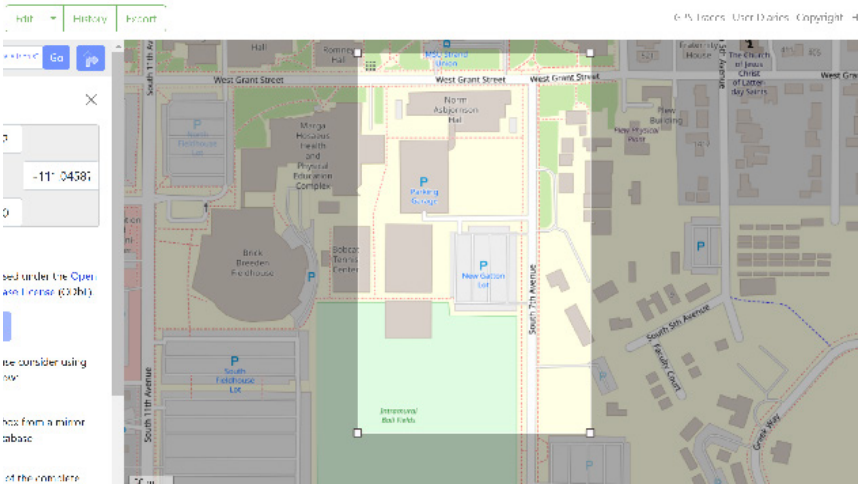
9/6/22

Getting Site into Rhino - Attempt 2



In order to get a more useful site model and topography, I downloaded site information from USGS Earth Explorer.

9/6/22



Downloading site context, such as roads and buildings from Open Street Maps.

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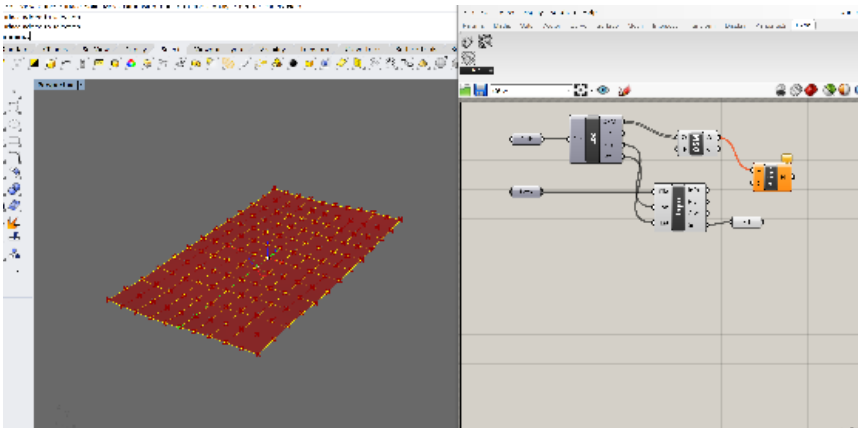

These pieces of data were then pulled into the grasshopper plugin Elk, where the path to the left then produces the desired site area in Rhino.

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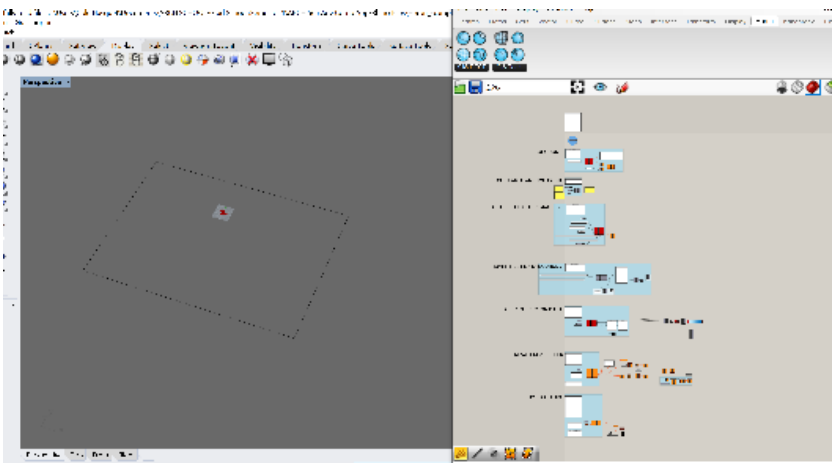

This is from the example we looked at in class, but it was my first experience with Huron, so seeing the different ways in which that plug in works and working through those issues as a class helps to foster an understanding of the program and what it is capable of.

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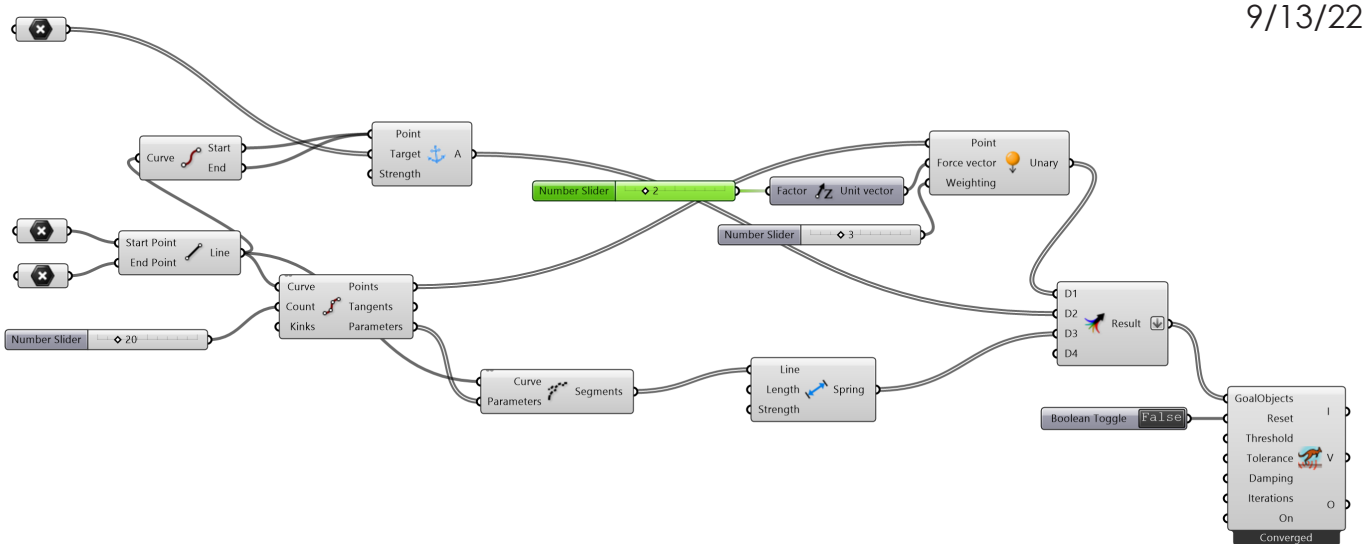
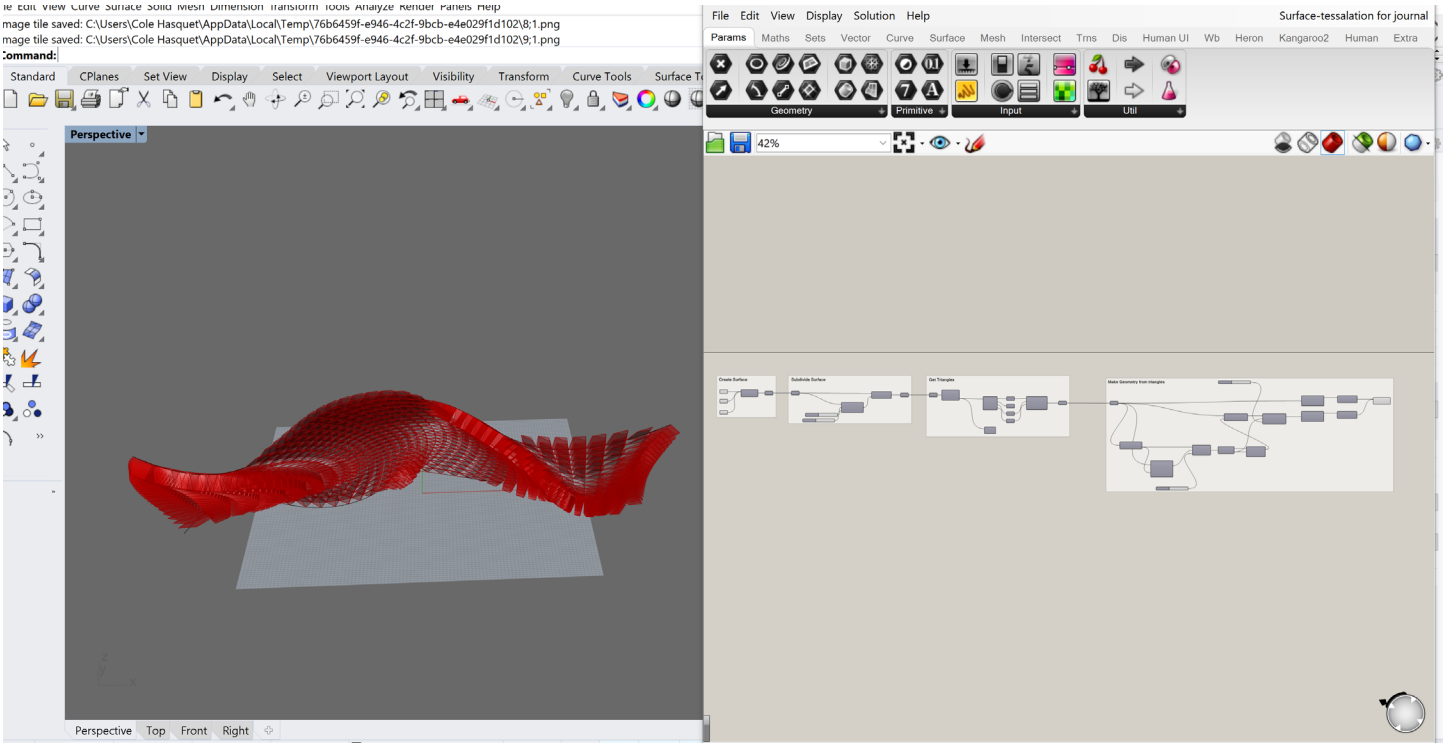
Tessellating Surfaces

With the progression of building technologies, we are able to create more complex and efficient shapes. In order to use these shapes and structures, we must be able to model them. Tessellation is one way in which these complex forms can become realized. This can be accomplished using Rhino, with the plugins of grasshopper and Kangaroo. Using these programs we can take a surface or shape, and begin to divide it up, and then create a shape, a triangle for instance, and tessellate that surface. This process is shown below and was created in assistance with Christopher Schwalbe.

9/13/22





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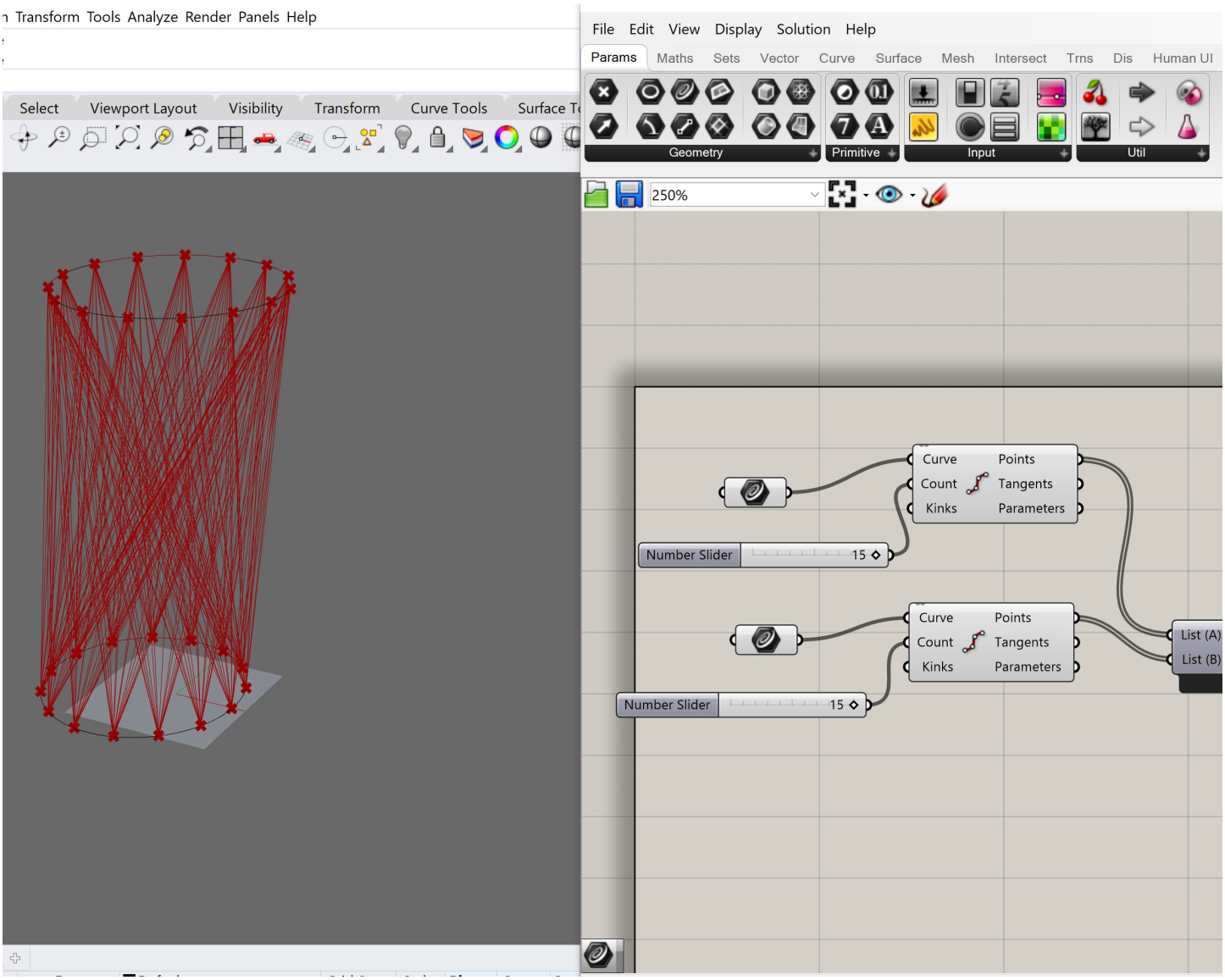
Data Trees

The complexities of modeling in the modern world can lead to chaos and confusion. With many people collaborating on projects, models can quickly become muddy and bogged down by errors and miscommunications.
Using the grasshopper plugin within Rhino, we can create data trees that help to illuminate components within models and create relationships between them that allow for cleaner, and more efficient models. Data trees are able to allow the model maker to create dynamic models because they are allowing the programming nature of grasshopper to assign values and information to model aspects that can then be manipulated to begin to create space and form. These values can be manipulated as necessary to begin to quickly shape forms. The example shown was done in collaboration with Christopher Schwalbe.

9/20/22



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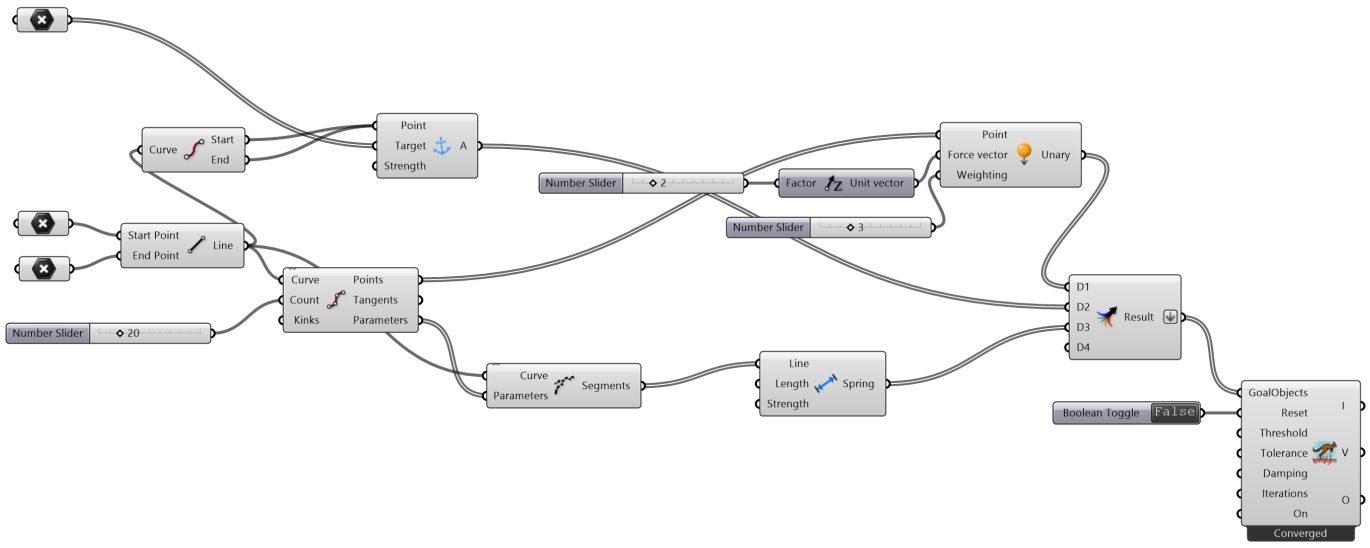
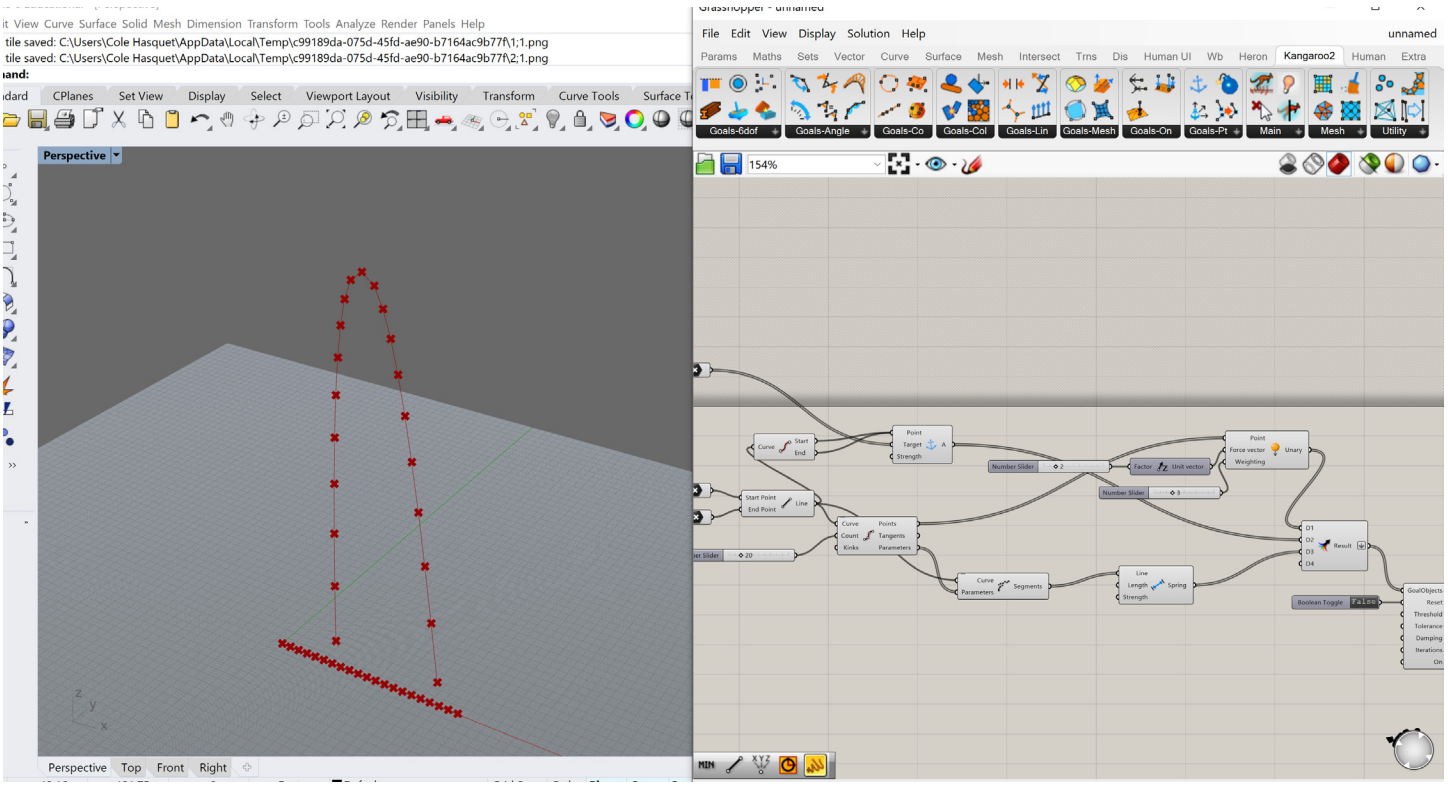
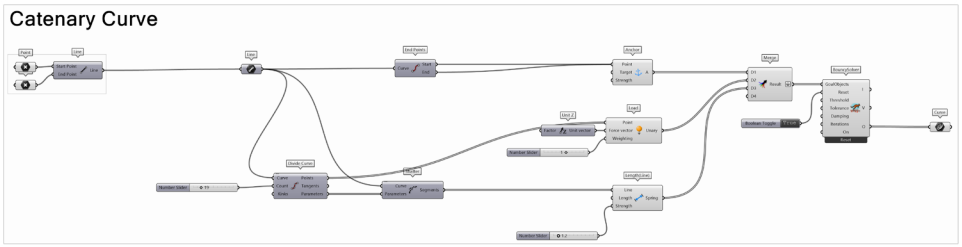
Physics Based Modeling

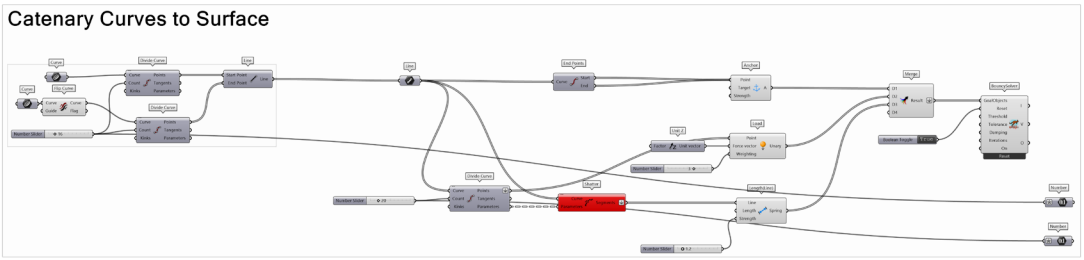


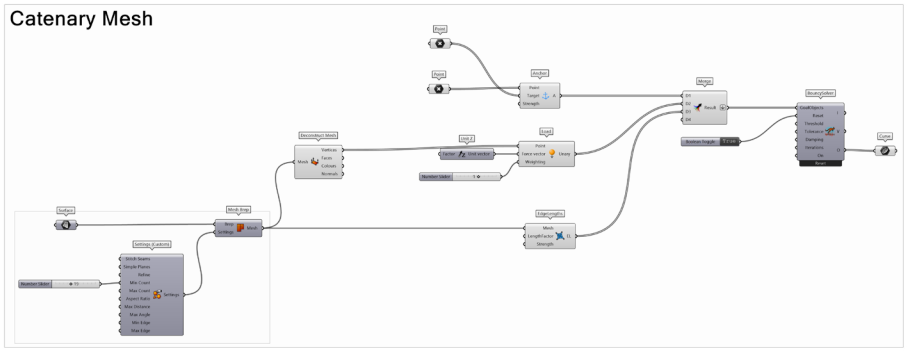


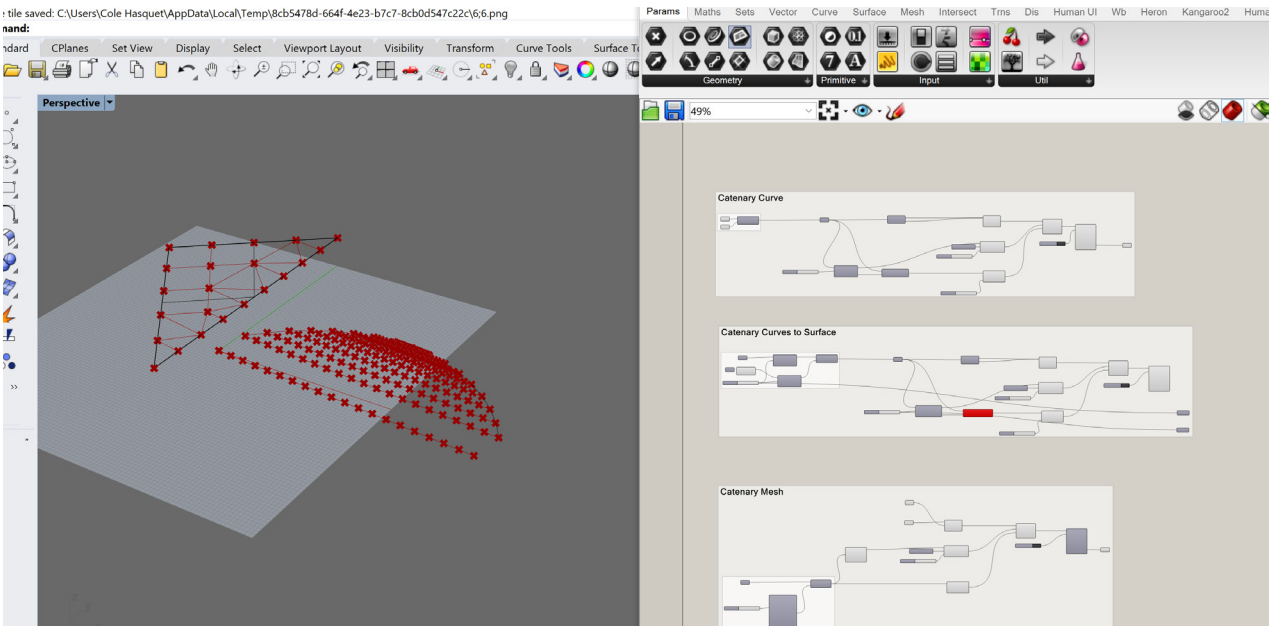
These images show a grasshopper script in Rhino using Kangaroo to produce physics based models. This script allows for the model in Rhino to become dynamic. The user is able to control variables that allow the model to move based on the parameters you set.

9/27/22









The scripts above build off of the ones from the page prior, and go another step in showing physics based modeling with the use of catenary curves and meshes. The scripts were built in Christopher Schwalbe's class.

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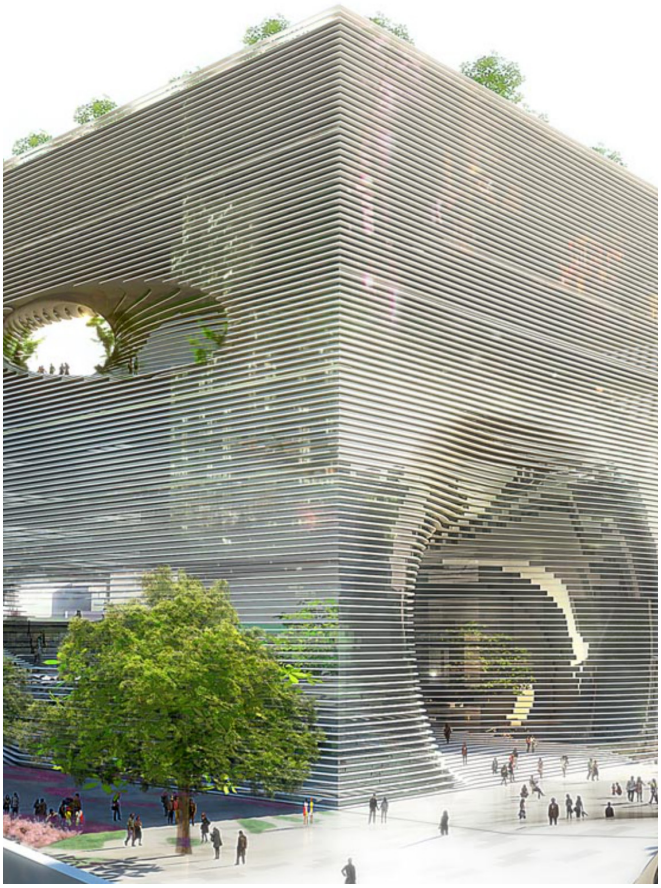

In class Thursday, 9/29, we discussed our top architecture firms and the direction we would like to go in the profession. While this discussion might not showcase specific computer programs, it is important to self-reflect every so often to analyze the direction you are going and evaluate what you want fro your career. A firm I have always enjoyed is BIG. They have produced many insightful and inspiring projects. All the images above are from BIG's website.
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Creating a Facade

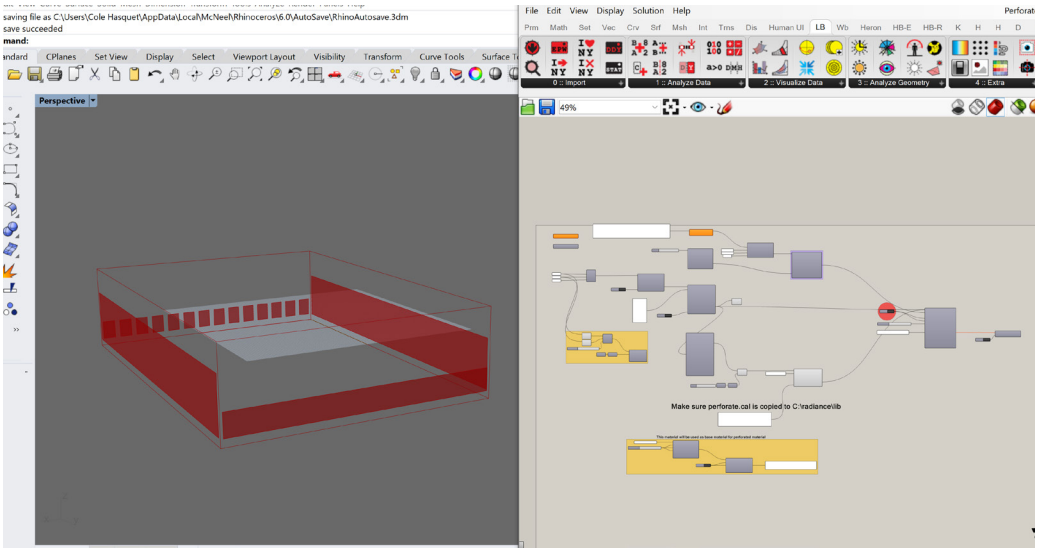
The School of Computing project currently being worked on needs a sustainable design response that is specific to the site and program. This response needs to cultivate a comfortable and efficient interior environment, while also creating a unique and intriguing external response.

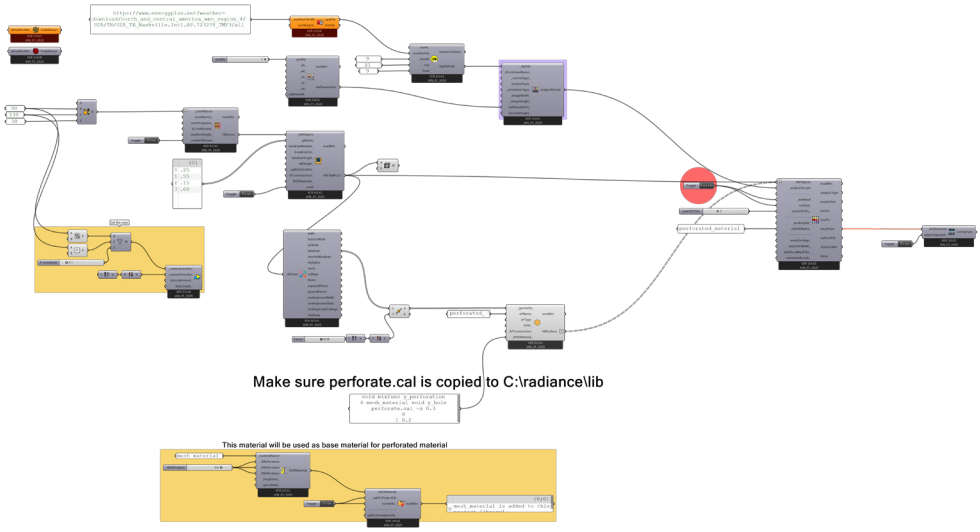
The solution is to create an operable, perforated metal facade or 'skin' that cloaks the exterior walls of the structure.

The use of the Grasshopper plugin in Rhino was employed in order to create a skin that reacts to the specific conditions on the site, and the perforation size and placement is relative to the solar gain and daylighting on each elevation. This works to reduce active system loads on the interior of the building and builds toward creating a net-zero building.

This process is not yet finished, but the script shown is in the process of creating that design response. The script was originally created by user mostaphaRoudsari on the Hydra Share website.

10/07/22





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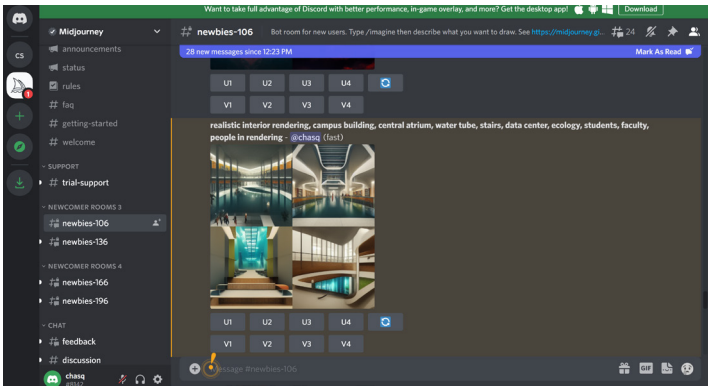
New Way of Visualization

As technology advances, we create more tools that can assist in the design process. Artificial intelligence is emerging as a more and more prominent tool to visualize and inspire.

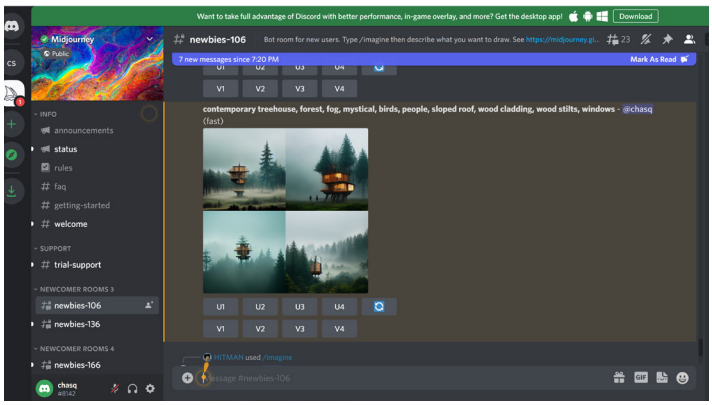
Looking to provide a different viewpoint and collect some additional insight, the use of A.I. generated art was employed.

Midjourney is a program that allows you to input a series of words and/or phrases, it then produces images that encapsulate all of the items that you input.

This process was used with key words and phrases from my design project to see what images would be conjured up.



Input and process in Midjourney (above)
Resultant Images (right)
Unrelated project input (bottom right)
Unrelated project images (below)



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Math Created Objects

Collecting, showcasing, and celebrating the collection of water within the building is a primary objective for the project. The project design utilizes a rectilinear form and organization to encapsulate the nature of the computer science program and looks to more organic forms to represent the natural elements that are composed in the building.

To accomplish this, mathematical formulas were used to create unique and specific forms. While looking to math to find inspiration for a form that could be used as a water storage device, the cushion surface was discovered. This object has a similar shape to a bowl.

THe grasshopper plugin within Rhino was employed to produce the object. Working with Christopher Scwalbe, we were able to create a script that produces the cushion surface. The script uses C# components in order to create the object. The cushion surface is made up of an implicit equation, so the script is a bit more complicated, and requires the script to take a set amount of points, and use the implicit formula to organize the points to create the object. This is a process, as the shape is so complicated, that it needs time to let the points solve themselves and slowly smoothen out to create the shape.

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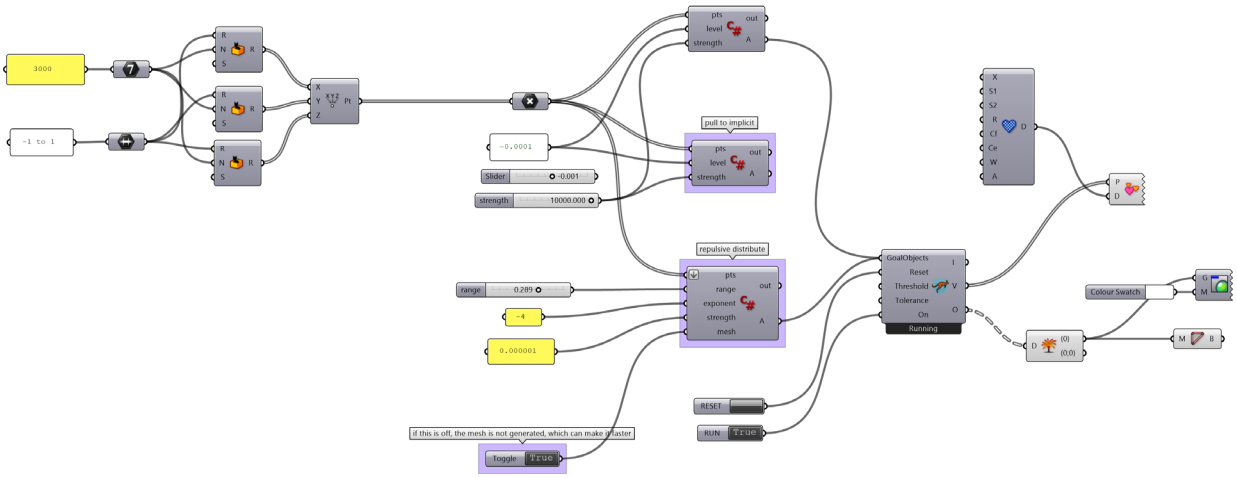

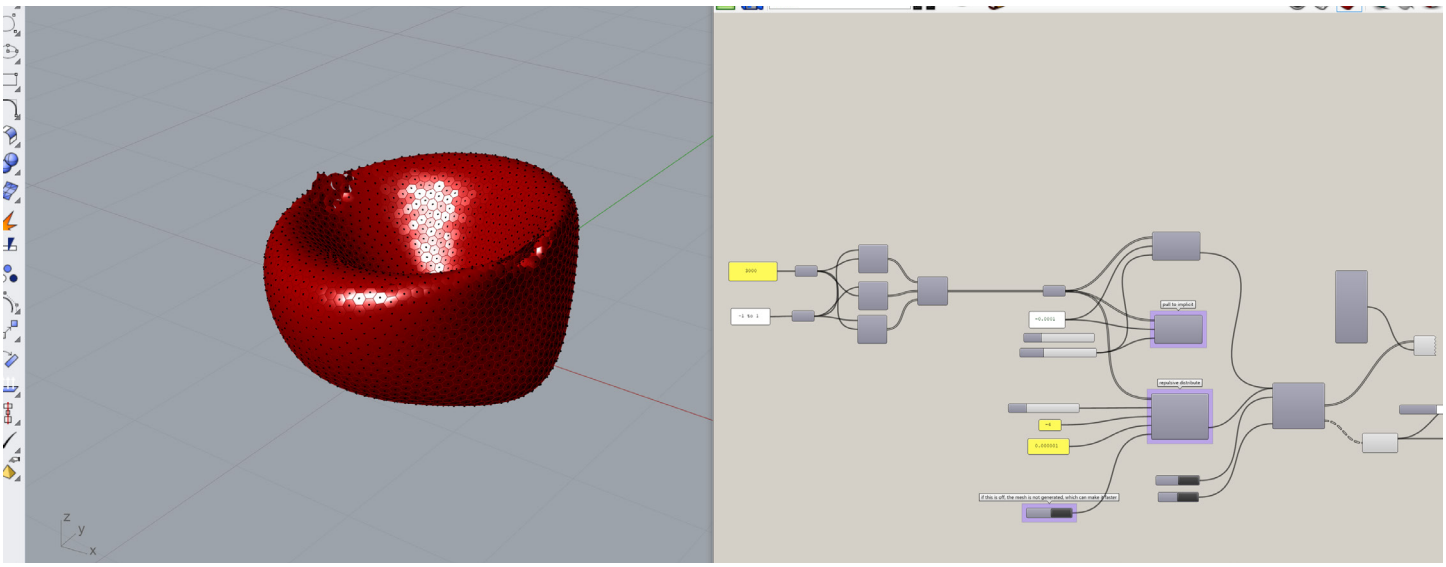

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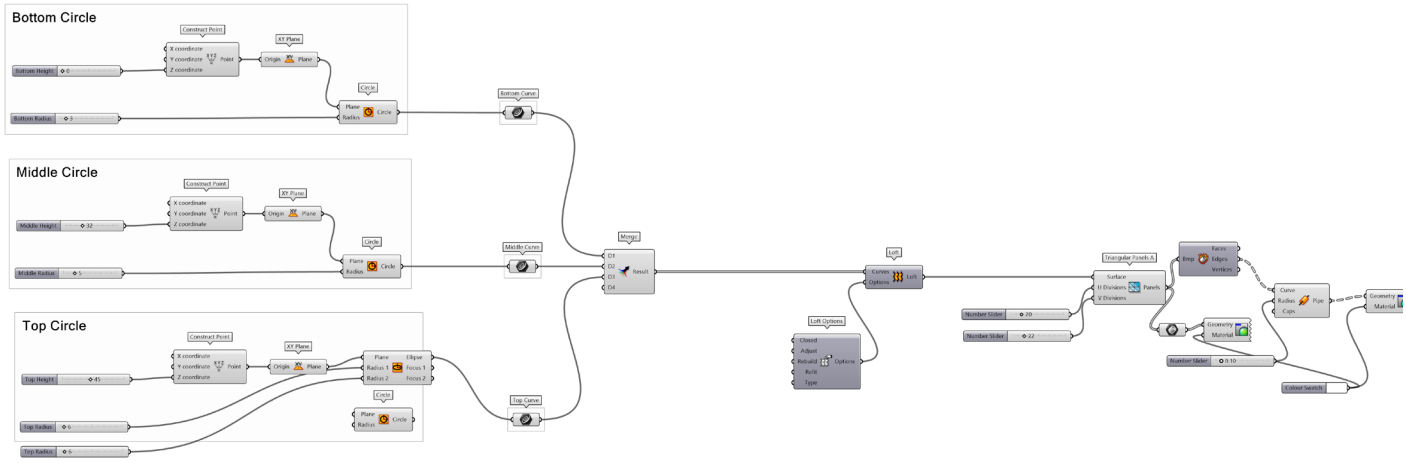
Creating a Parametric Canopy

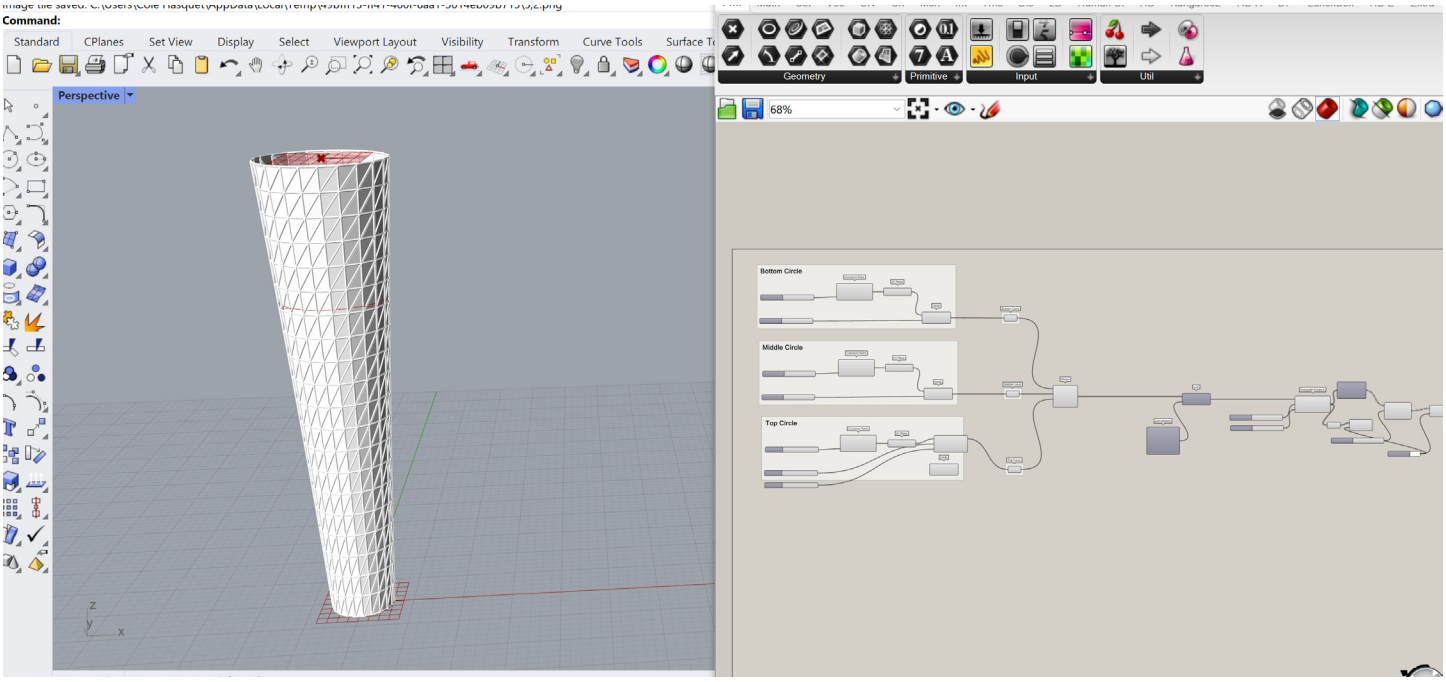
My studio project design contains a central, vertical element that brings water collection from the roof through the building to the first floor where it can be stored and then used for watering vegetation, cooling the data center, or for gray water in the restrooms. This central element, while essential to the project concept, requires a thoughtful and specific design response. There is a need to explore design options.

To explore options, a grasshopper script was devised to create a parametric, panelized canopy that is able to be manipulated easily to see what size and shape will work for the tube as well as the project as a whole.

The script, created with Christopher Scwalbe, is fairly straightforward and relies on the manipulation of three primary circles or ellipses. The spacing and sizing of these shapes can be changed to create different, and unique forms.

10/13/22





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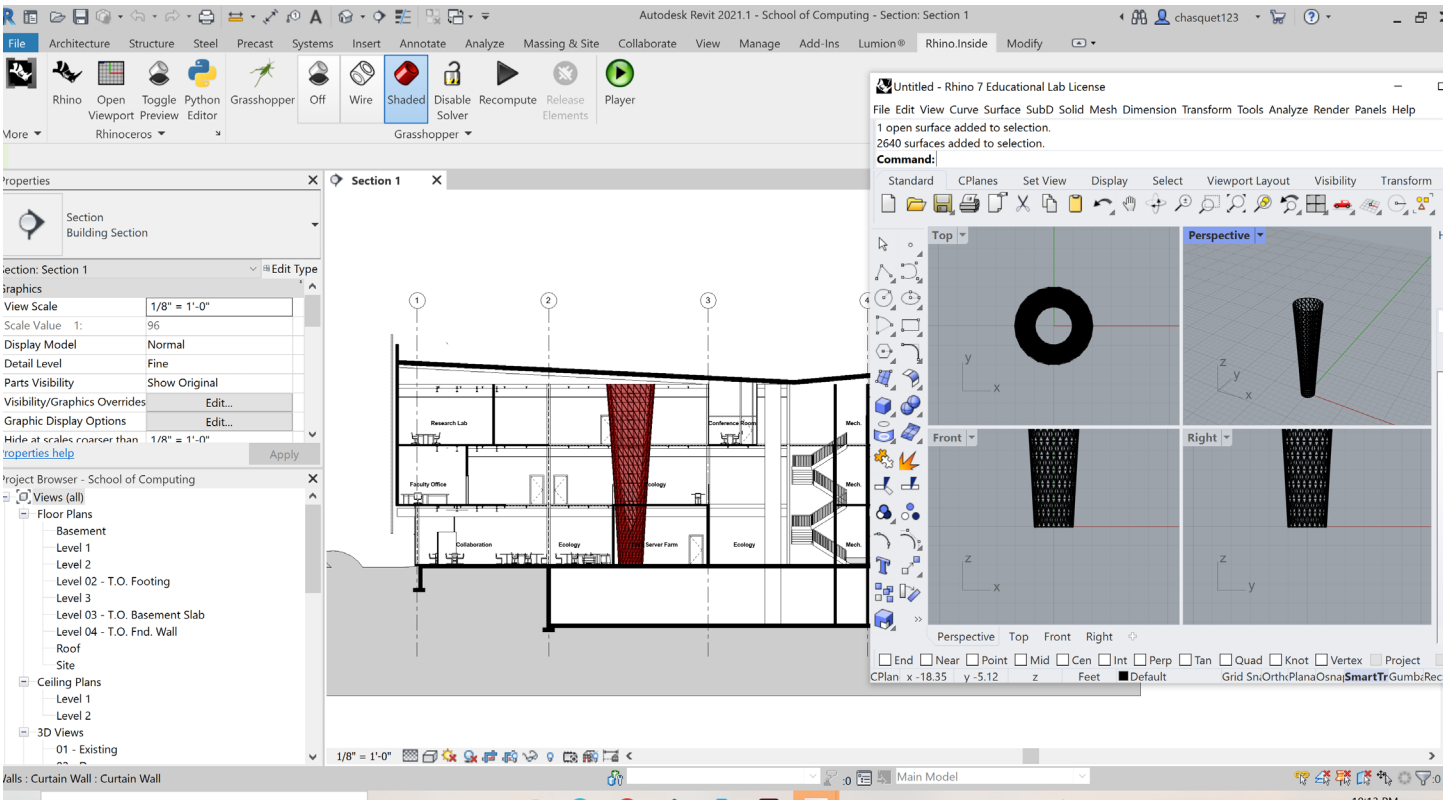
Interdisciplinary Modeling

There is a need for efficiency within modeling in order to best use time and resources in the design process. In order to maximize this, we must find ways to best use every program. Programs such as Rhino are able to produce more complex, unique, and organic shapes and forms much easier than Revit. Revit, however, is able to produce documents and very efficiently.

By installing Rhino Inside Revit, we are able to transfer model elements between programs, and get the best of both worlds. For the studio, I will be able to transfer the cushion surface and parametric canopy from above, into my existing Revit model. This will add another level of richness and information to my design and presentation. As I will be able to see more clearly how modeled elements relate to one another.

10/13/22



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Mapping a Facade

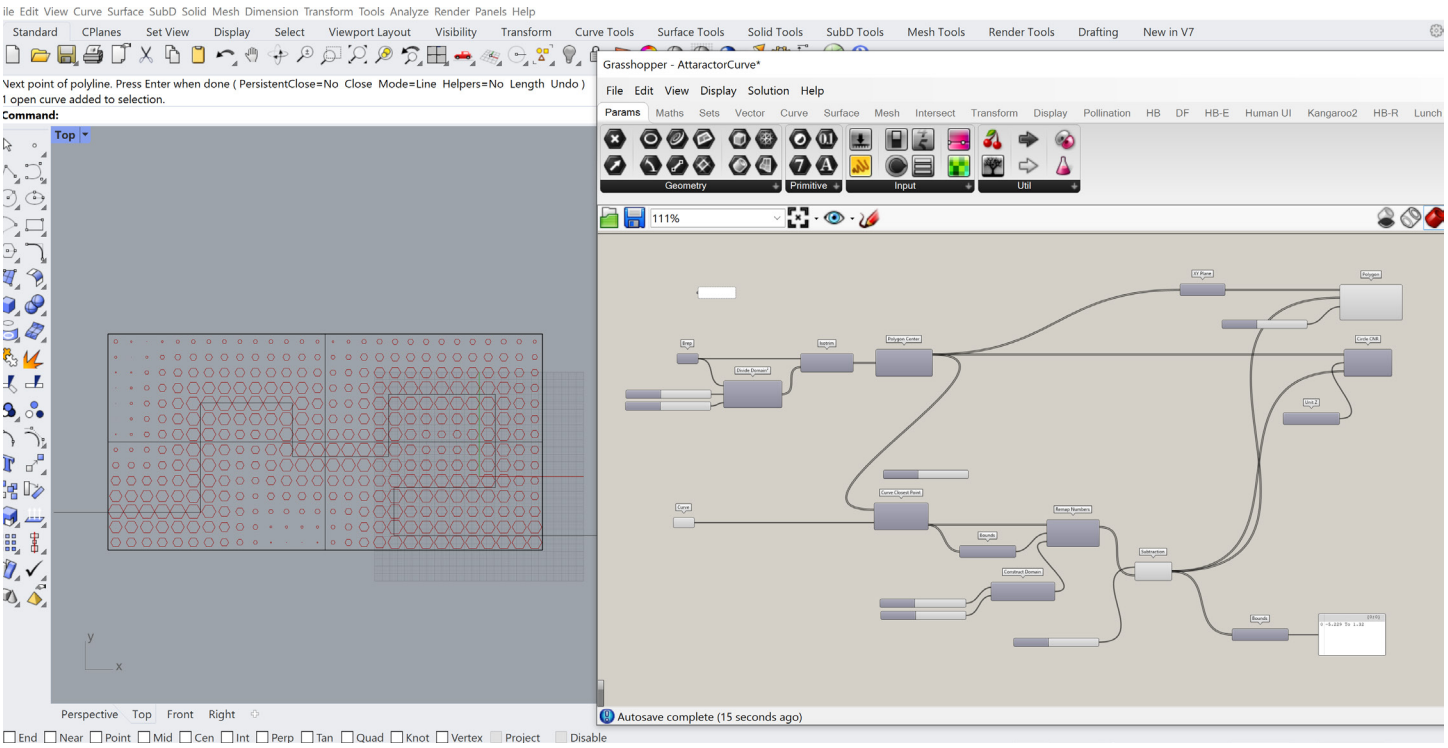
In order to create a 'skin' like facade that can provide an efficient and comfortable interior environment, we can 'map' the internal program organization onto the exterior of the building. By doing this, we create optimal opportunities for thermal gain as well as shading, while also allowing occupants to be comfortable.

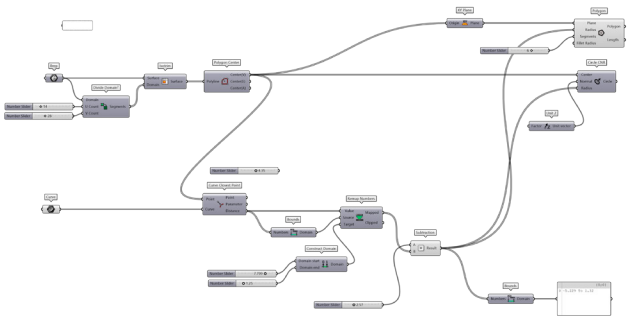
To create this, we need to find a way to create a dynamic element that can create a pattern of openings that are able to change size as well as shape.

To do this, we employ the Grasshopper plugin within Rhino 7. We can systematically create a script that will allow for a surface to respond to a given internal environment.

The script shown, created in tandem with Christopher Schwalbe, shows how the program is able to create a response that accomplishes this.

The script and product will be further developed to create a surface to be used on my current studio project.





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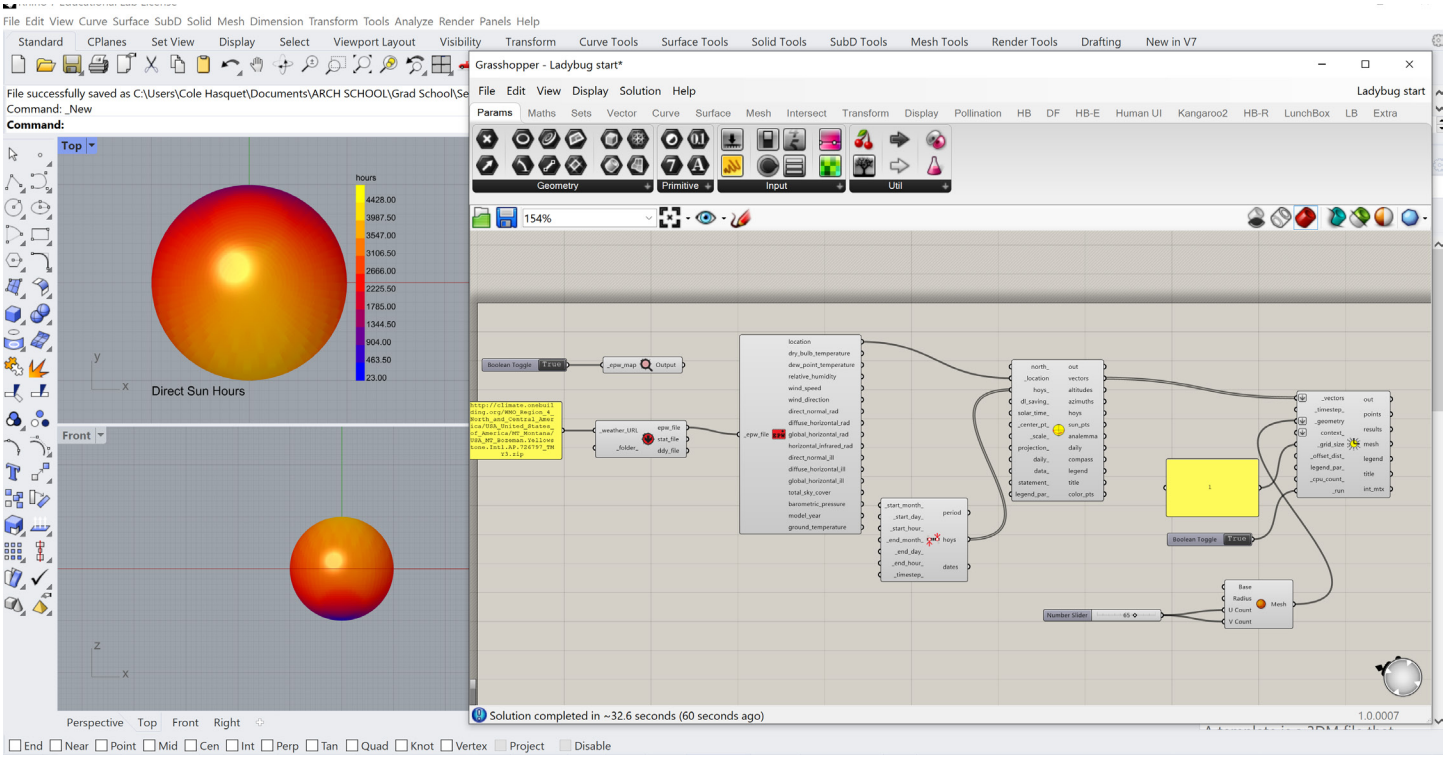
Climatic Data

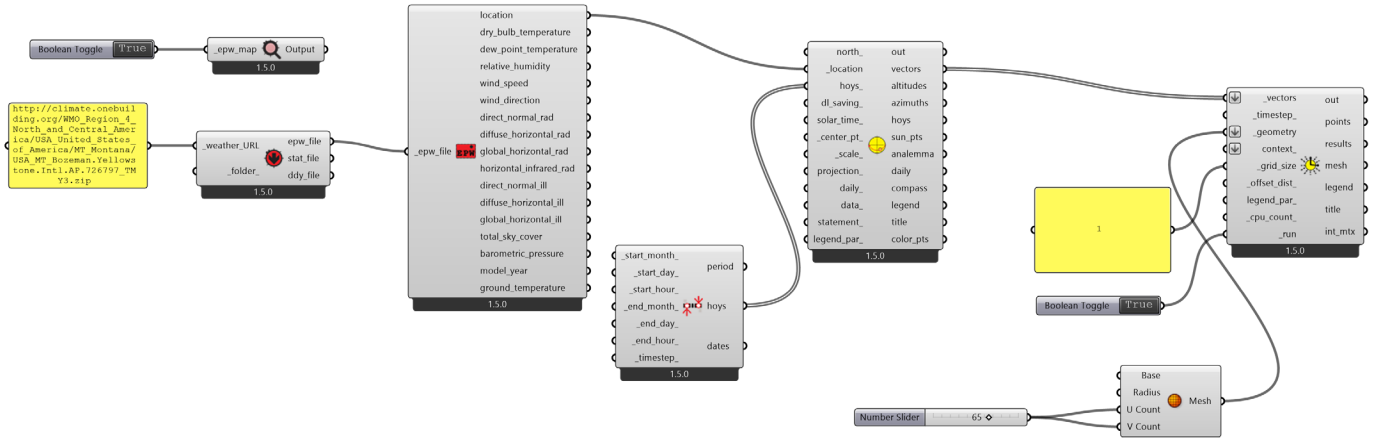
In order to truly design and create for a place, we must understand both the general and specific information about that environment.

By using Grasshopper, Ladybug, and Rhino, we can begin to understand the climatic data that is inherent to a certain place. As we collect data, these programs are able to produce visual representation of the data so we as designers are able to analyze and understand, and can in turn enrich our design and process.

The script shown is just a beginning to using Ladybug to produce climatic information to create charts and graphs. The script was created following Christopher Schwalbe during an in-class tutorial.

10/20/22





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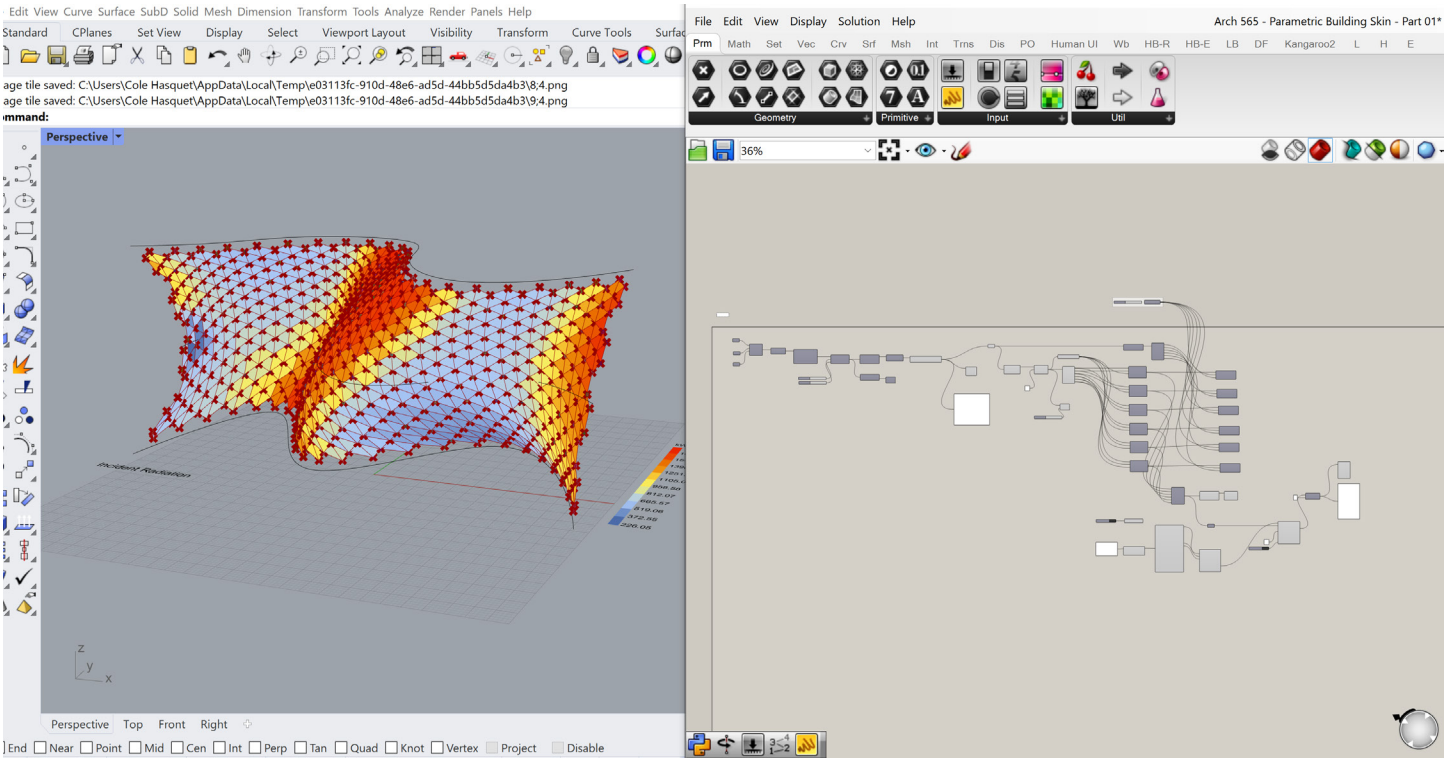
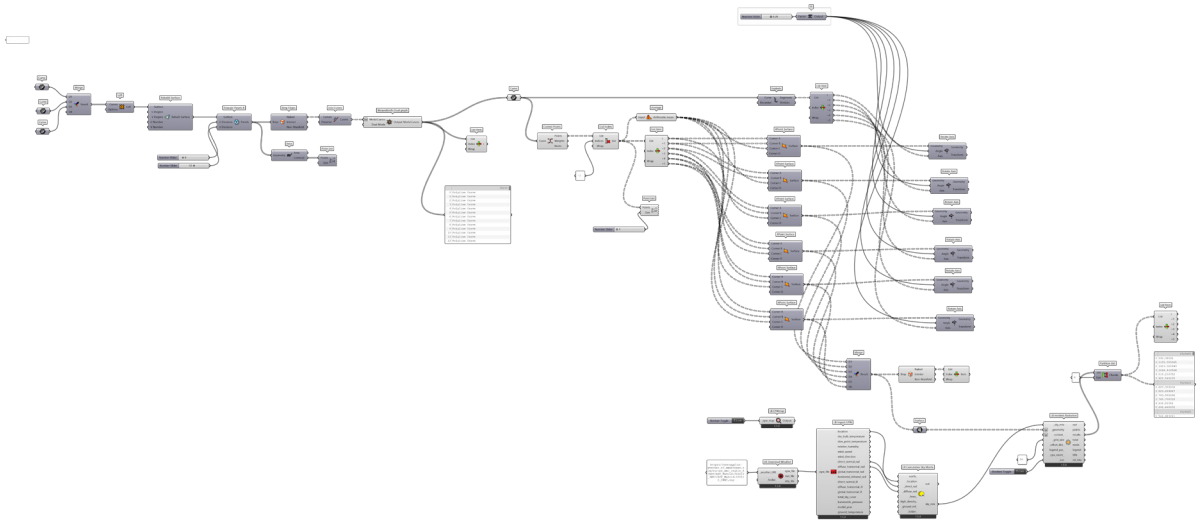
Environmentally Responsive Facade

Building off the idea of developing a skin and collecting climatic data, we can merge the two notions so that they inform one another. Creating net-zero or sustainable buildings can rely heavily on how the building meets the exterior. We need to build a way to begin to understand how solar and shading is being impacted on the exterior of the building, so we can adapt design and understand how it will affect the interior environment.

By using Grasshopper with Rhino, we can create a script that uses Ladybug to analyze the solar impact on a particular surface. This will allow us to gain a better understanding of our project and provide evidence that can shape design.

The images provided show a grasshopper script being developed (with Christopher Schwalbe) that shows the heat pattern on a surface. Ladybug is able to import climatic data from almost any major city in order to provide an accurate analysis.





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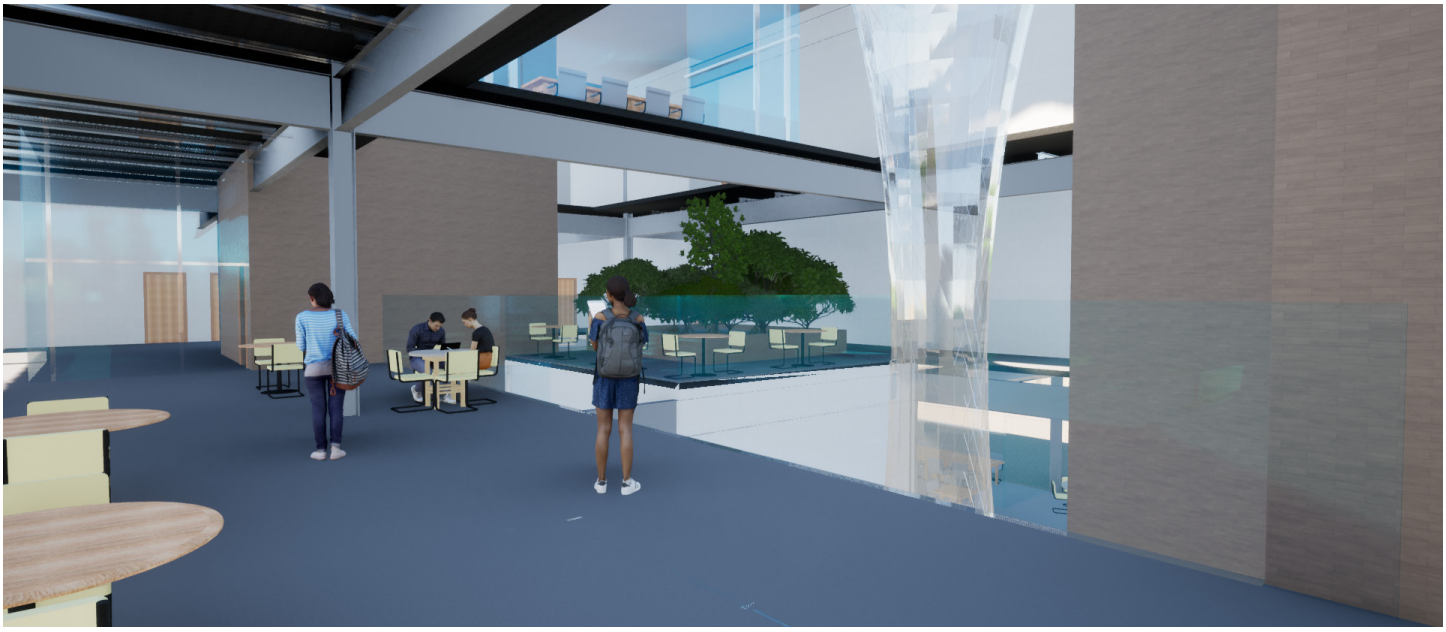
Visualizing Design

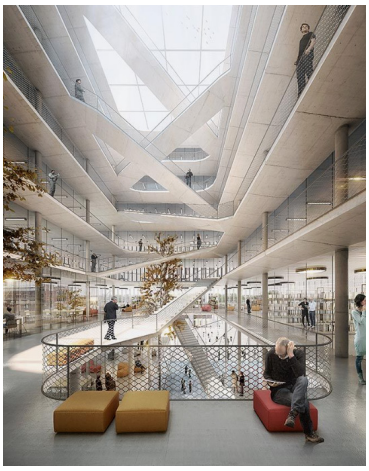
The necessity of realization is growing ever more important in the architectural industry. As clients and the public fund projects, there becomes a clear desire and need for the stake-holders to be able to see the design and what they can look forward to being constructed. They need to be excited.

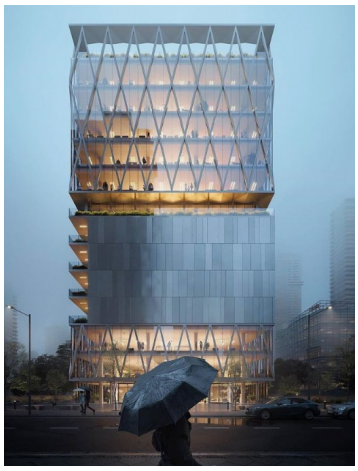
Many programs have been created to help with this process, but some stand out more than others. As technology keeps advancing, software is able to develop scenes that viewers have difficulty distinguishing as reality or illusion. These stunning creations help people under-stand design and allow for input and discussion to take place where designer and client are able to be more understanding of one another.

Twinmotion is a software that is able to create realistic renders due to its capacity to import a large variety of context, materials, and render qualities. DataSmith can also be installed so that you can export a Revit model straight to Twinmotion to render. This system can then be used to bring projects to life and work to help designers and clients understand what the potential reality of the space will look and feel like.



Early stages of an interior rendering for the School of Computing Design Project using Twinmotion and Revit model.





Rendering precedents for articulating a mood or feeling

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Computer Application Journal #10

Realizing Design

Now that we have the software needed to produce imagery to display the project, we must be able to convey a message, mood, or feeling with the finalized material. This is done by understanding how to work a software in order to maximize its potential.

In Twin Motion, we are able to produce realistic lighting and scene setting due to the vast resources of objects as well as path tracing. These features enable another layer of realism that can immerse the viewer further into experiencing the space. In order to create a more realistic rendering of the image on the page above, we are able to manipulate many settings to create a more finalized product. First, we can place the project in the correct location on Earth, which will produce accurate sun angles. Next, we can alter the season and sky cover to further articulate lighting intensity and help to create a mood. The intensity of the light is important, especially with an interior space, as the initial image feels much darker than the final product. Twin Motion also carries a vast material library. These materials can be easily scaled and rotated so that they can fit specific desires and needs. This software also carries a variety of artificial lighting elements, which help to highlight certain elements or work to create a wall wash.

I have found that one of the largest positives of this software is that it is noticeably easier and quicker to create and produce a scene compared to similar products. This is partially due to the learning curve that I have developed in learning other softwares first, but it seems to me that Twin Motion is exceptionally efficient in the creation process.

A further developed interior rendering for the School of Computing Design Project using Twinmotion and Revit model.