A Lamp Story...

from Form Finding
to Assembly

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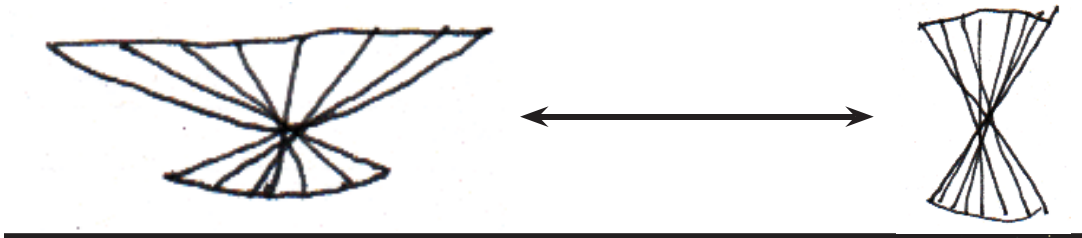
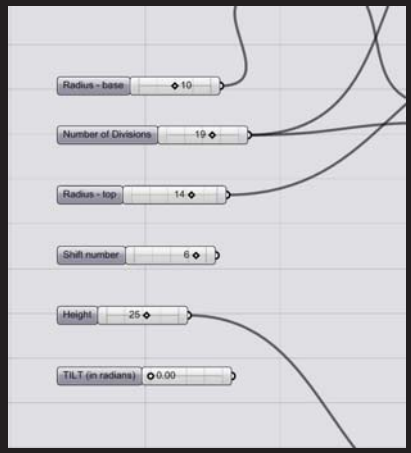
A) Form-Finding

1.The initial form was based on a broad, open basket. After experimenting the form, we oriented our interested towards the possibility of creating a taller, more slender basket, which would function better as a vase

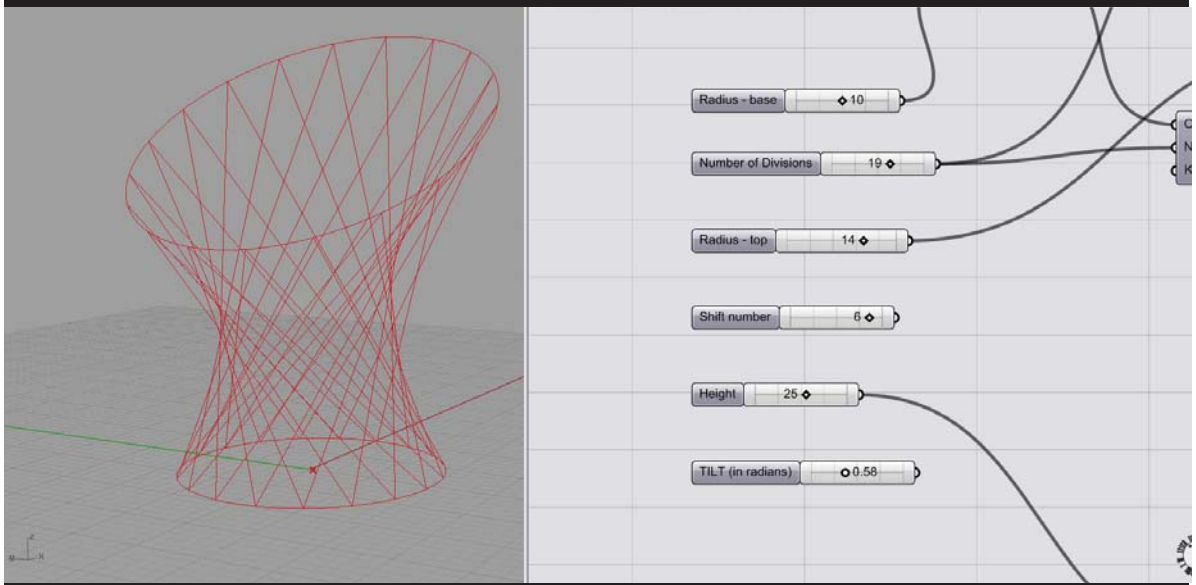


2.Considering the function was flexible, we continued to experiment with the form to create a shape that could be modified in grasshopper.



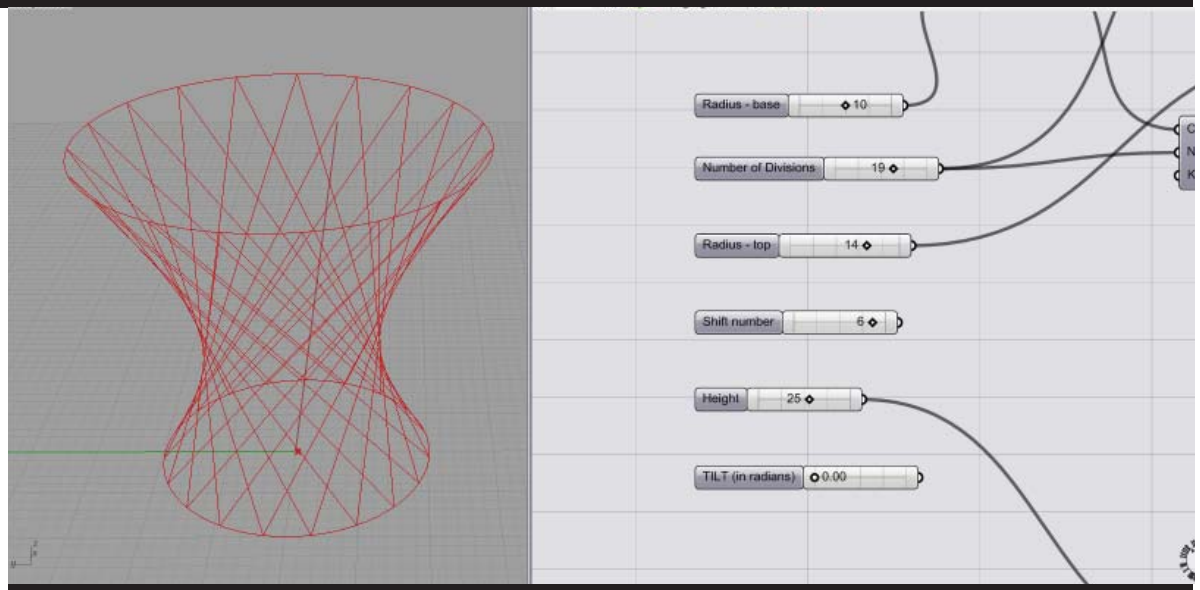
3.The scripting was organized to leave variables for form-finding at the beginning so alterations could easily be made.

4.The initial form, with the tilted top circle, had geometry issues. This is evident when looking at the lines formed by the script preview.

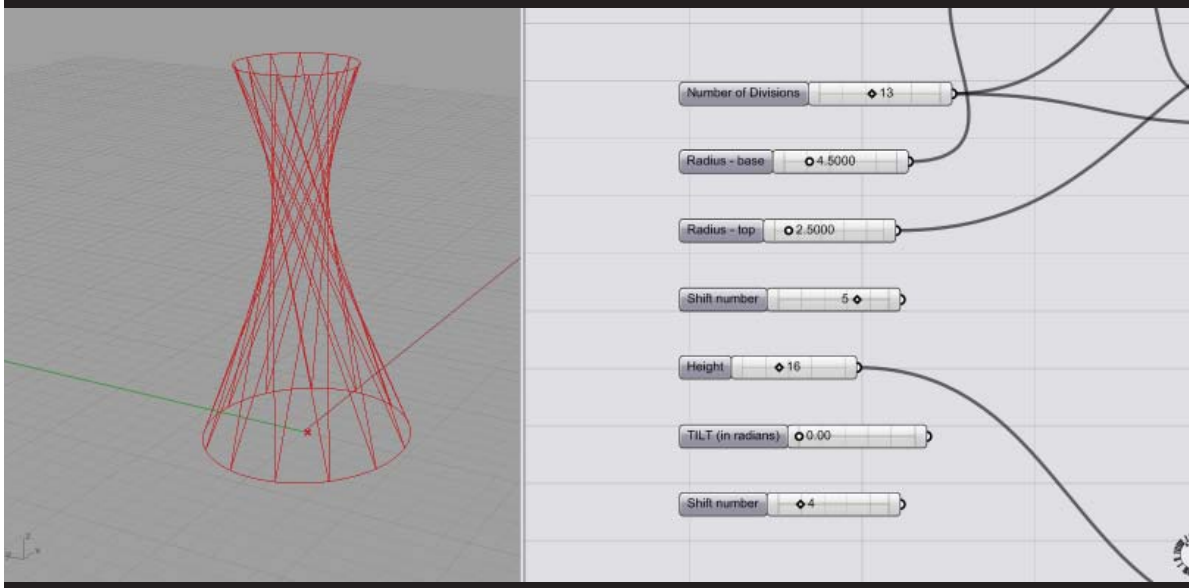


A) Form-Finding

5.The tilt of the top circle was thus set to zero, to keep the geometry clean and neat.



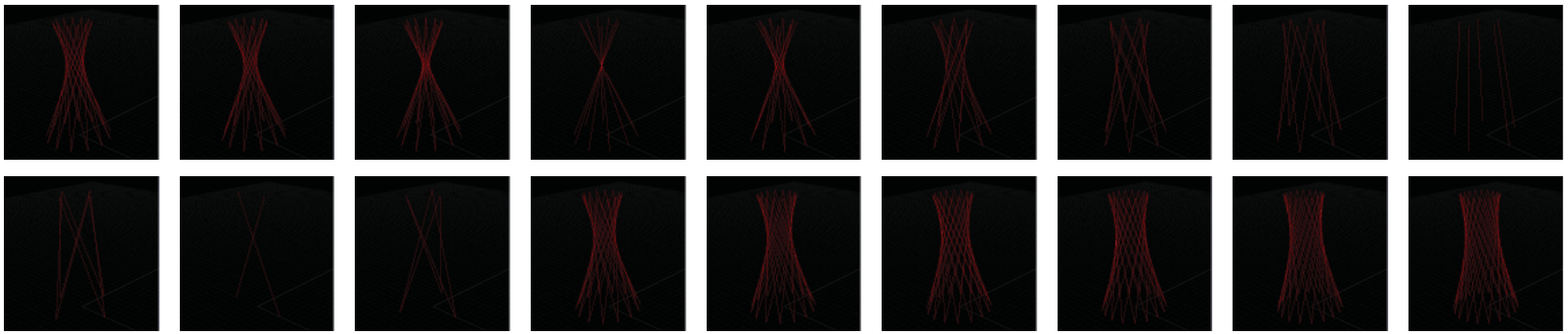
6.After building the prototype from this form, we decided to adjust the form to meet the new function of a pendant lamp.



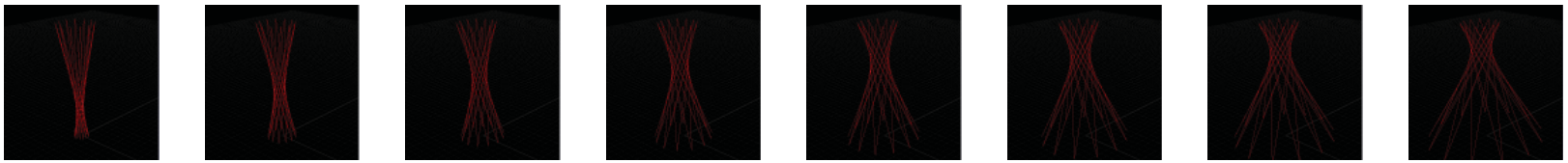
A) Form-Finding

7.Changing the parameters accoridng to :

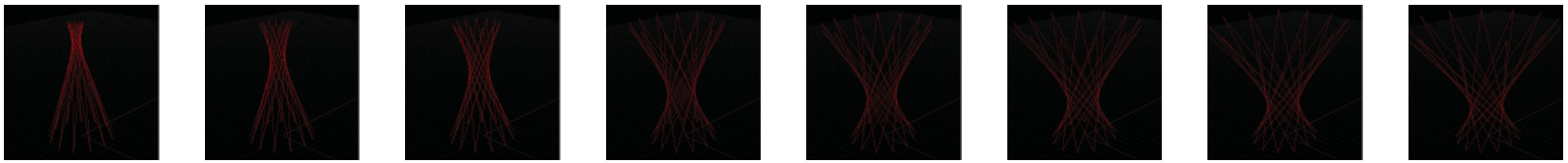
a.Number of divisions



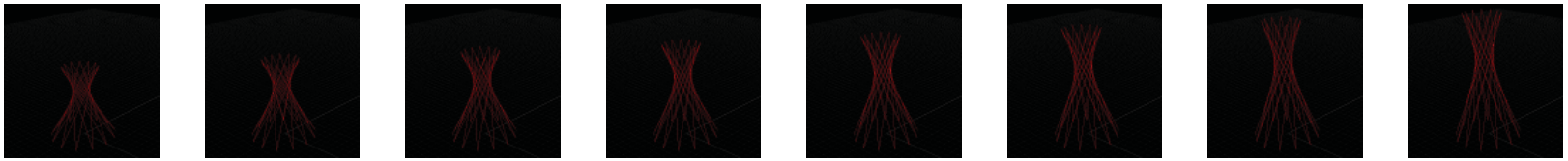
b. Top radius



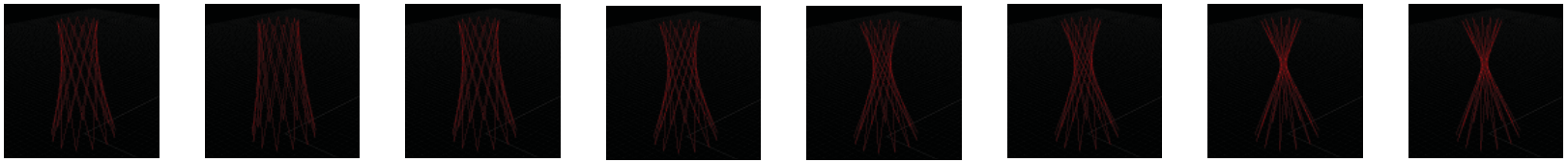
c. Base radius



d. Height

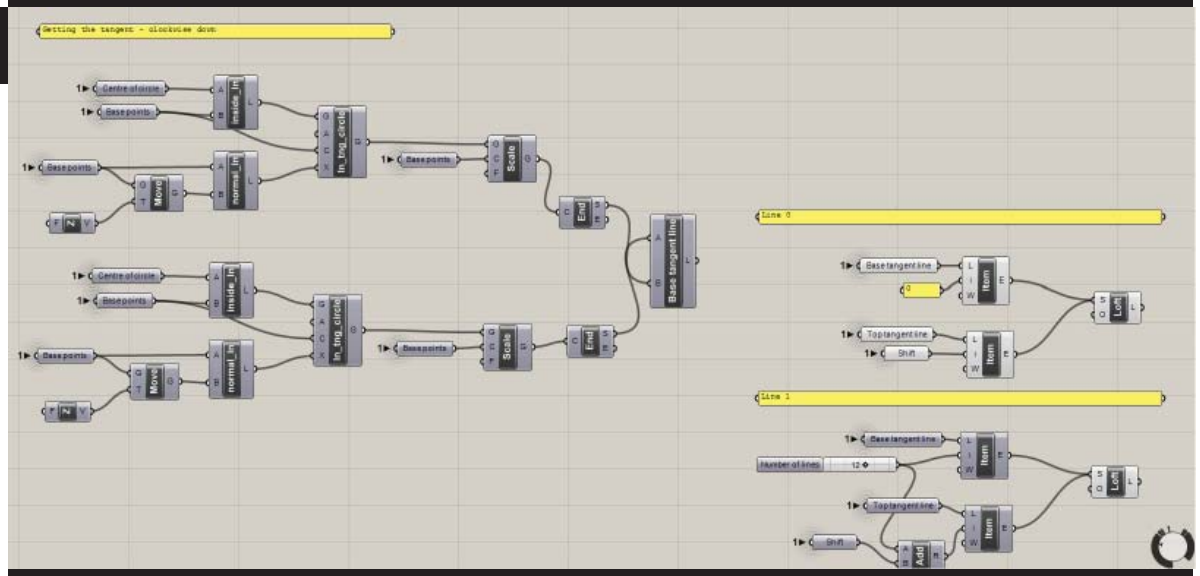


e. Shift



B) In Grasshopper

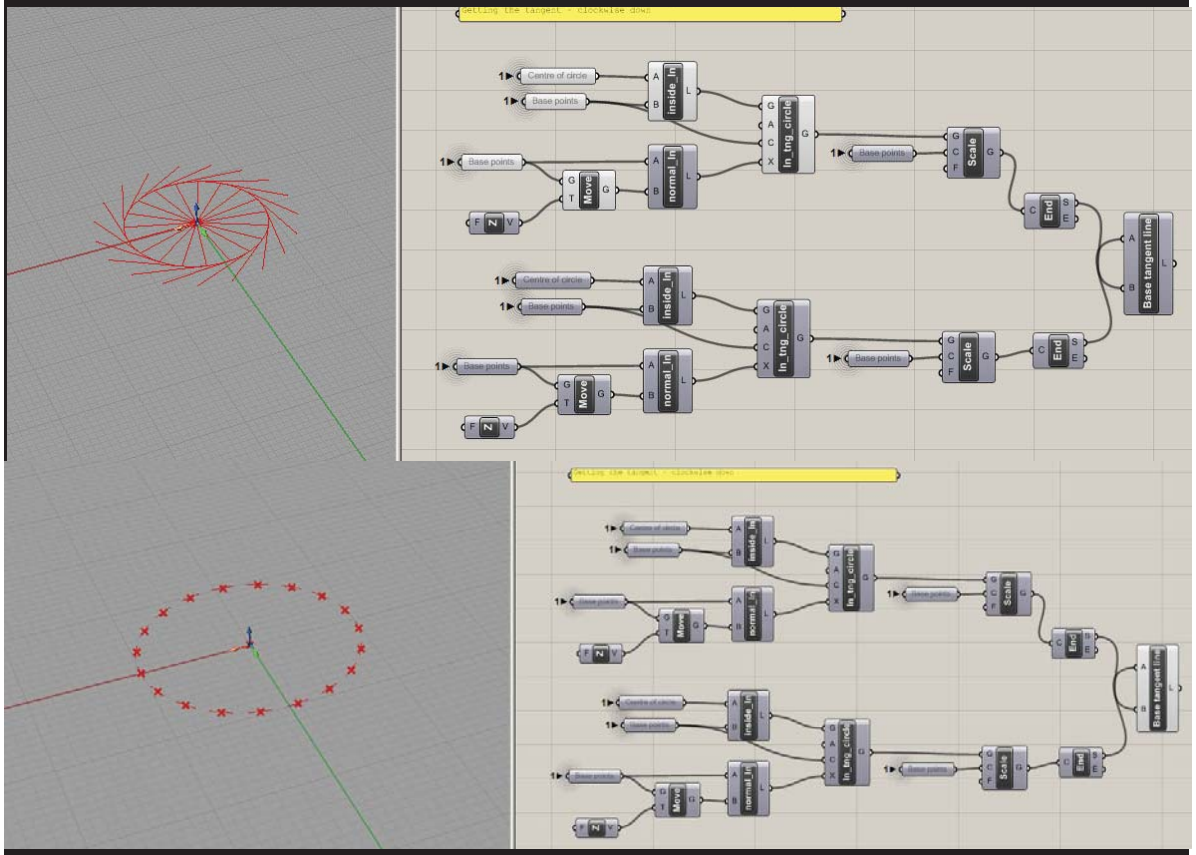
8.We used the tutorial we did in class as the basic idea of the grasshopper script. We wanted to keep the amount of objects drawn in Rhino to an absolute minimum so we could use the variables in our grasshopper script to “form-find”. Also, in our previous assignment, we had confused two of our Rhino files so we ended up baking on a surface that was too small – a 30 x 30 square centimeters – instead of the 40 x 40 square centimeters, which resulted in a very dense grid that was too small and harder to construct. (We didn’t want to make that mistake again!) Once we picked a form, we started to resolve the thickness of the strips and the holes for the connections.



9.We proceeded finding the tangent vector to the points on the curves.

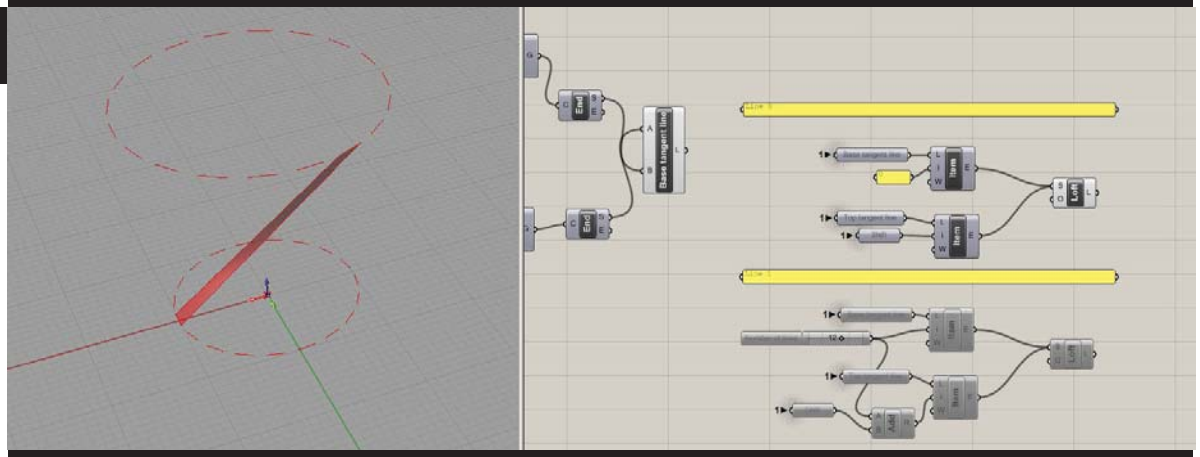
To find the tangent vectors to the points of the circle, a line was first drawn from each of the points to the center of the circle and then rotated 90 degrees.

Then the line was scaled and mirrored on both sides of the point.

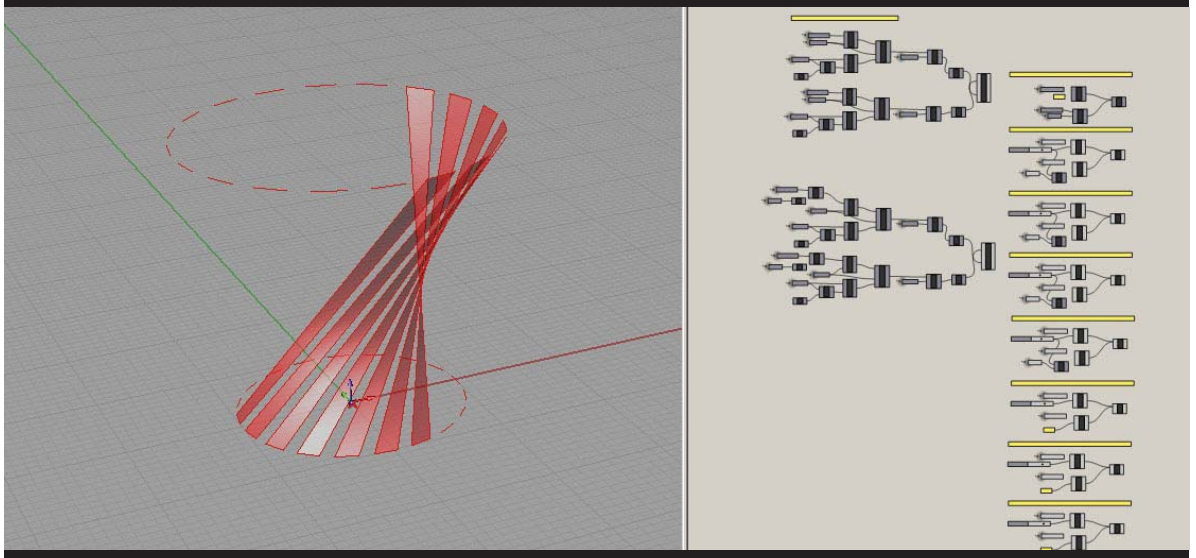


B) In Grasshopper

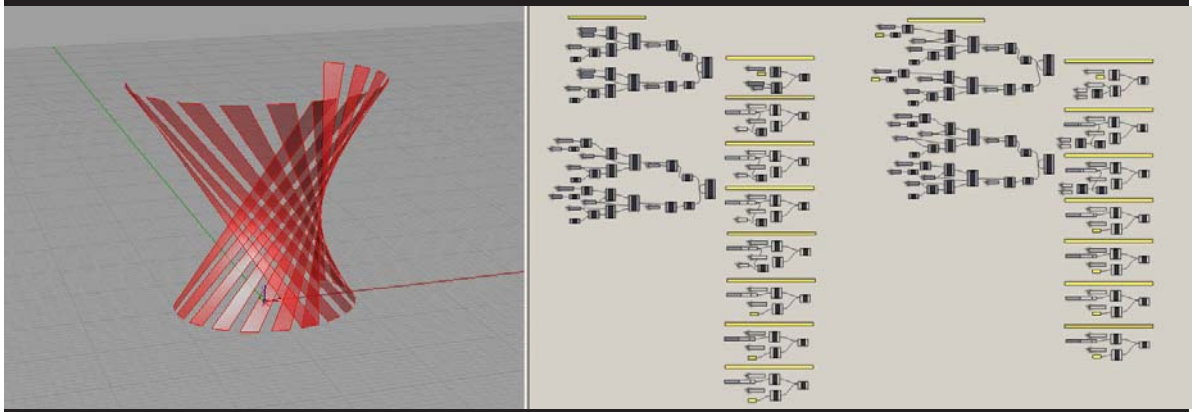
10.After this was done on the base and top circles, a script was created to loft the lines together with the twist number included.



11.There were attempts to have a series loft all the strips at once, but the twist and shifted sequence of numbers proved to be too much a challenge and so the lofting script was instead repeated for each line.



12.A similar script was then replicated to create the strips running in the opposite direction to the initial script.

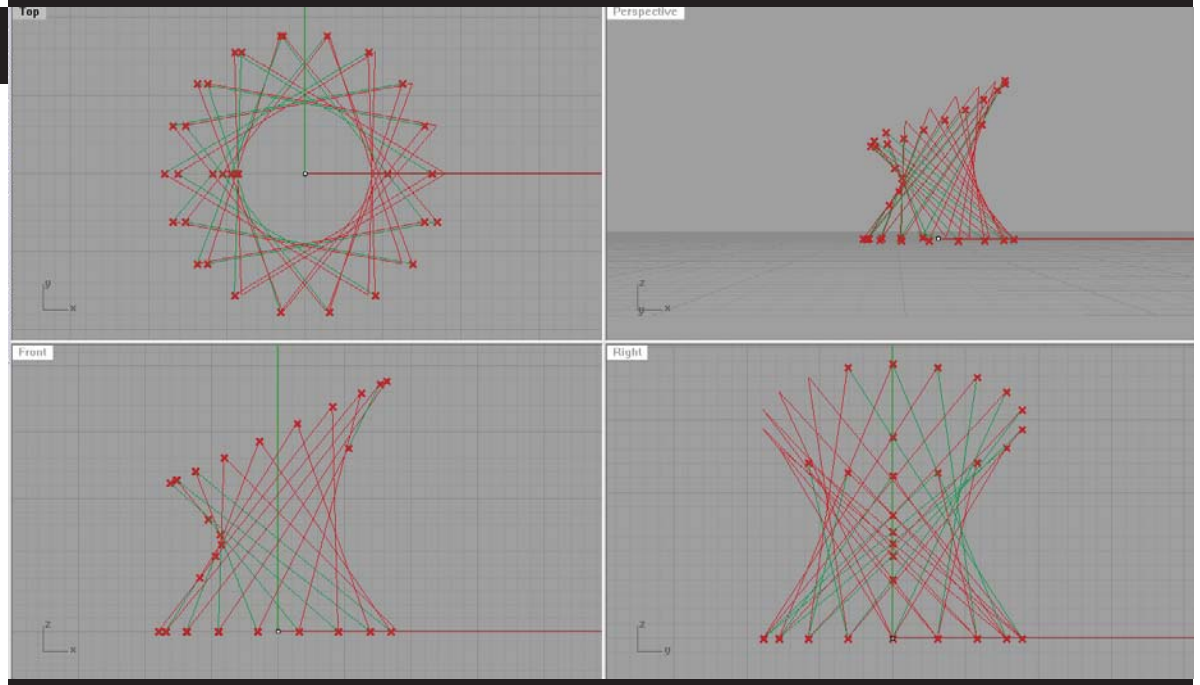


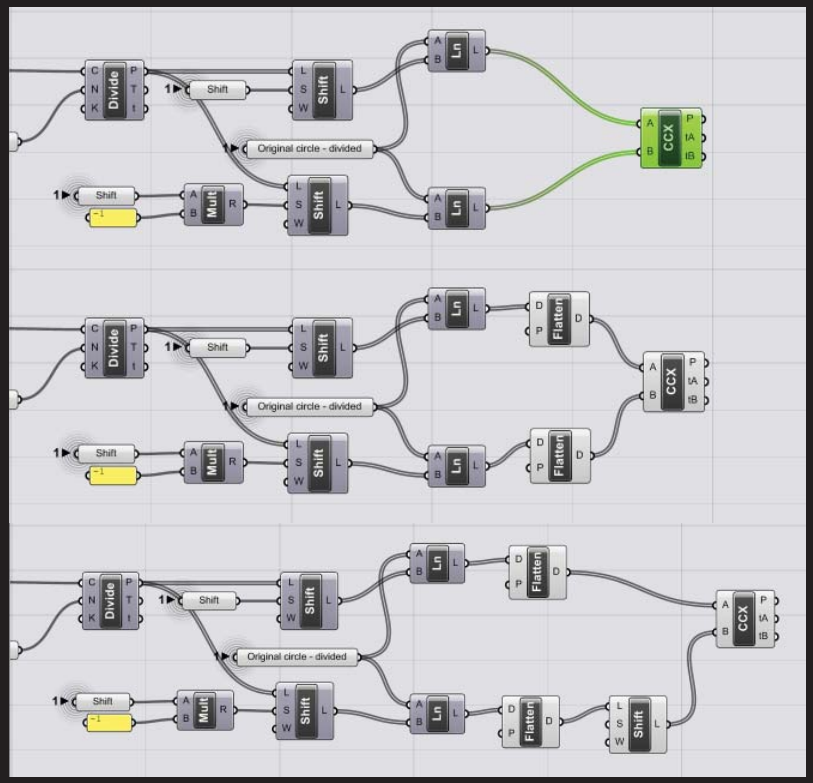
B) In Grasshopper

13.Holes and points of intersection

Points of Intersection:
We assumed the curve intersect tool would work (CCX), but it only resolved a set of points, but not all of them.

We baked and found that the geometry was warped because of the tilt of the top circle, so to make things simpler, we changed the tilt to zero radians (making the circle flat again, no tilt) and the function worked fine.





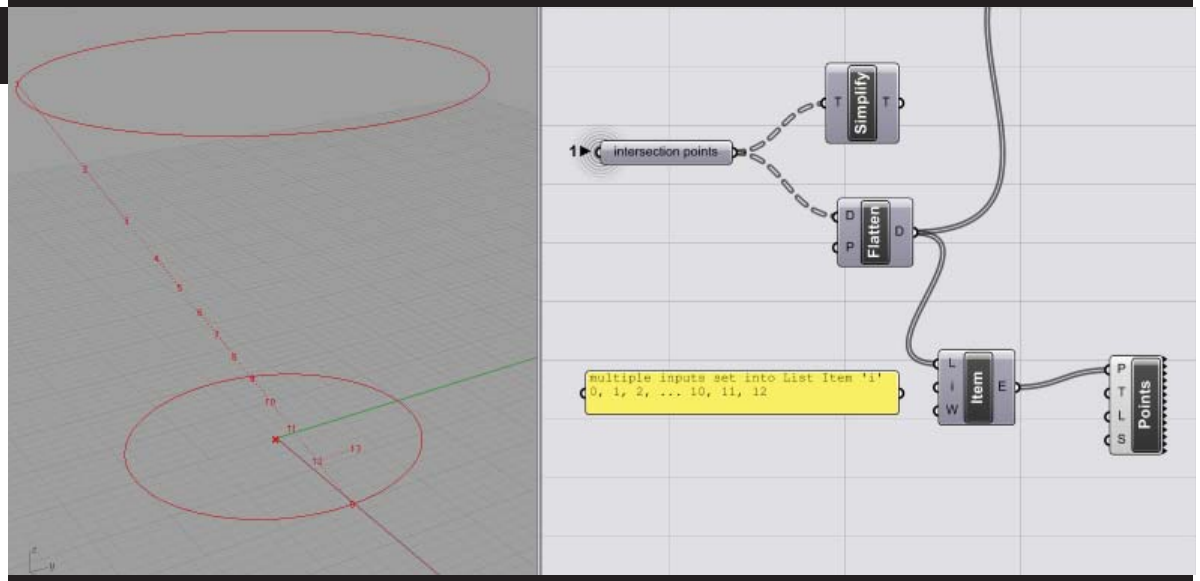
B) In Grasshopper

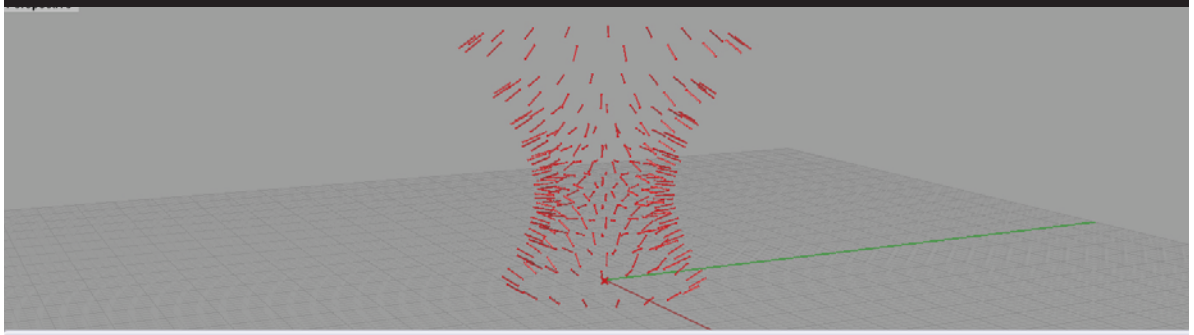
14.Holes

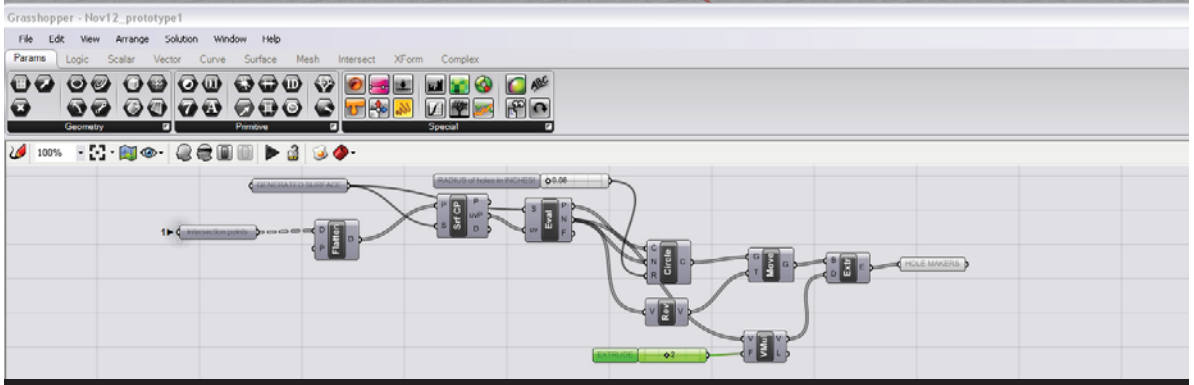
We first tried to use the lofted surfaces (refer to Jessica's script) to provide the surface upon which we should apply the points of intersection for the holes. This proved to be too complex once we realized the order that the points were generated in (once flattened).

This would require an inefficient and tedious script that would take a lot of time in order to coordinate the points to the correct lofted surface. This would also cause troubles when we played more with the form to determine the final shape. So we decided to sweep the surface using the top and bottom circles as the two rails and one line as the section curve. Though we had used the grasshopper "sweep2" command (the variables had plugged in fine and no errors showed), there was no result previewed on the screen. So instead, we had to do the same command in Rhino (which worked fine). This is the surface that we set into the Grasshopper function "surface" seen in the working script here:

We then connected the data to the points to the surface and made extruded holes similar to our method used in the previous assignment. Also, to save time, we used the "split" command in Rhino to cut the holes in the strips instead of using the "trim" command in Grasshopper.







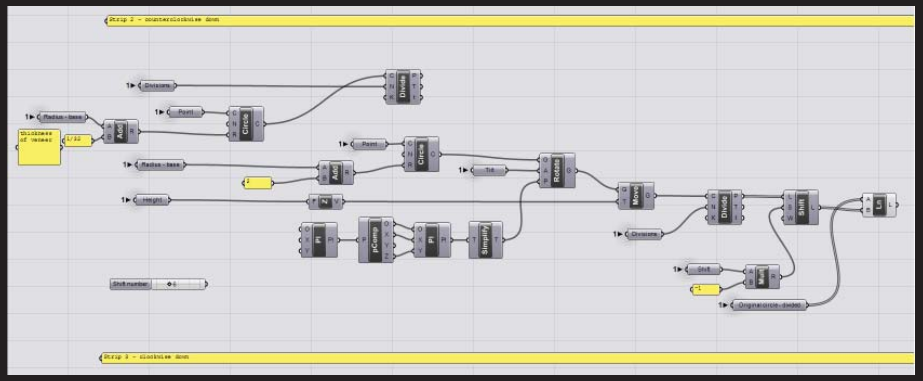
B) In Grasshopper

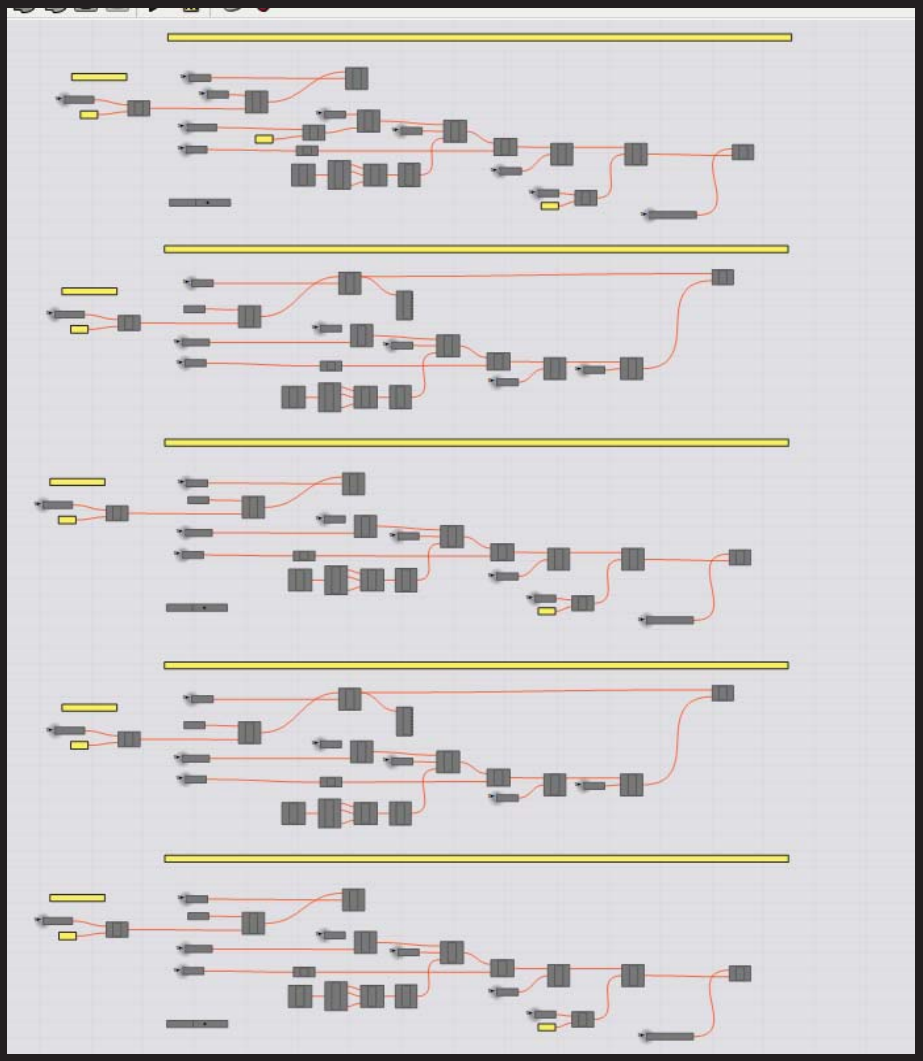
15.Offsets

We were originally going to copy the first script and change the radius of the circles to correlate with the thickness of a sheet of veneer.

This script was obviously repetitive and would be tedious if something in the original script changed.

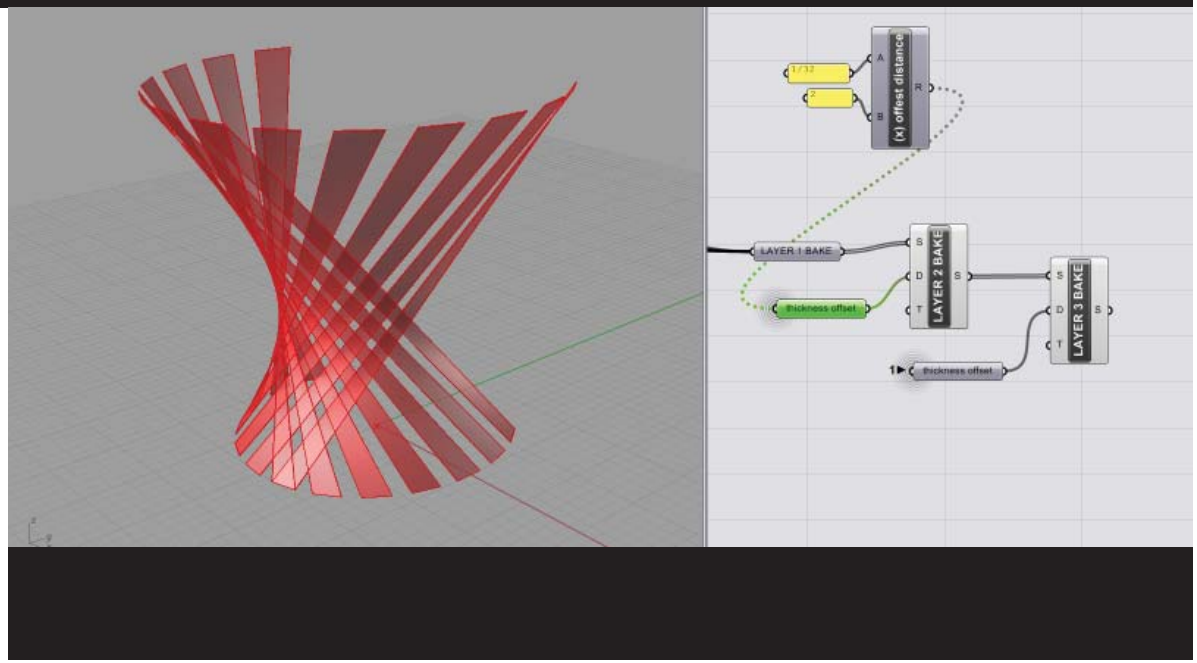
Instead, we used a simpler offset method like our previous assignment and clearly labeled it for the team members, who would now take the file to bake.





B) In Grasshopper

16. Instead, we used a simpler offset method like our previous assignment and clearly labeled it for the team members, who would now take the file to bake.



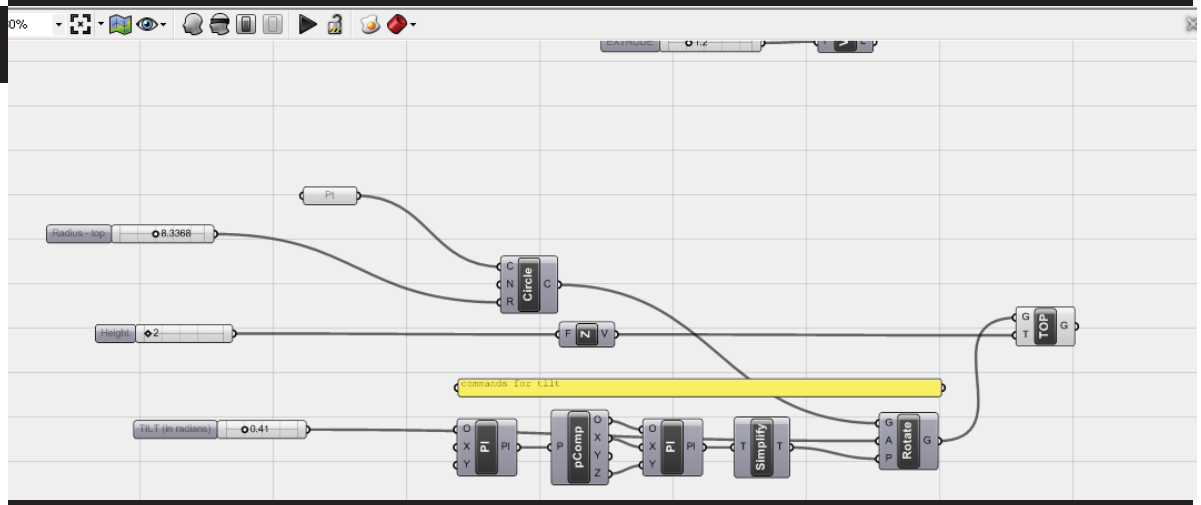
C) In Rhino

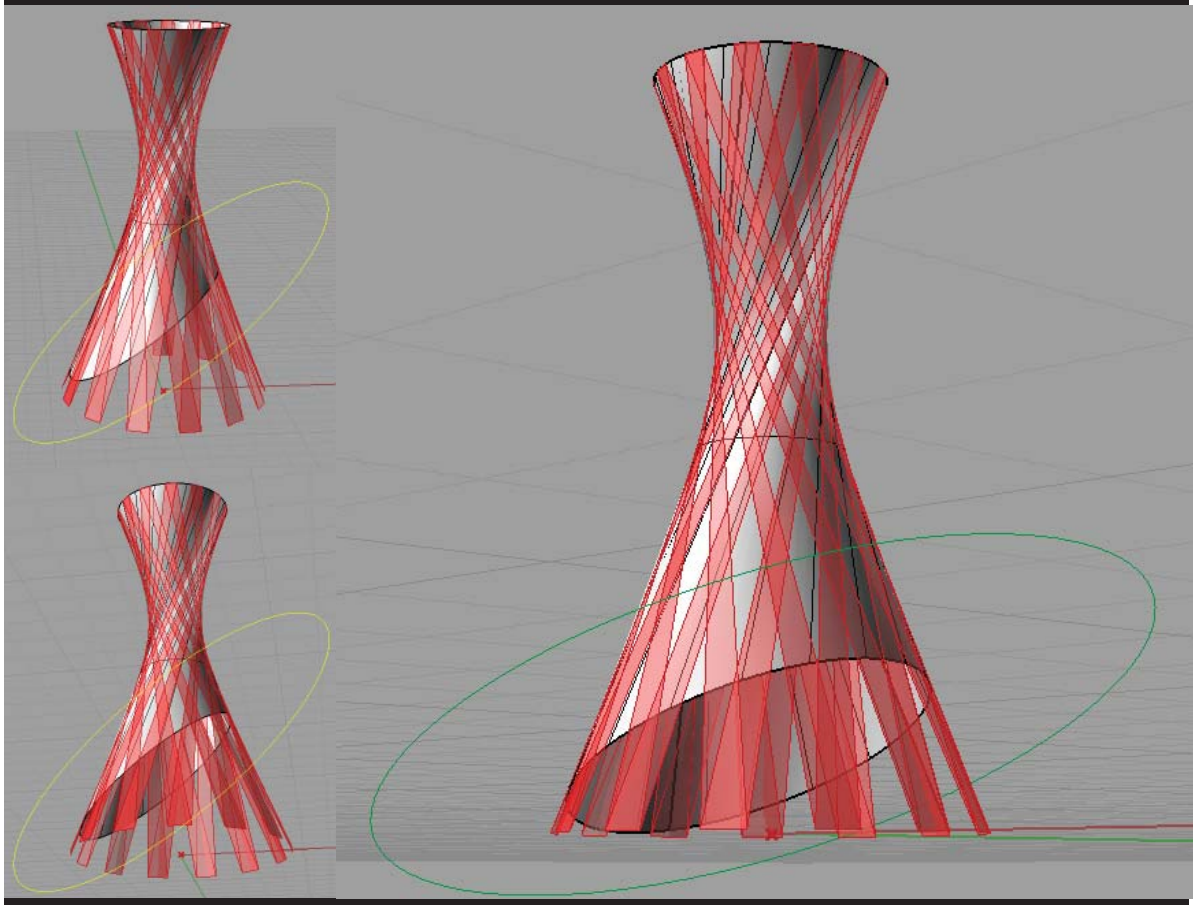
The problem we had with the tilted form in the Grasshopper script made us decided to cut the baked form in Rhino to obtain the tilt effect.

The cutting plane was defined in the script, so we only had to cut the strips with this inclined ellipse.

After, we subtracted the “holes makers” (which are tubes form the grasshopper script) to the baked strips.

The form was then ready to be unroll.





D) Respecting Budget

We knew the number of veneer panel needed once we placed the pieces of strips in the AutoCad layout.

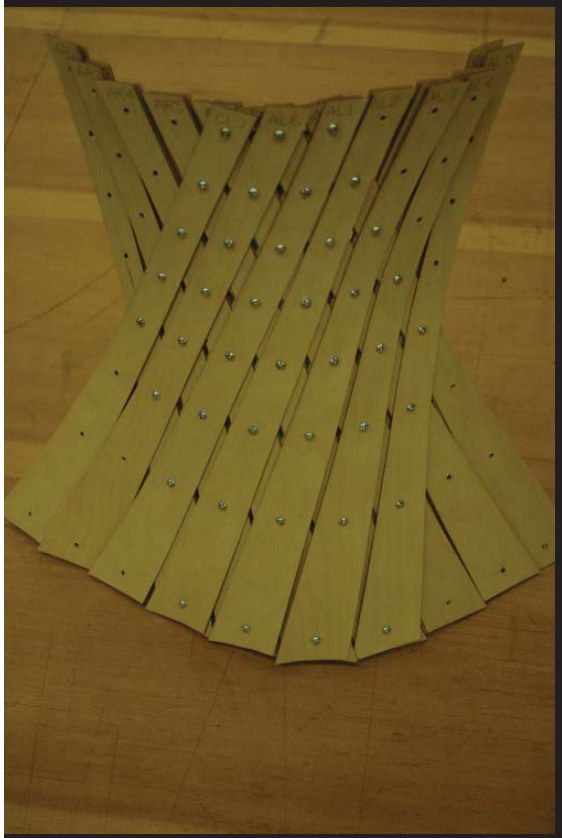
From our initial mock up, we learned that the original form used more veneer panels than we can really afford.

The initial estimation for the connections amounted to approximately 20-30, hence we hoped to limit our veneer sheets to 3 or 4.

Hence, we reduced the thickness of the strips and the size of the model. As a result, we were able to fit everything into 2 sheets of veneers, which totalize 24$ in material.

At the end, we used a total of:
-5$ for the mock up for connections
-15$ for the final connections
-2 sheets for the mock up and 2 sheets for the final at 48$
-10$ for the light bulb and light fixture

Our final pricing for the fabrication the product was: **24$ + 15$ + 10$ = 49$**
This was under the 70$ budget!



E) Learning from Mockup

Making a mock up was critical in our process to stay UNDER budget.
By only constructing 20% of our initial design, we realized that we were way over budget, as we were using already 2 sheets of veneers.

Testing in our mock up, we had cut the strips along and against the direction of the grain. The strips were stronger as we cut along the grain of the veneers.

During the construction of the mock up, we tested with nut and bolts. We preferred the aesthetic of the connections. However, we were aware of the difficulty of assembly, as they needed to be bolted inside the lamp.

Assembly was predicted to be tedious and difficult, but we had some able hands on board the team.

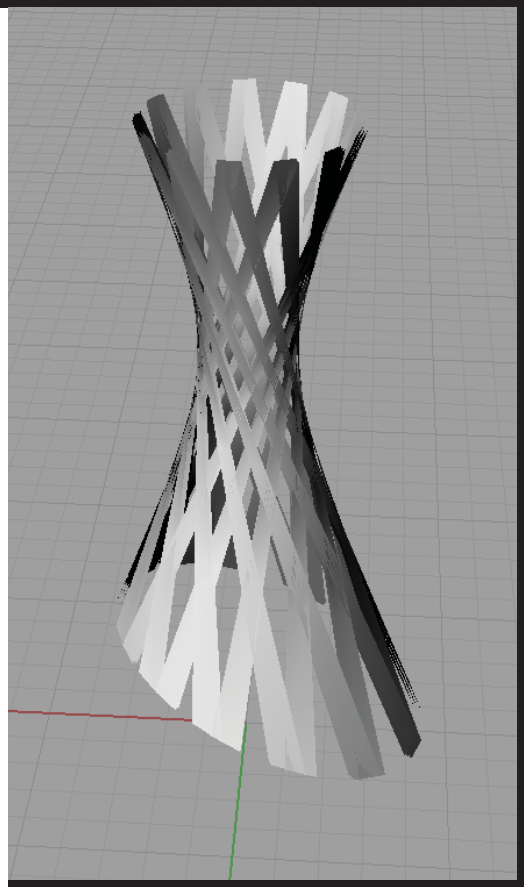
Laser cutting was problematic. Since the veneer sheets warped and pieces cut would move.

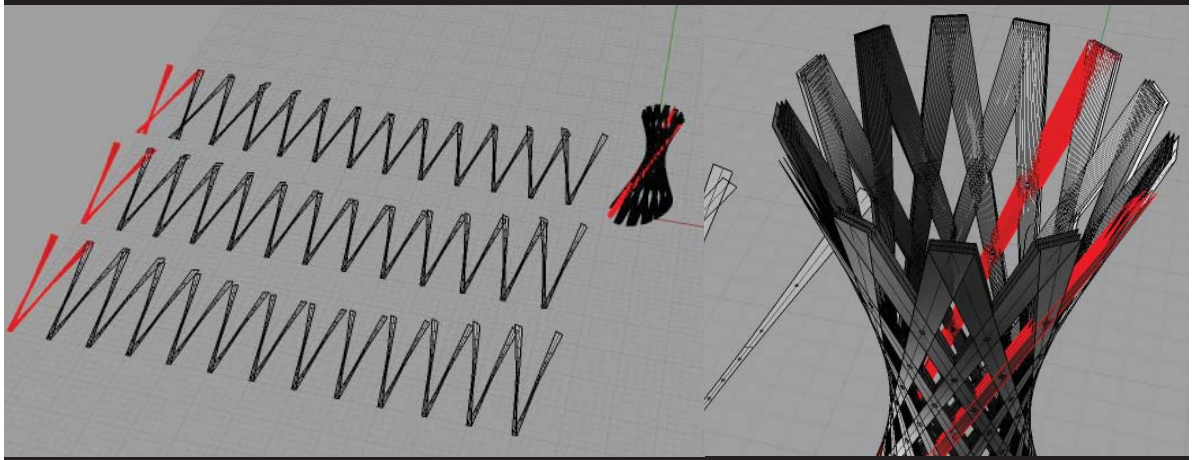



F) Bake & Unroll

In the unrolling process in Rhino, the strips were flipped. Hence the surface facing the exterior of the lamp was flipped inward and vice versa.

This was unannounced to us, as we proceeded with assembly. As a consequence, the bottom edge is not straight across. However, we were quite satisfied with the aesthetic results.





G) Laser Cutting

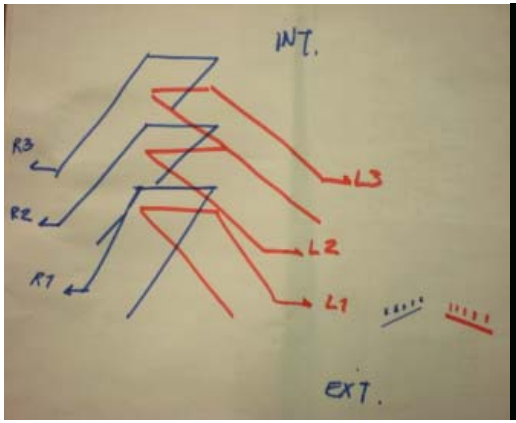
We wanted to find an aesthetic way for numbering our strips. Since ithey do appear on the exterior layer of the lamp, we wanted symbols that would dictate the number of the layers, the direction of the strips and the order of the strips.

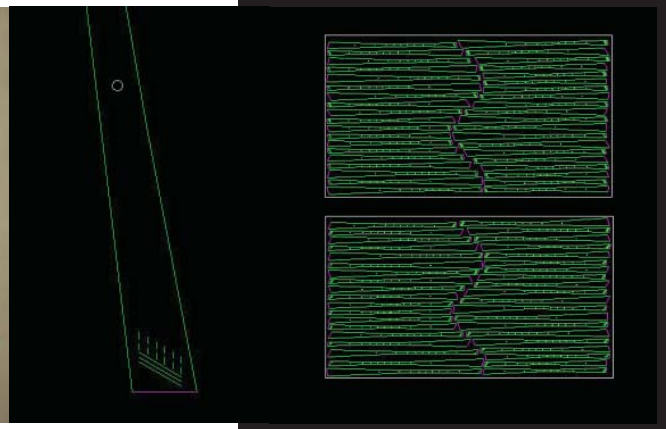
The strips were along the longitudinal direction of the lamp, they were laid out in the same way on the panel. The strips were laid down along the grain of the veneer for strength.

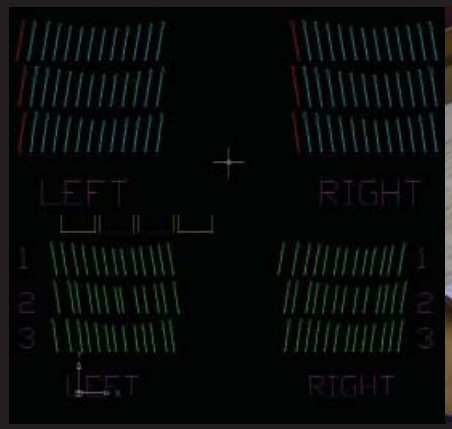
From our initial experience laser cutting the mock up, we noticed that the veneer sheets were warped. As a result, the pieces cut would move while the machine was cutting

To prevent problems, we assigned the colors in laser cutter so that the holes were cut first, then the long edges of the strips, then the shorter edges.

Also the veneer sheets were mounted on a MDF board with double sided tape.







H) Assembly

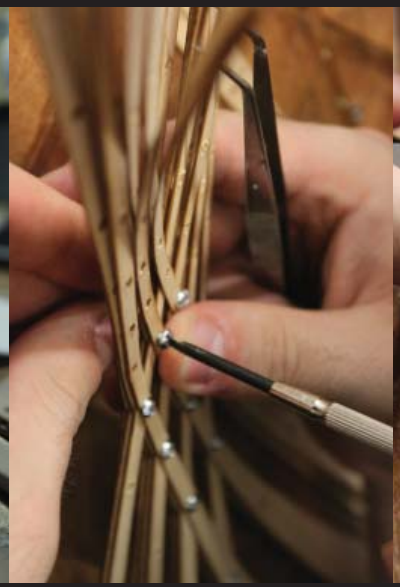
A precise and detailed transfer of information and process is important in the project. It is difficult to relate the cut pieces with the initial model. In addition, an organization of the pieces and precise planning before assembly is eminent.

The building process was tedious, as the double sided tape needed to be removed. Also, the smaller lamp meant that it was more difficult to tighten the bolts in the interior of the lamp.
Having the right tools is essential in assembly such an object.

Another issue was the size of the holes, which were too small. Hence, we had to enlarge them before assembly.

Many skilled hands were needed at once to hold and bolt at the same time.




H) Assembly

Building

Final product

Final Product