The submitted project is a forward thinking lighting design concept that fully engages contemporary means of digital design and production – creating mass-customized fixtures efficiently and economically. Rather than designing a single and specific light **we designed a system for producing multiple and endlessly variable forms of lights** – that could all utilize the same material, detail and means of production. Ease of assembly, minimizing fasteners, and generating a design whose components could be flat-packed were additional and essential features.

The project was made possible through modeling software that facilitated the design of a system based on variable parameters. The variables were: **Form** (control through the shape and position of three elliptical profiles), **Twist** (control of the modulation, degree, and direction of twist in the fixture segments), and **Segments** (control of the number of segments in the fixture body.) Additionally a computer script was written to produce the edge tab-ing and part labeling for each segment of a particular fixture. This unique tabing design allows for fastener free assembly of the fixture body - and through the play of light and shadow gives a texture to the fixture surface - collapsing the distinction between ornament and utility.

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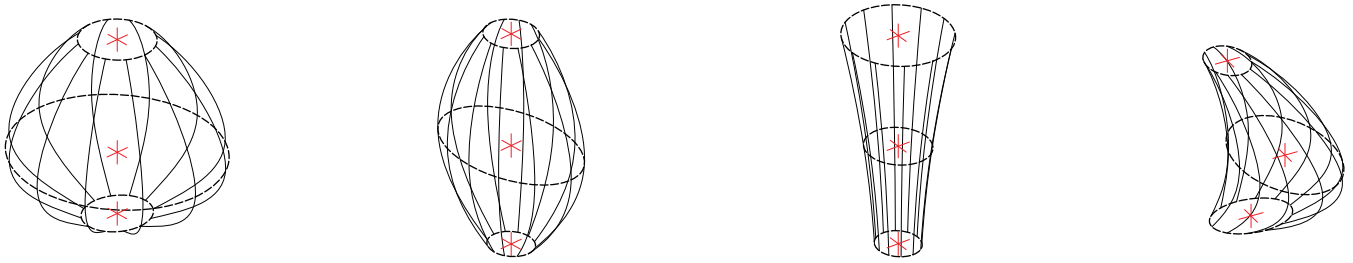
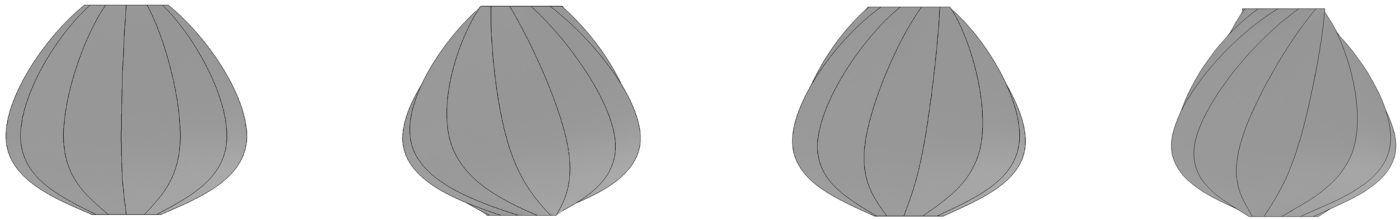
Luminaires installed in restaurant

FORM
The form of the fixture is controlled through the shape and position of three elliptical profiles.

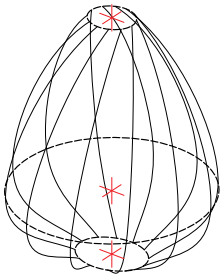


TWIST
Twist in the form is varied through the modulation, degree, and direction of twist in the fixture segments.

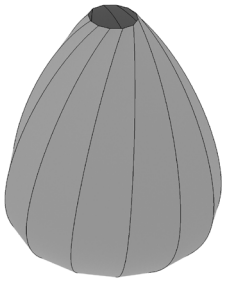


SEGMENTS
The number of segments can be varied - which has a great impact on the shape of the form.

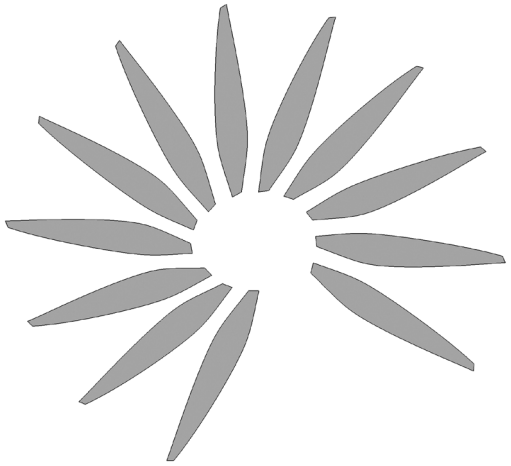
A unique characteristic of the project is the flow between the system of design and means of production. Central is the fact that **no drawings are produced to make the fixtures from**, rather – the lines that are output from the software are the tool-paths the machines read to cut the elements of the fixture. The body of the fixture is cut out of YUPO (a 100% recyclable plastisized paper) on a ZUND-CNC knife cutter. Depending on size, each fixture can be cut in 3 – 6 minutes. The acrylic bracket that holds the lamp is laser cut in a similar fashion. And additional tab-ing which holds the bracket to the fixture body is also knife cut from PETG plastic.



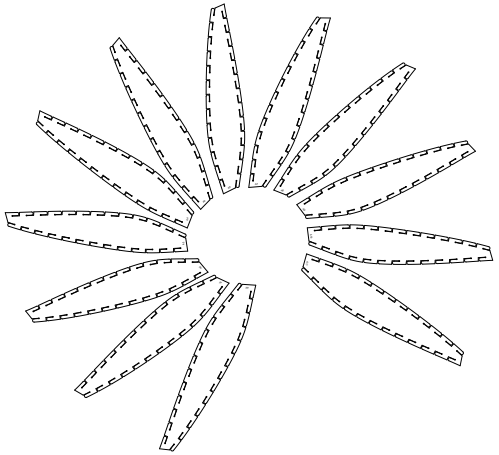
Form of fixture is designed by manipulating variables. This produces a series of sectional lines.



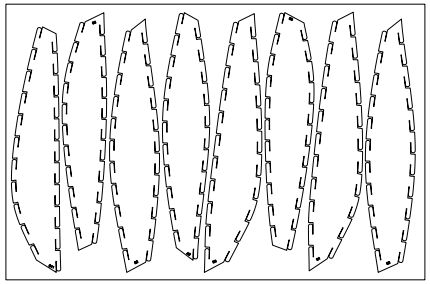
Developable surfaces (ones that can be flattened) are then generated from the sectional lines.



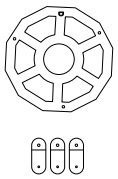
Surfaces are 'un-rolled' (i.e. flattened.)



Tab-ing and labeling scripts are run on unrolled surfaces - producing tool paths for machining.



Tool-Path segments are nested on sheets for CNC knife cutting.



Brackets and supplemental tab-ing are cut from cast acrylic and PETG plastic.

After flat-pack shipping fixture is assembled on-site by hand.

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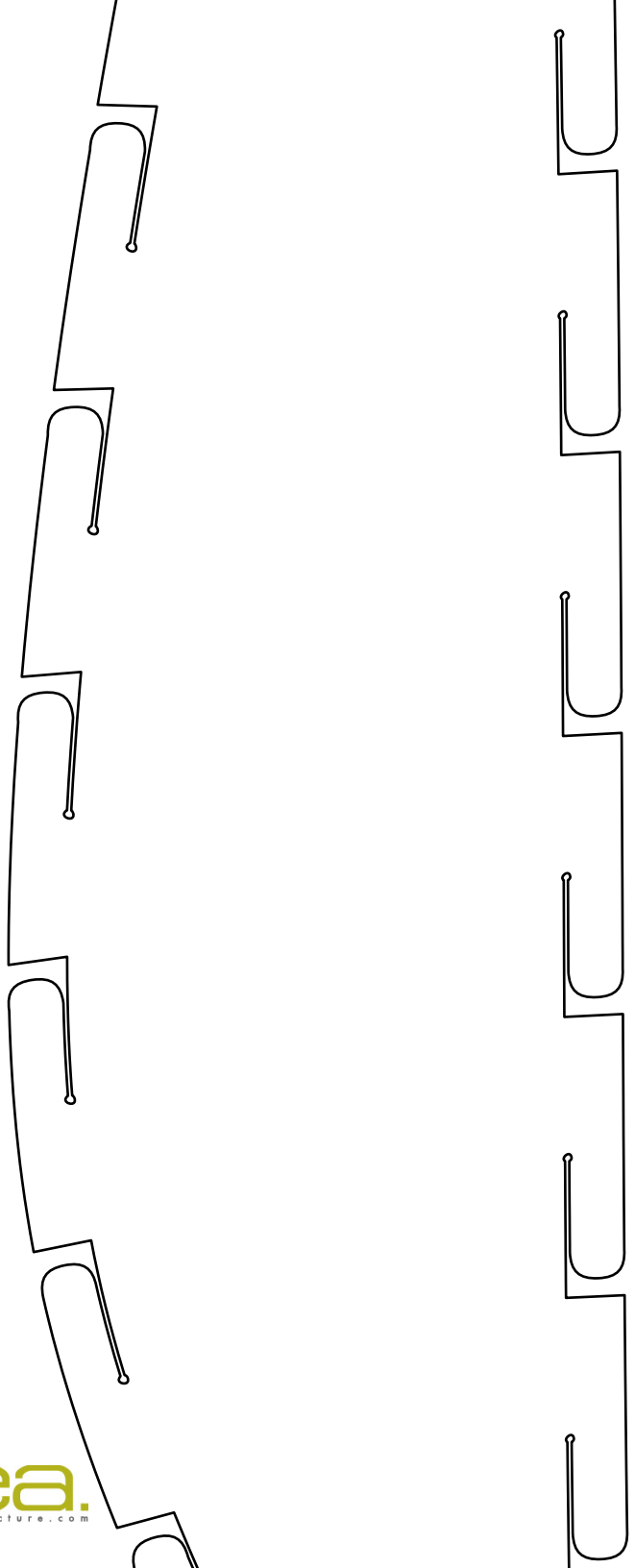
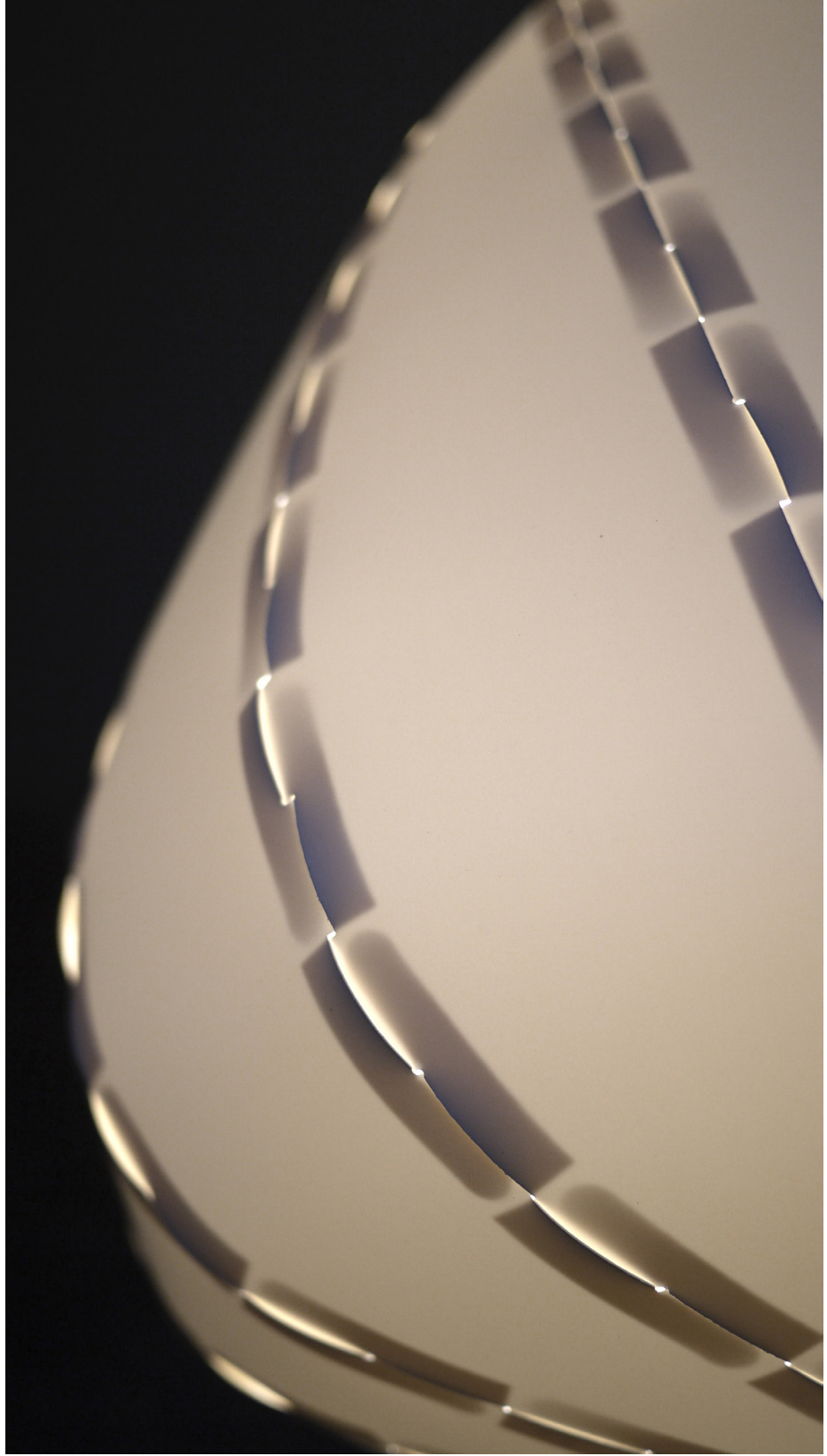
Assembly of Fixture Body





Tab Detail

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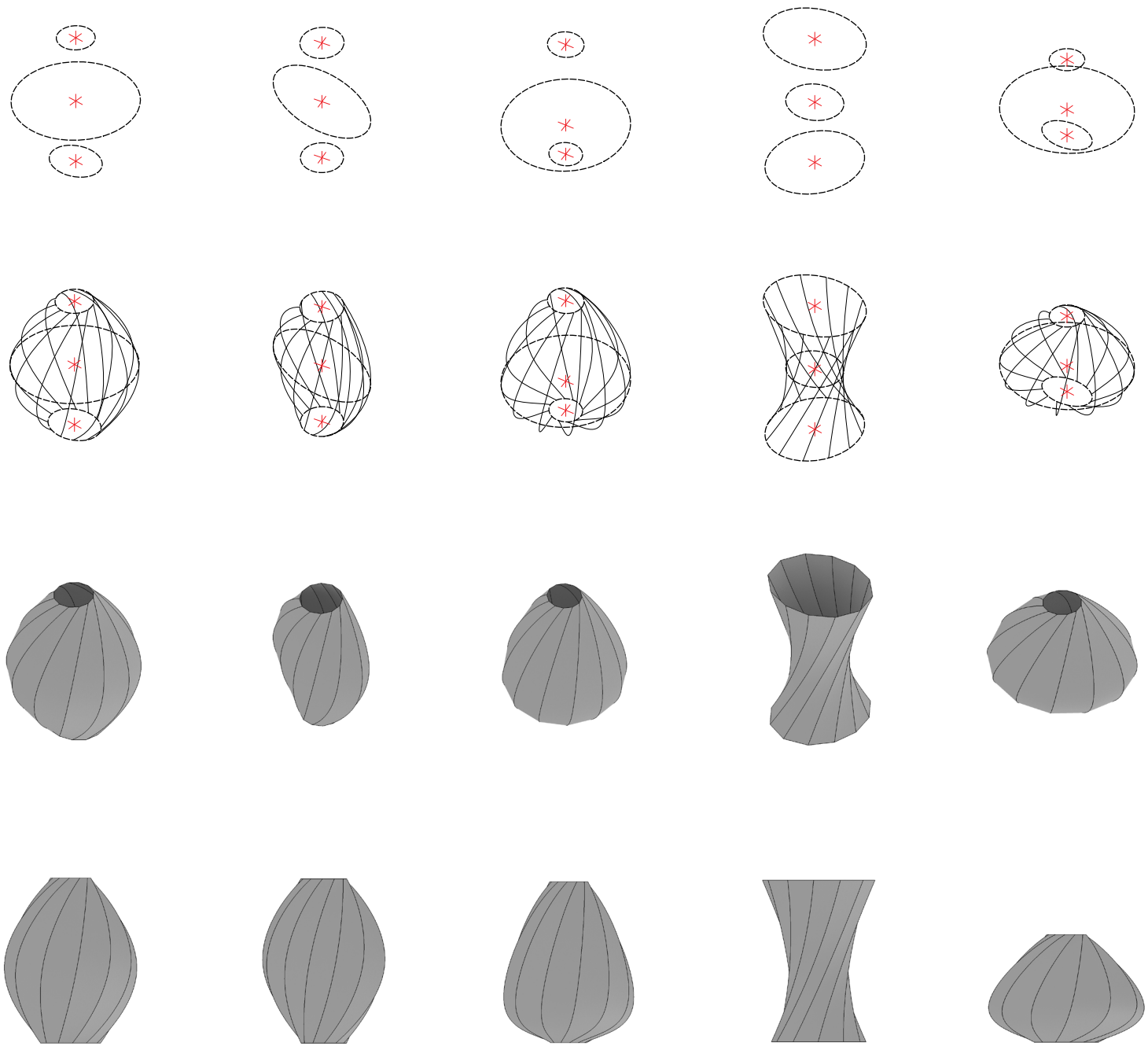
Endless variations of form are possible. All variations utilize the same tab-ing detail which, through scripting is designed to respond to different formal conditions.



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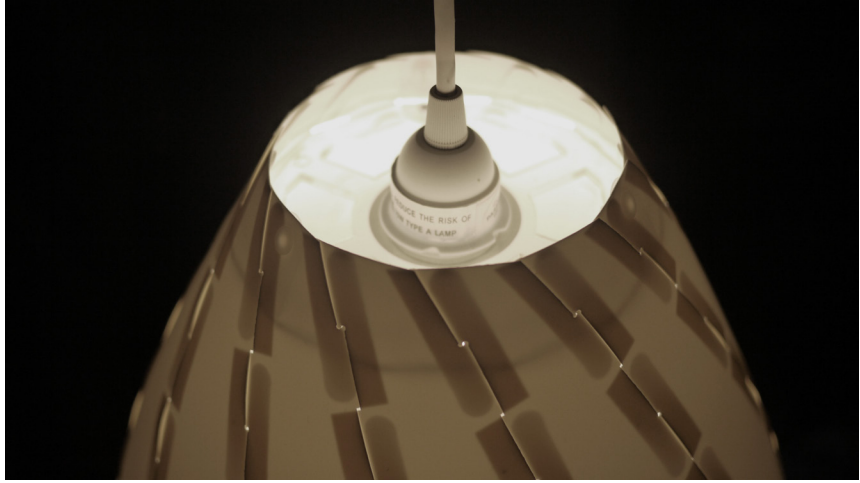
Potential Variations



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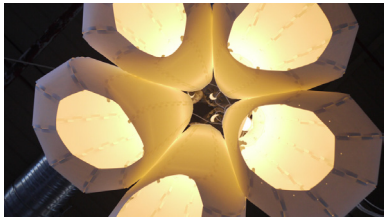
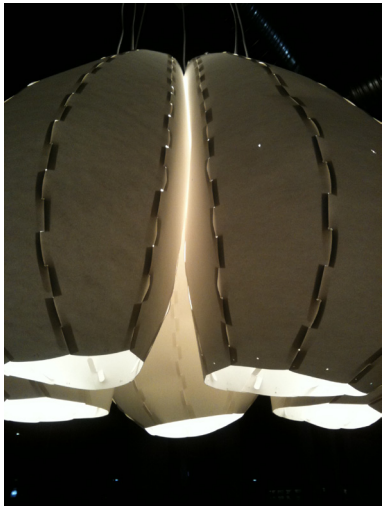
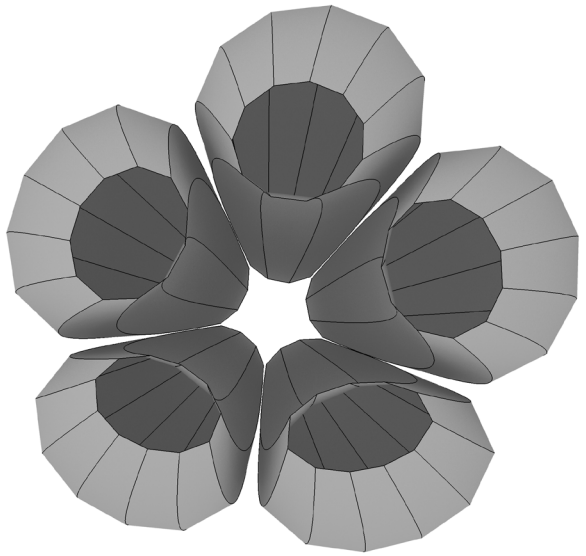
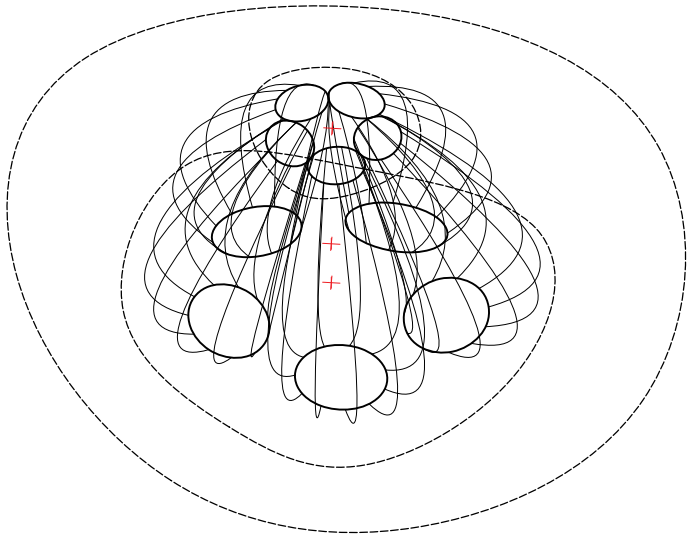
Still under prototype development - fixtures which combine multiple elements in a single ‘chandelier’ form. The overall form is controlled by manipulating three amoeba shaped rings. The number of elements, segments, and form of each element is controlled through the system. Individual elements are output in the same fashion as the single lights and are joined together with nylon rivets prior to hanging.









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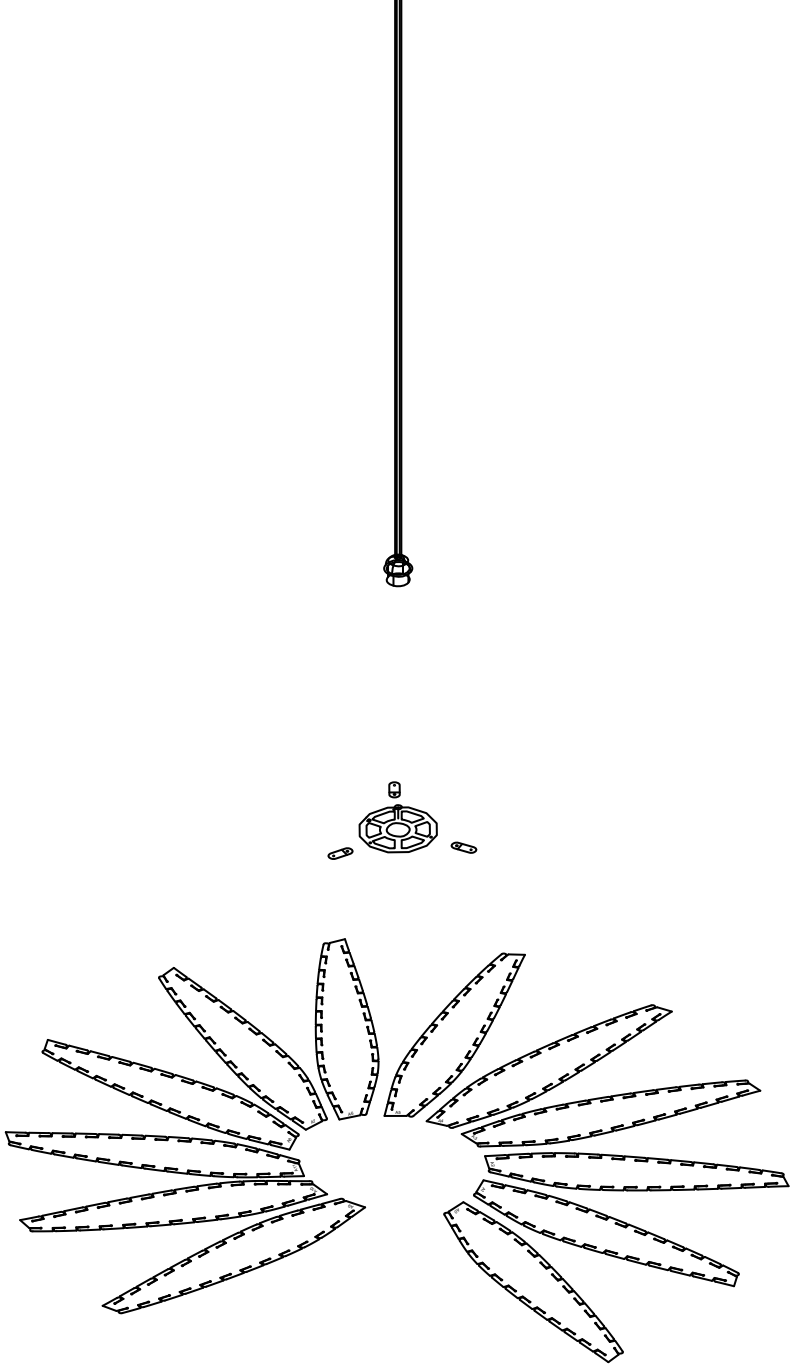
Multi-form Prototype Development

SPECIFICATIONS

Dimensions
Height - varies (10” - 31”)
Width - varies (8” - 50”(multi-form))

Materials
Fixture Body - YUPO Paper
Lamp Bracket - Cast Acrylic
Bracket Tabs - PETG Plastic
Aluminum Rivets - (bracket tabs to lamp bracket)
Nylon Rivets - (lamp bracket to fixture body)
Lamp - standard incandescent bulb fixture (75 watt max)

Software
Rhinoceros 3D modeler
Grasshopper plug-in for Rhinoceros
Python with Rhinoscript

Processes
ZUND CNC knife cutting - Fixture Body and Bracket Tabs
Laser cutting - Lamp Bracket

Costs
Total material cost for single fixture - under $10.00