

GlaDes2

Glasses Designer V2

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F22' CMU 48724-A

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GlaDes2 Overview:

The design of glasses is an expert system problem; despite their simple appearance, a number of complex variables are involved with many dependent and semi-standardized components.

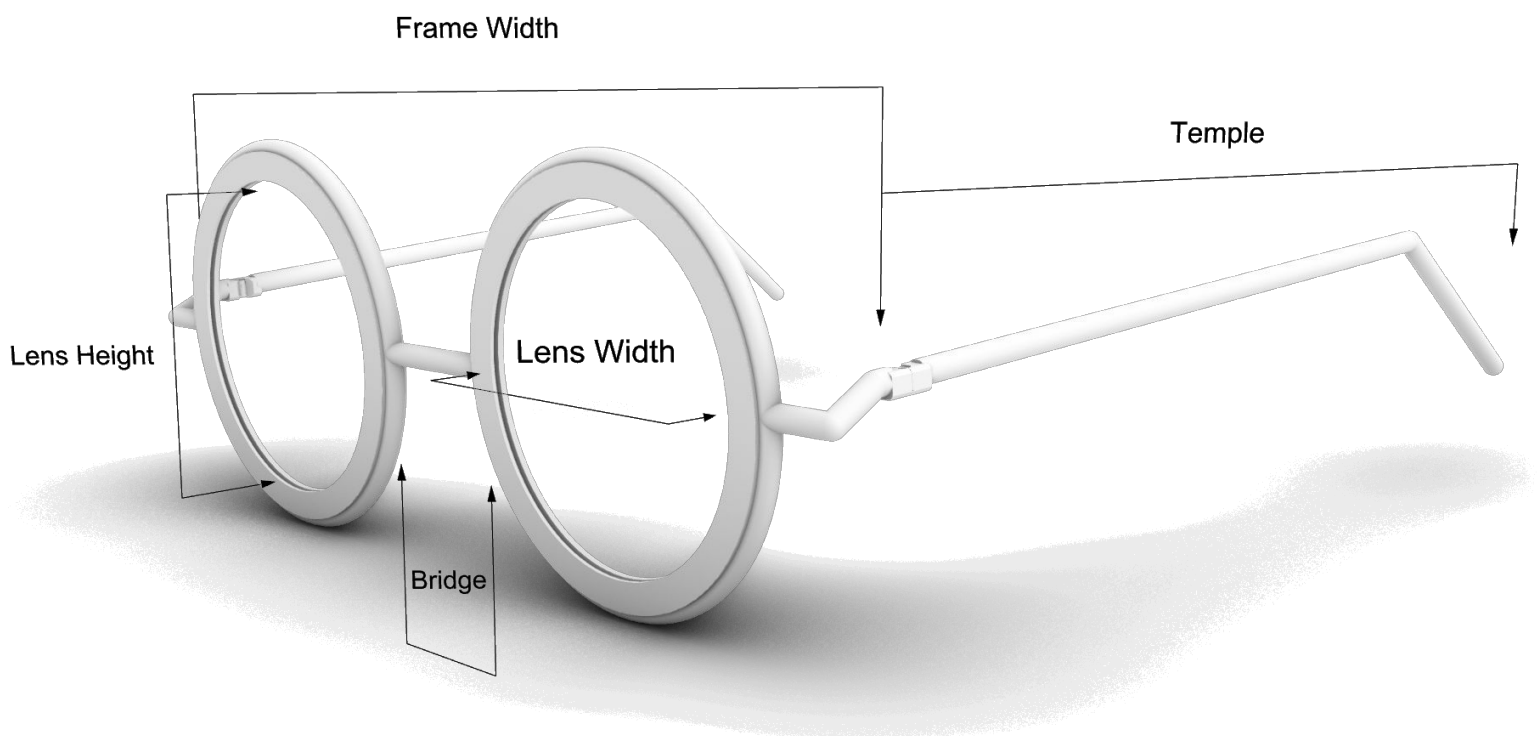
The current glasses design environment is largely controlled by a few principle companies such as Luxotica, with smaller companies such as North Point Eyewear and Warby Parker.

GlaDes aims to provide a simple and intuitive user experience for designing their own eyewear; through incremental improvements the system allows for a large number of forms and features with a focus on independent production and considerations for commercialization, design for manufacturing and future adaptability.

With a focus on one-off designs, 3D printing is the optimized production technology, print in place components and snap together features have been a significant focus. Due to the complexity of lens calculations and fitting, available export options for lens shapes are ideal for laser cutting of flat lenses such as polarized filters.

Overview of common glasses features:

- Frame Width: Edge to edge width of the frame.
- Nose Bridge Width: Distance between insides of lenses minus frame thickness.
- Lens Height/ Lens Width: Affects field of view and placement within frame width.
- Temple/Arm Depth: Temple length is measured from front of hinge position, to ear-hook bend, then straight to end-piece.
- Hook Position and Angle: Determines where start of the bend in temple arm begins and the angle at which it bends down to hook behind ear.



GlaDes2 Controllable Script Network

User Inputs

Head Model Options

Select your preferred head model please.
 0 = Female Head
 1 = Male Head Style 1
 2 = Male Head Style 2

Frame Parameters

Decide your frame width. This should be within 125 to 150 mm.

Decide your bridge width. This should be within 14 to 24 mm.

Decide your temple length. This should be within 125 to 150mm.

Decide the temple displacements.

Please adjust the following values to make the frame fit your head.

Decide your hook position.

Decide your hook degree.

Please adjust the following value to make it fit your head.

Lens Parameters

Select the base shape you would like to start:
 0 = Circular, 1 = Rectangular and 2 = Freecurve Shapes

If you selected 2 - FreeCurve Shapes, please choose a preferred FreeCurve.

Notice that if you didn't select 2 in the above list, changing this will not make any difference.

The following parameters may not be available if your frame width is not large enough for containing the components.

Decide your lens width. This should be within 40 to 60 mm.

Decide your lens height. This should be within 32 to 45 mm.

Decide your frame thickness around the lenses. This should be within 2 to 6 mm.

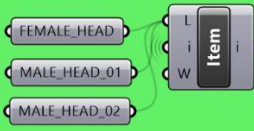
Decide your rectangular fillet radius. This should be within 1 to 20 mm.

Only available for 1-Rectangular Shape Option

Decide the thickness of your lens glasses.

Implementation

Head Model Options

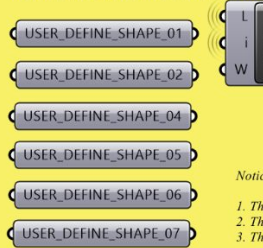


Head Rendering



User Customized Shapes

Please use the prepared 7 curves as a demo trial.



Alt frame style test

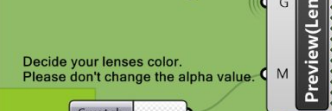


Notices for current version:

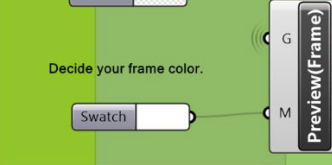
1. The customized curve should be drawn on the XZ plane.
2. The bounding box of the curve should have its left-bottom corner placed at the original point.
3. There could be bugs for some non-convex shapes, but overall it should be working well.

Output Parameters

Frame Rendering

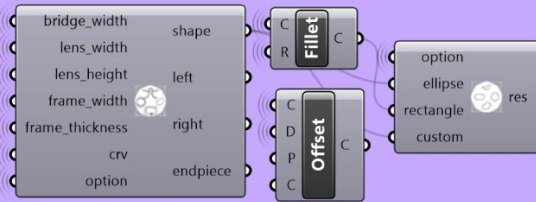


Decide your lenses color. Please don't change the alpha value.

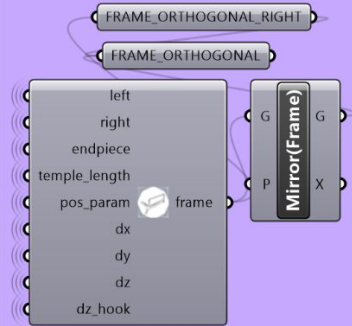


Decide your frame color.

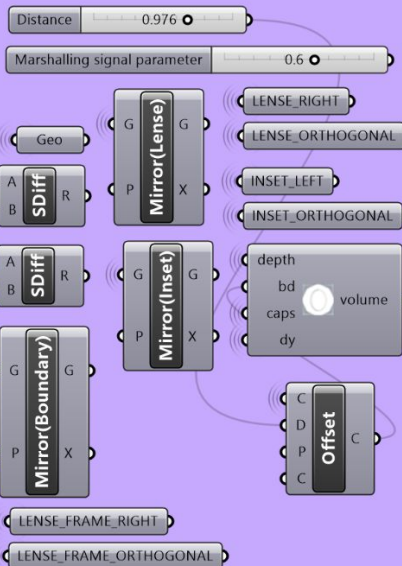
Construct Lense Outline Shapes



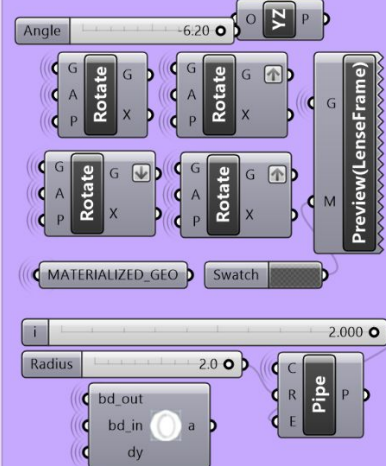
Construct Frame Shape



Construct Glasses & Insets

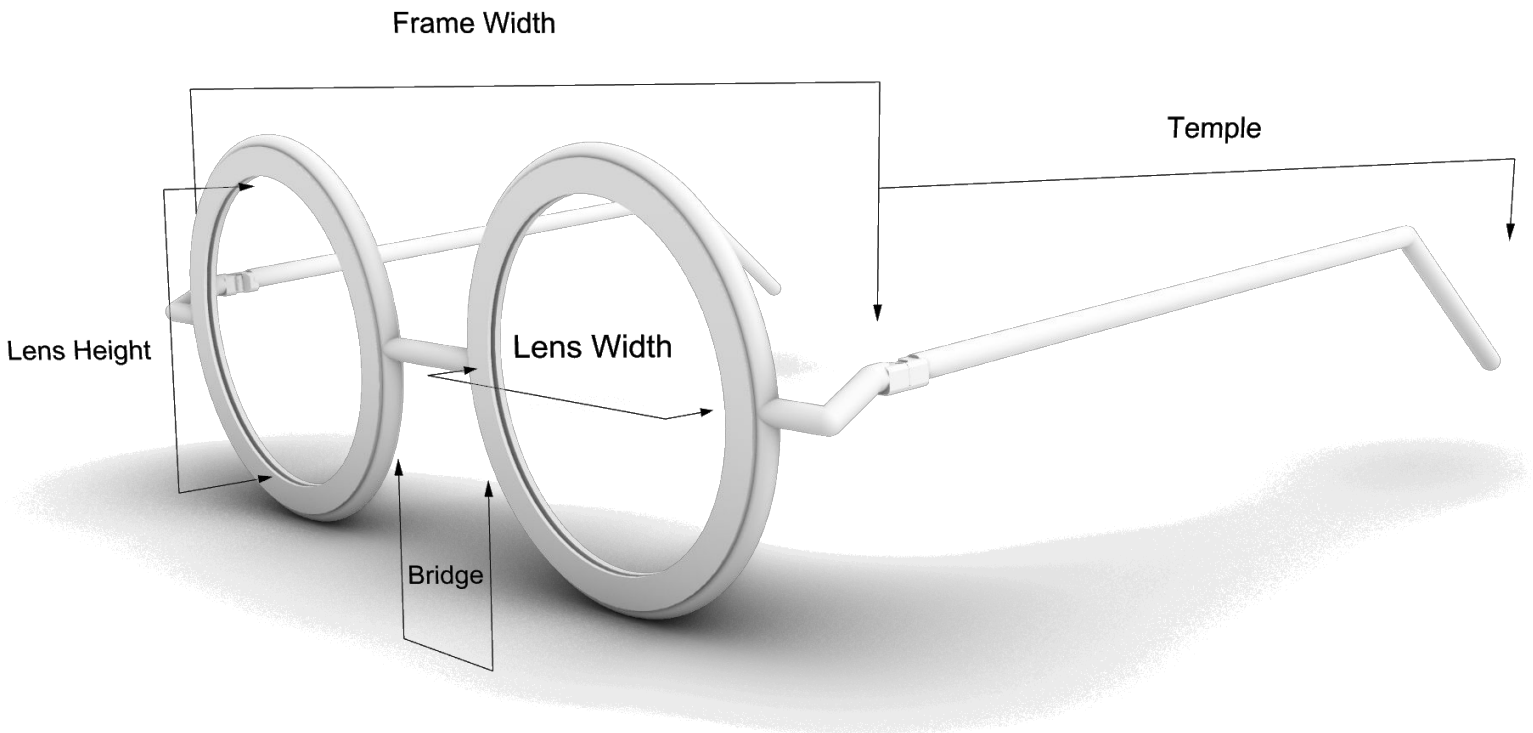


Rotation & Finish



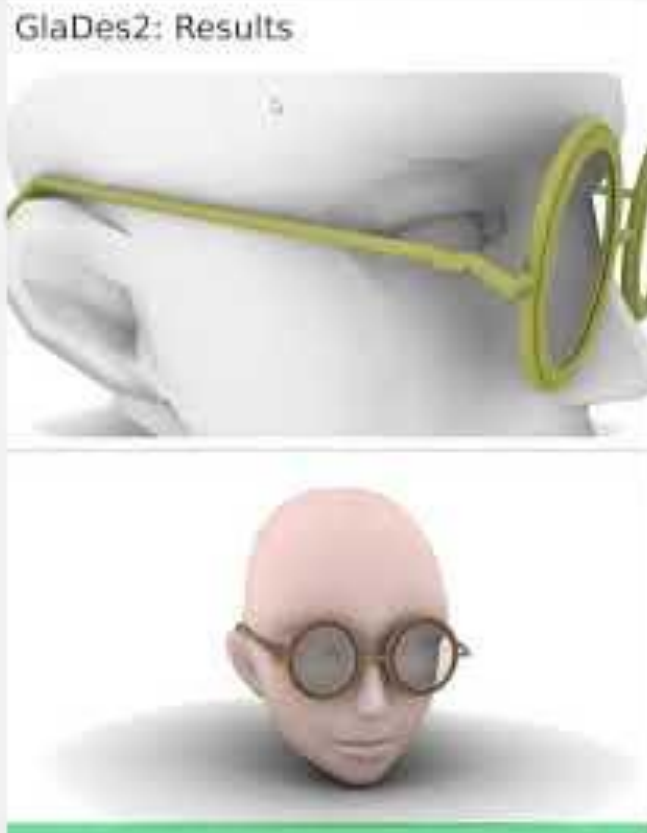
Key Variable Domains:

- Frame Width: ~125-150mm
- Nose Bridge Width: ~14-24mm
- Lens Height/ Lens Width: 32-45mm(H) / 40-60mm(W)
- Temple/Arm Depth: ~125-150mm
- Hook Position and Angle: .65-.75% of Temple Depth, negative 10-22 degrees



GlaDes2 Video Demo and Walk-Through

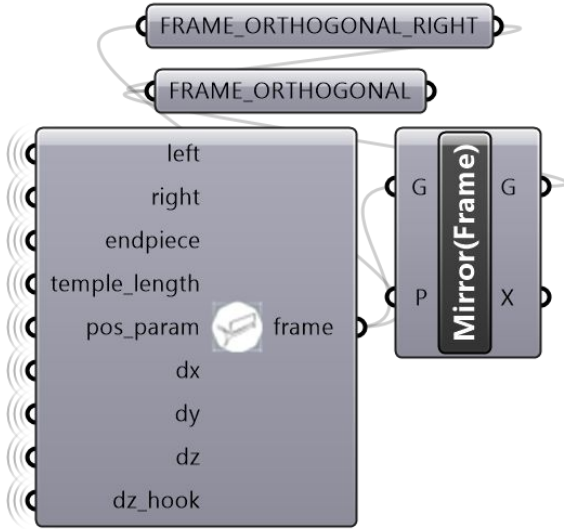
<https://youtu.be/bzwsU-Yve4k>



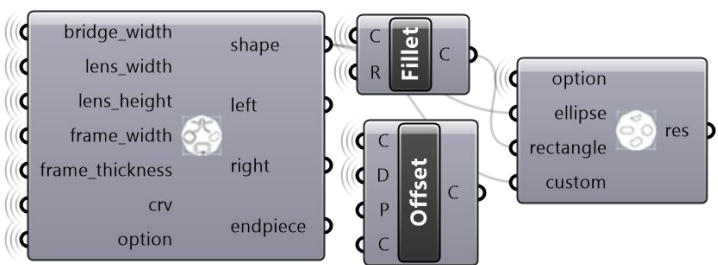
- Initial setup is done left to right, top to bottom.
- Grouped variable controls are based on shared features.
- A dual monitor setup is recommended to more easily see live changes.
- Please save a separate copy before you start working to easily return to default settings.
- The primary UI is the left column of sliders, a written description walks users through the options.

GlaDes2 Component Library Overview

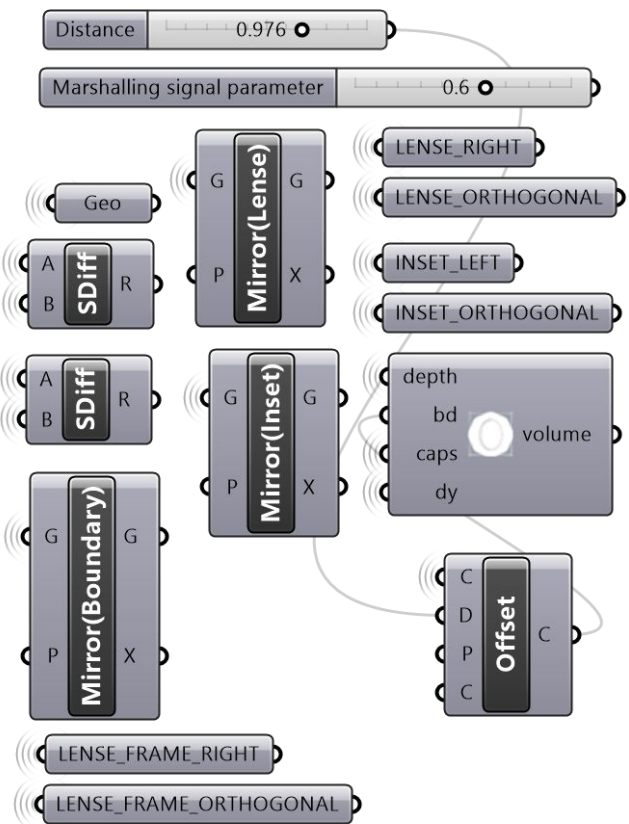
Construct Frame Shape



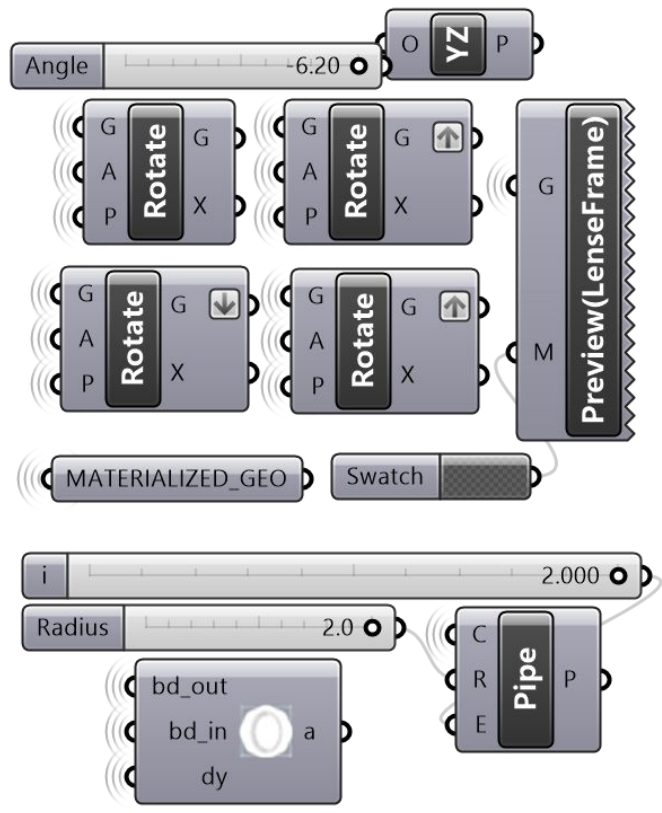
Construct Lense Outline Shapes



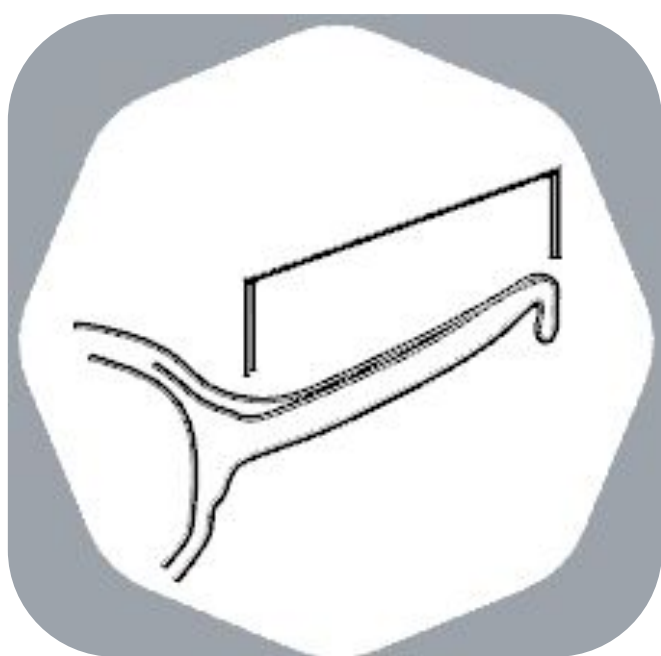
Construct Glasses & Insets



Rotation & Finish

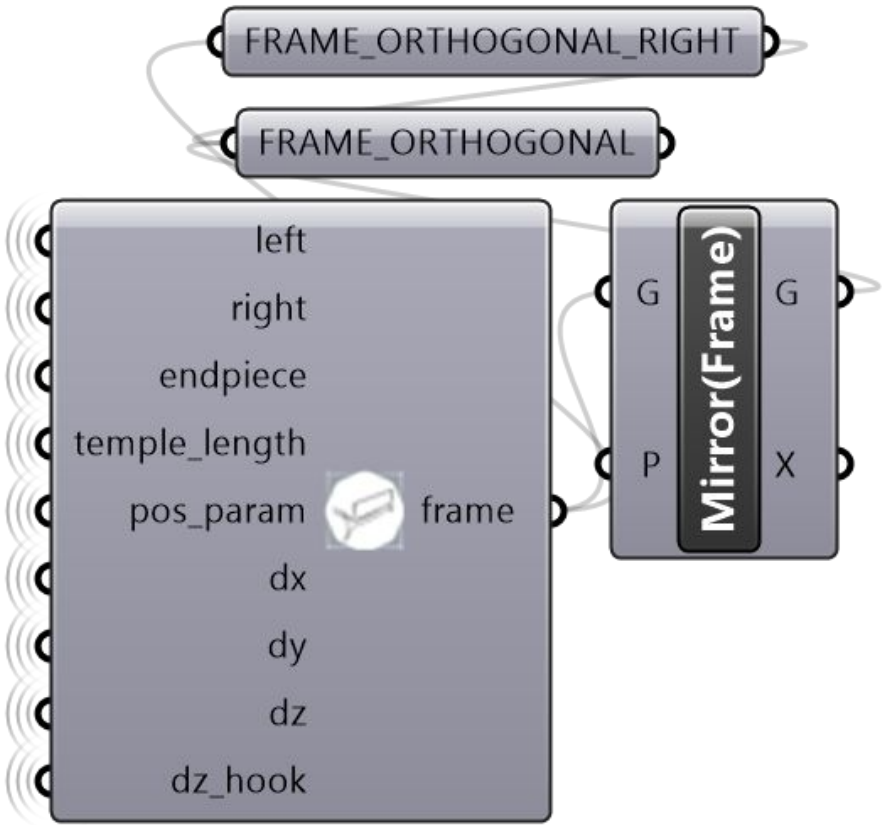


GlaDes2 Component: Construct Frame

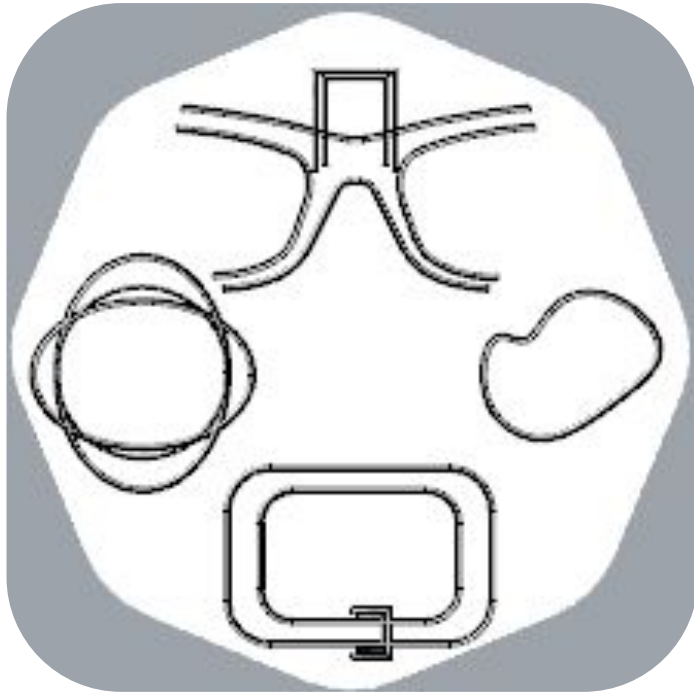


Constructs frame width guide, temple arm curves, displacement and location of endpieces.

Construct Frame Shape

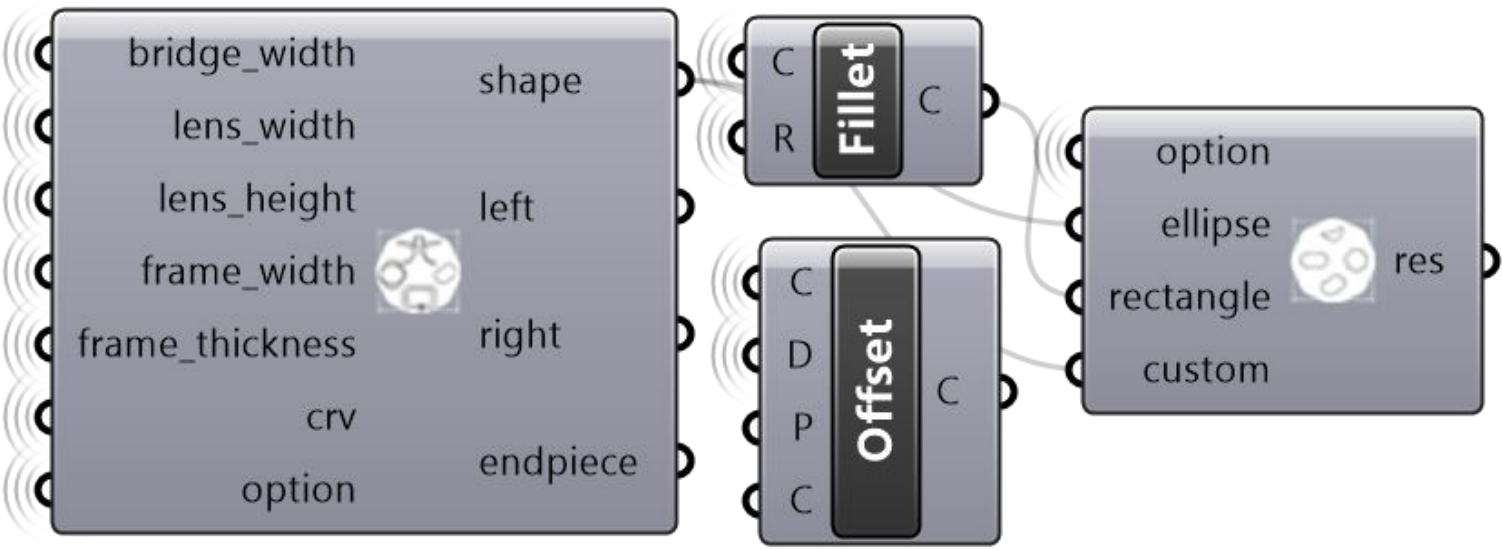


GlaDes2 Component: Construct Lenses

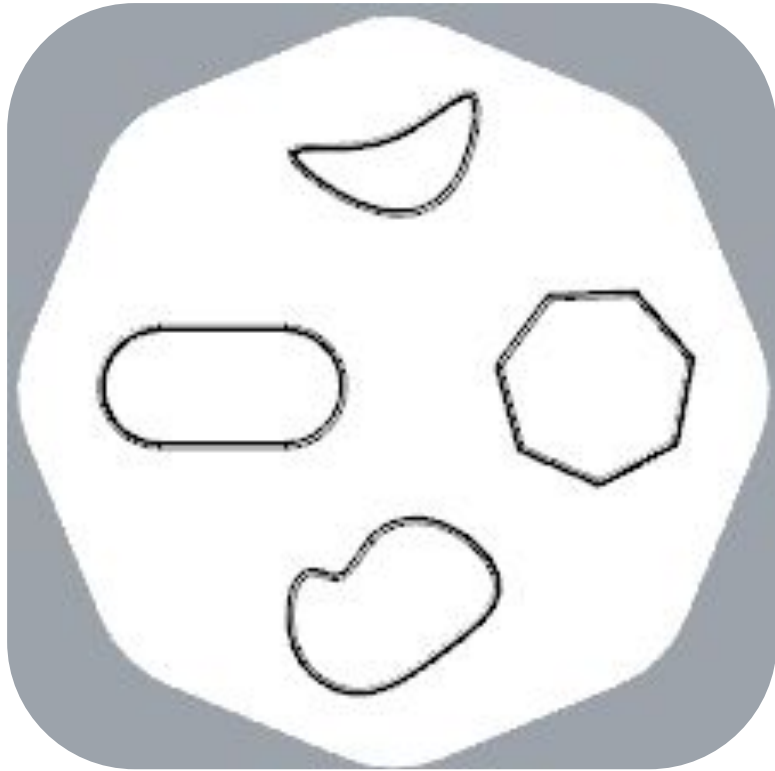


Establishes bridge position, lens base shape style and dimensions including thickness to be inset in frame, with the frame thickness acting as a limit.

Construct Lense Outline Shapes

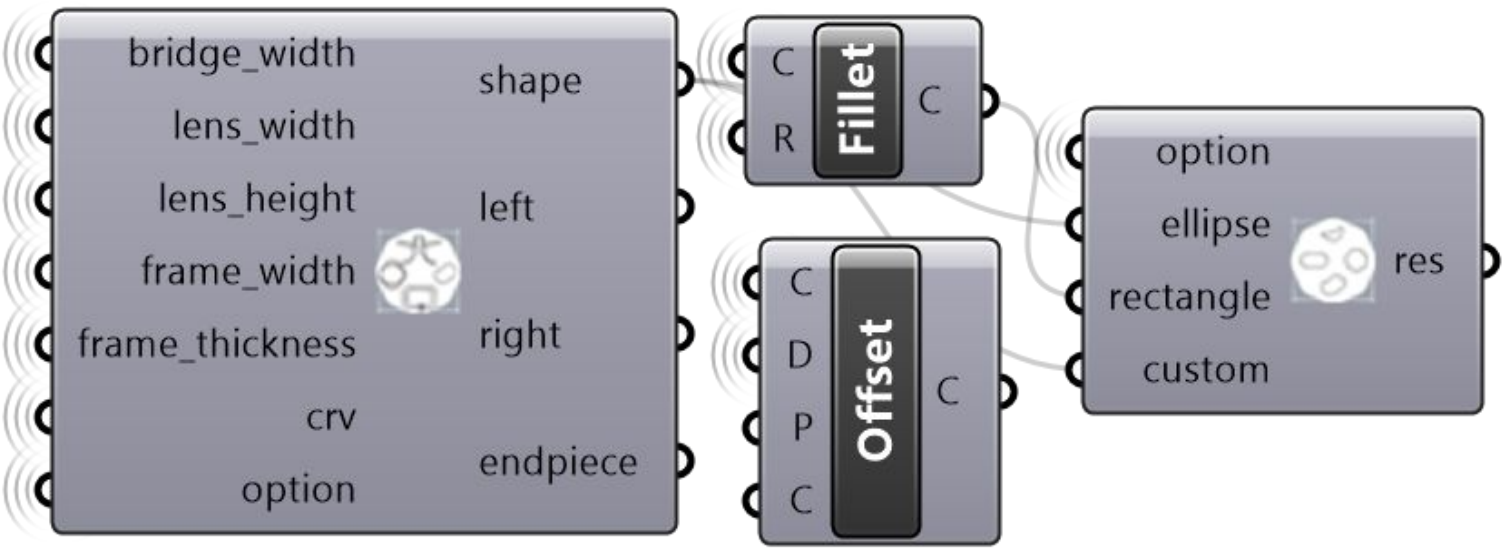


GlaDes2 Component: Shape Filter

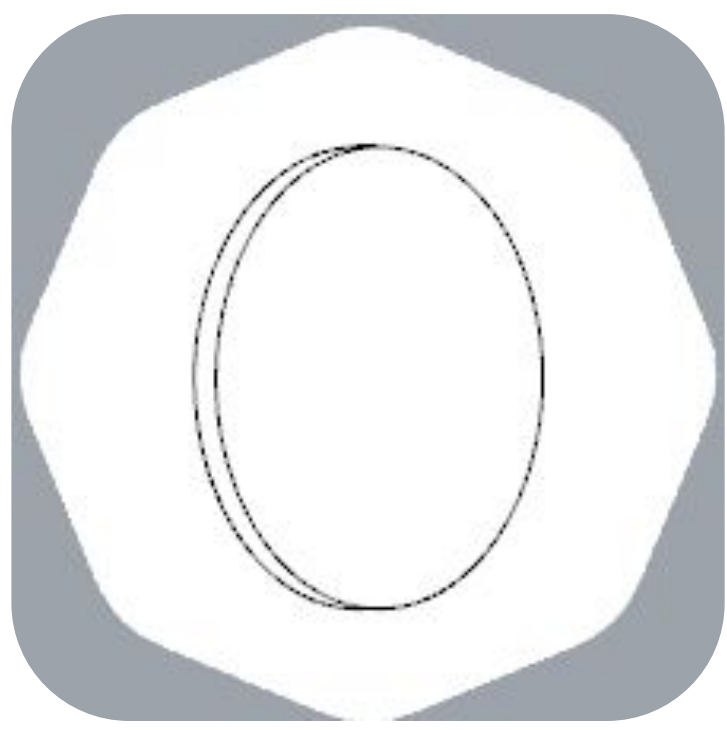


Handles sub shape options, rounding, number of sides for base polygons. Ties to the construct lenses component.

Construct Lense Outline Shapes



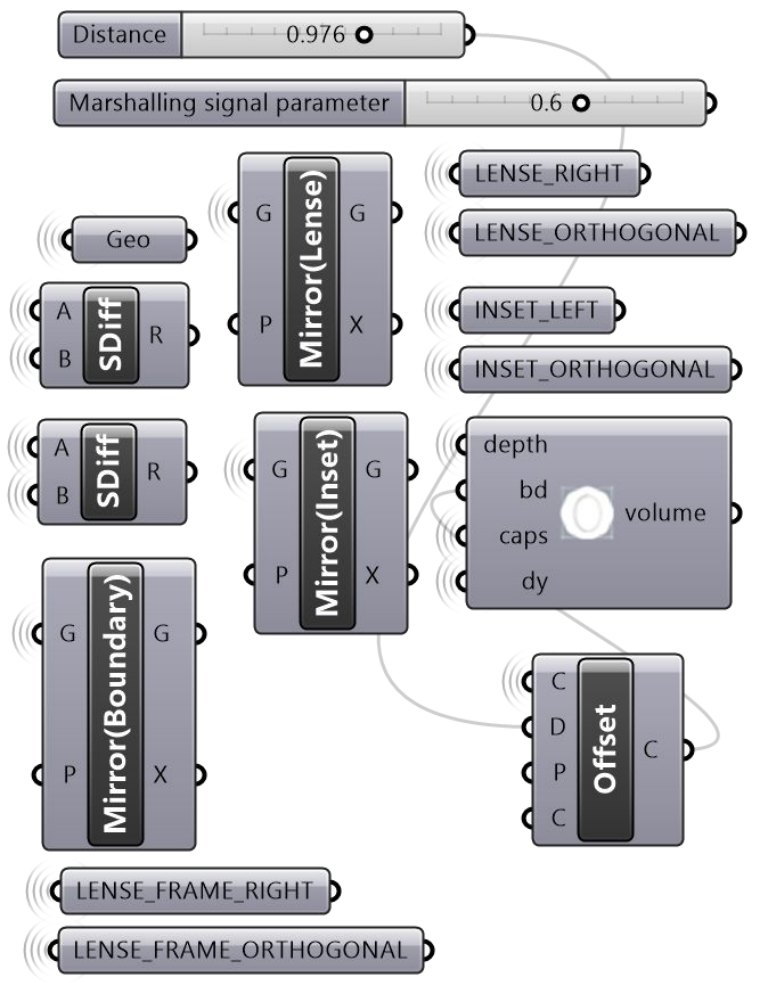
GlaDes2 Component: Lens Solid



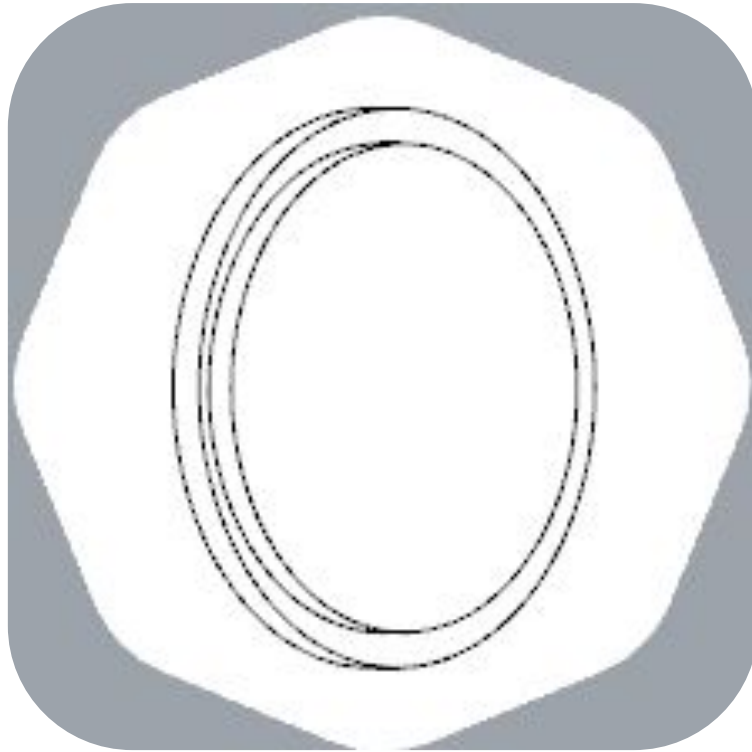
Generates lens solids with thickness and mirrors all associated geometry about the center of the bridge.

Also handles the flat lens shape template geometry to generate appropriate cut sheets and material ordering specifications.

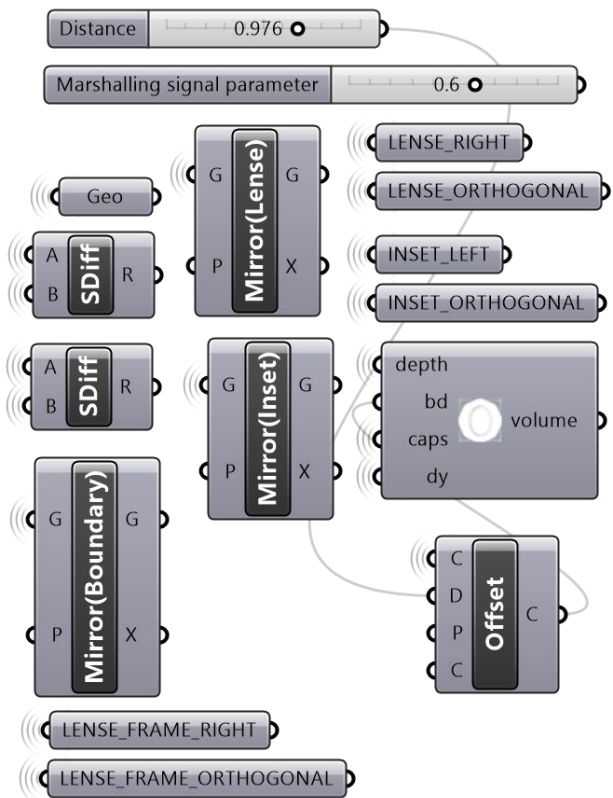
Construct Glasses & Insets



GlaDes2 Component: Lens Inset



Construct Glasses & Insets

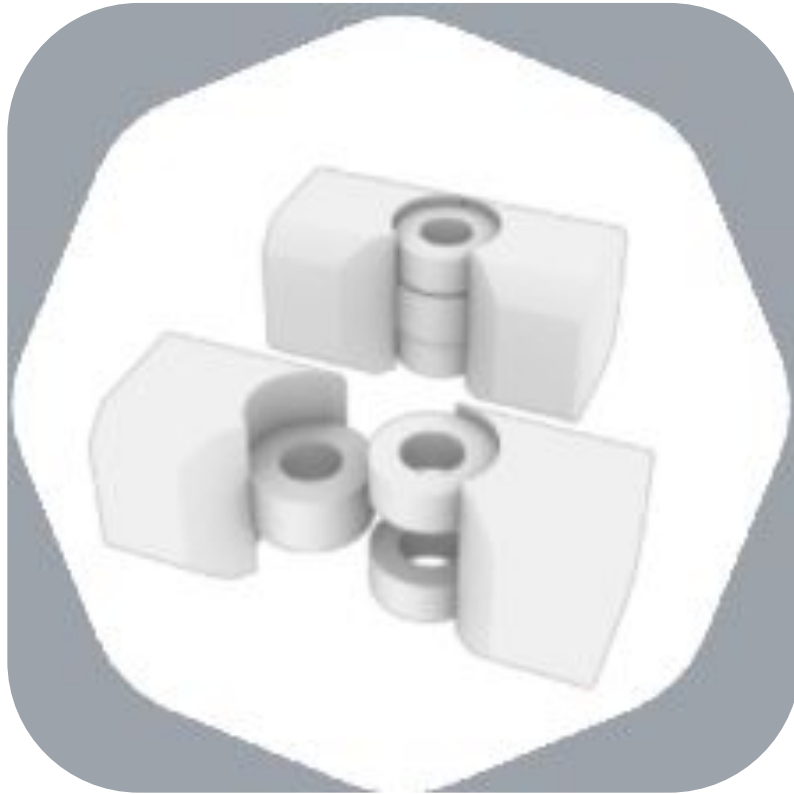


Determines the depth which lens will be extended into frame body and performs necessary boolean differences.

Currently lenses are intended to snap into the frame, but moving forward this module will be the basis of frame splitting and relief cuts for easier installation.



GlaDes2 Component: Endpiece/Hinge Connection



One current hinge design.

Verified able to be 3D printed using Multi Jet Fusion. A simple folded wire staple secures the assembly.

Optionally, designers can add spherical interface joints to make snap-together joints.



GlaDes2 Interface UI Directory:

Head Model Options

Select your preferred head model please.

- 0 = Female Head
- 1 = Male Head Style 1
- 2 = Male Head Style 2

Frame Parameters

Decide your frame width. This should be within 125 to 150 mm.

Decide your bridge width. This should be within 14 to 24 mm.

Decide your temple length. This should be within 125 to 150mm.

Decide the temple displacements. Please adjust the following values to make the frame fit your head.

Decide your hook position.

Decide your hook degree. Please adjust the following value to make it fit your head.

Lens Parameters

Select the base shape you would like to start:
0 = Circular, 1 = Rectangular and 2 = Freecurve Shapes

If you selected 2 - FreeCurve Shapes, please choose a preferred FreeCurve.

Notice that if you didn't select 2 in the above list, changing this will not make any difference.

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Decide your lens width. This should be within 40 to 60 mm.

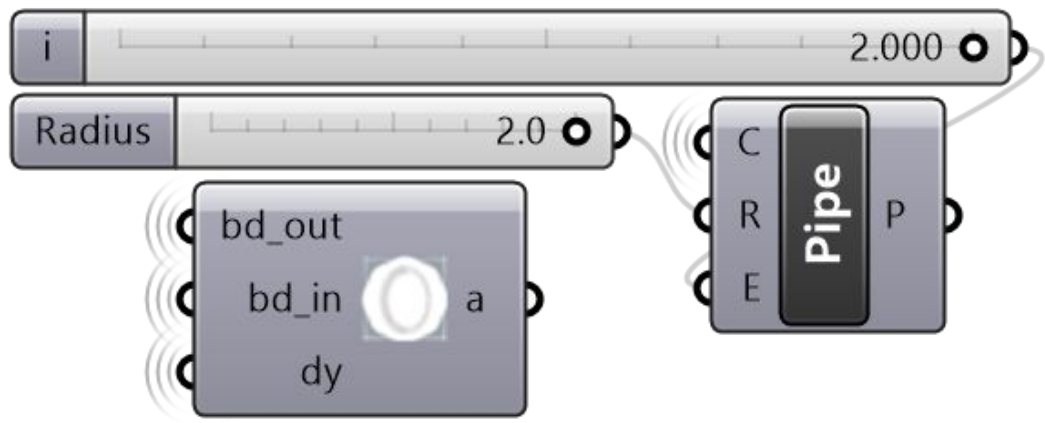
Decide your lens height. This should be within 32 to 45 mm.

Decide your frame thickness around the lenses. This should be within 2 to 6 mm.

Decide your rectangular fillet radius. This should be within 1 to 20 mm.

Only available for 1-Rectangular Shape Option

Decide the thickness of your lens glasses.

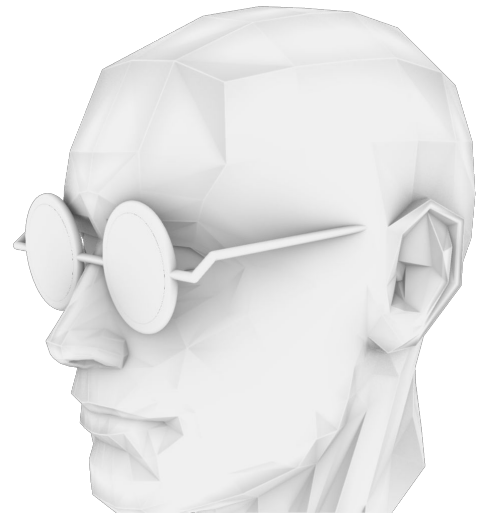
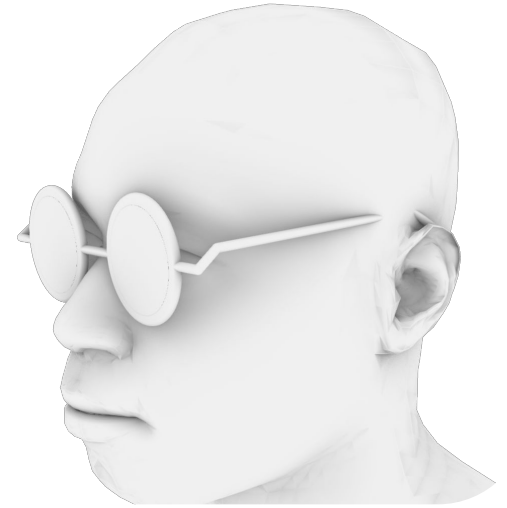
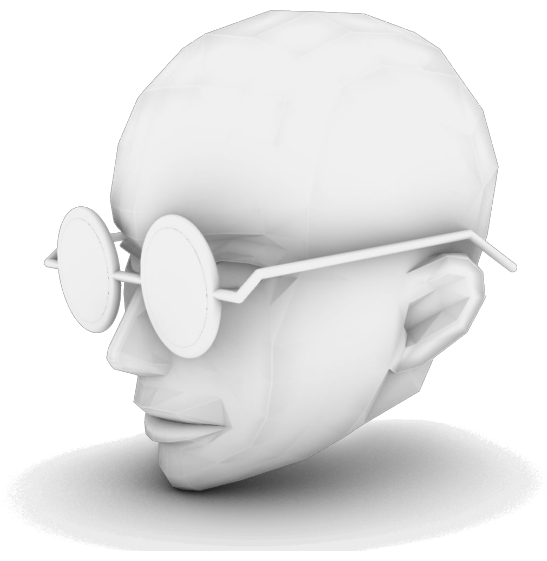


GlaDes2 UI: Head Model Options

There are three current options of head models.

These models display a high amount of morphology for generalized visualization.

For GlaDes3 there is a prioritization of 3D scanning of user selfies and geometric key marker identification for scaling application. This will allow for more accurate visualization and tolerances.



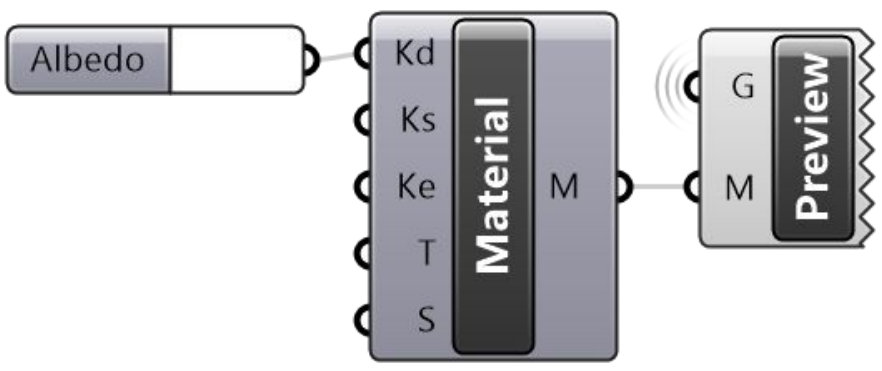
Head Model Options

Select your preferred head model please.

- 0 = Female Head
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Head Rendering



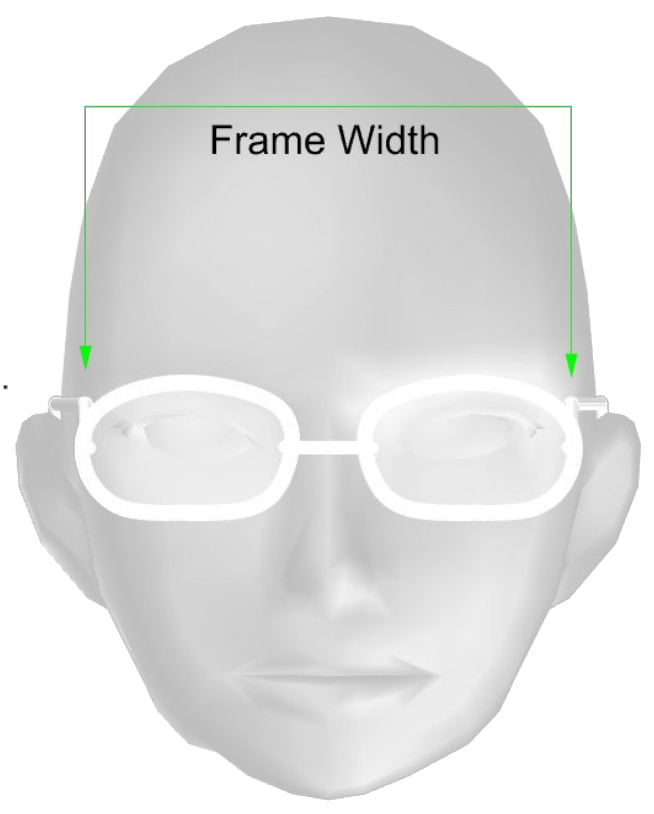
GlaDes2 UI: Frame Width and Tilt

>

Frame Parameters

Decide your frame width. This should be within 125 to 150 mm.

Frame Width



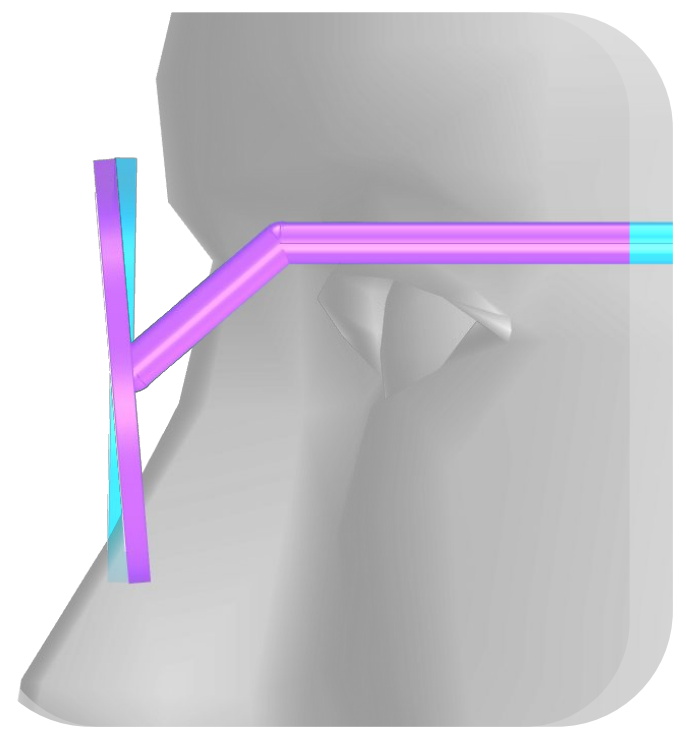
Rotation & Finish

Angle O YZ P

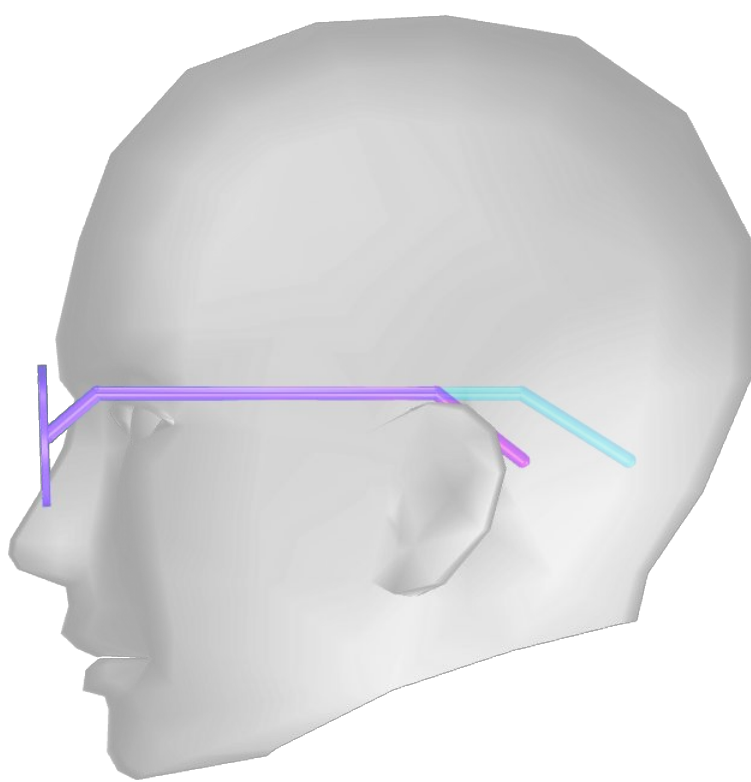
Rotational controls:

- Rotational control 1: G Rotate G X
- Rotational control 2: G Rotate G X ↑
- Rotational control 3: G Rotate G X ↓
- Rotational control 4: G Rotate G X ↑

Preview(LensFrame) M



GlaDes2 UI: Bridge Width/Temple Length



Decide your bridge width. This should be within 14 to 24 mm.

Bridge Width

Decide your temple length. This should be within 125 to 150mm.

Temple Length

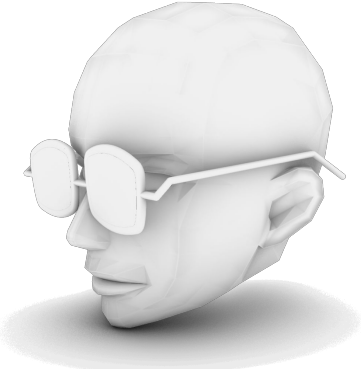
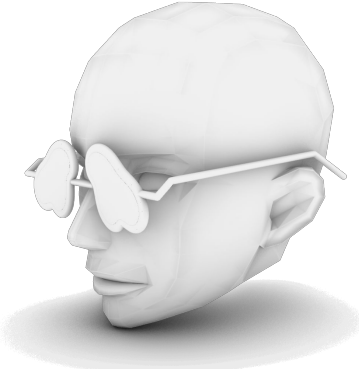
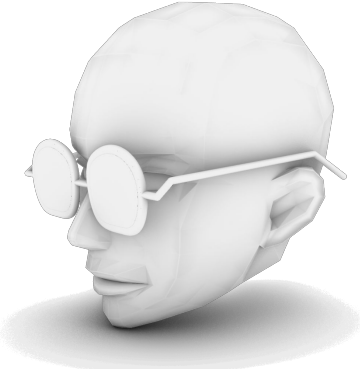
Decide your hook position.

Position Parameter

Decide your hook degree.
Please adjust the following value to make it fit your head.

dz_hook

GlaDes2 Lens Shape: Style, Width and Height



Lens Parameters

Select the base shape you would like to start:
0 = Circular, 1 = Rectangular and 2 = Freecurve Shapes

If you selected 2 - FreeCurve Shapes, please choose a preferred FreeCurve.

Notice that if you didn't select 2 in the above list, changing this will not make any difference.

The following parameters may not be available if your frame width is not large enough for containing the components.

Decide your lens width. This should be within 40 to 60 mm.

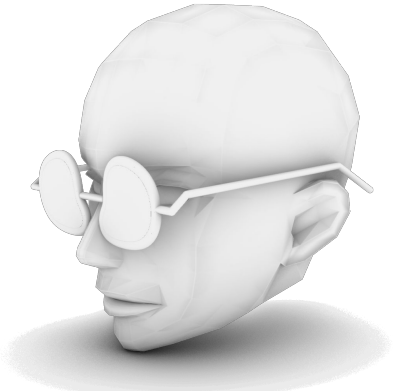
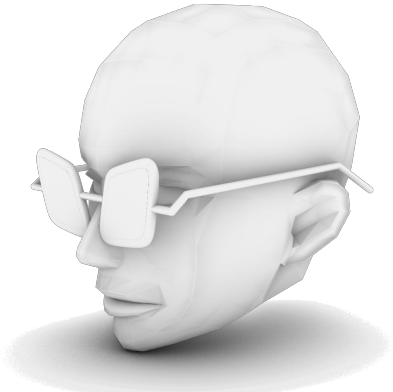
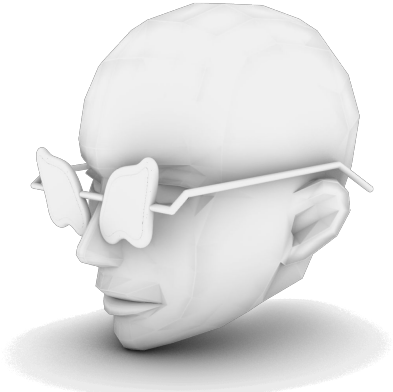
Decide your lens height. This should be within 32 to 45 mm.

Decide your frame thickness around the lenses. This should be within 2 to 6 mm.

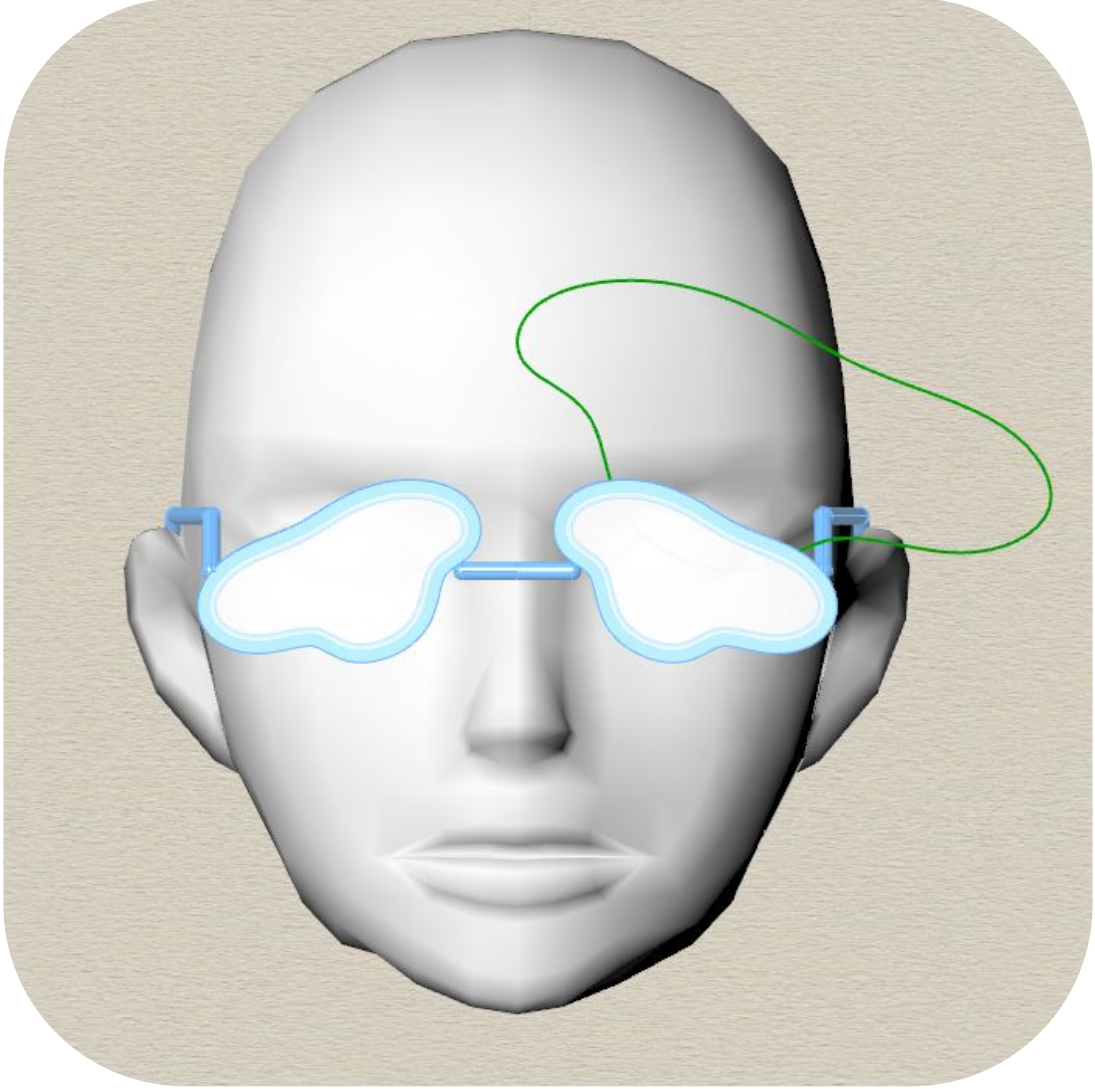
Decide your rectangular fillet radius. This should be within 1 to 20 mm.

Only available for 1-Rectangular Shape Option

Decide the thickness of your lens glasses.

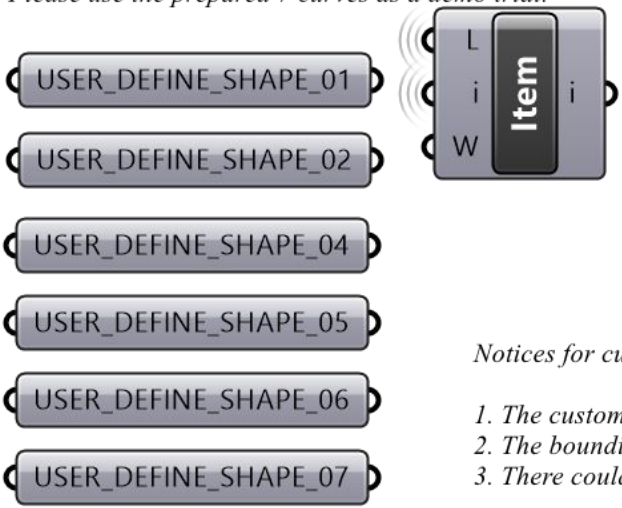


GlaDes2 UI: Special Shaped Lenses Guide



User Customized Shapes

Please use the prepared 7 curves as a demo trial.



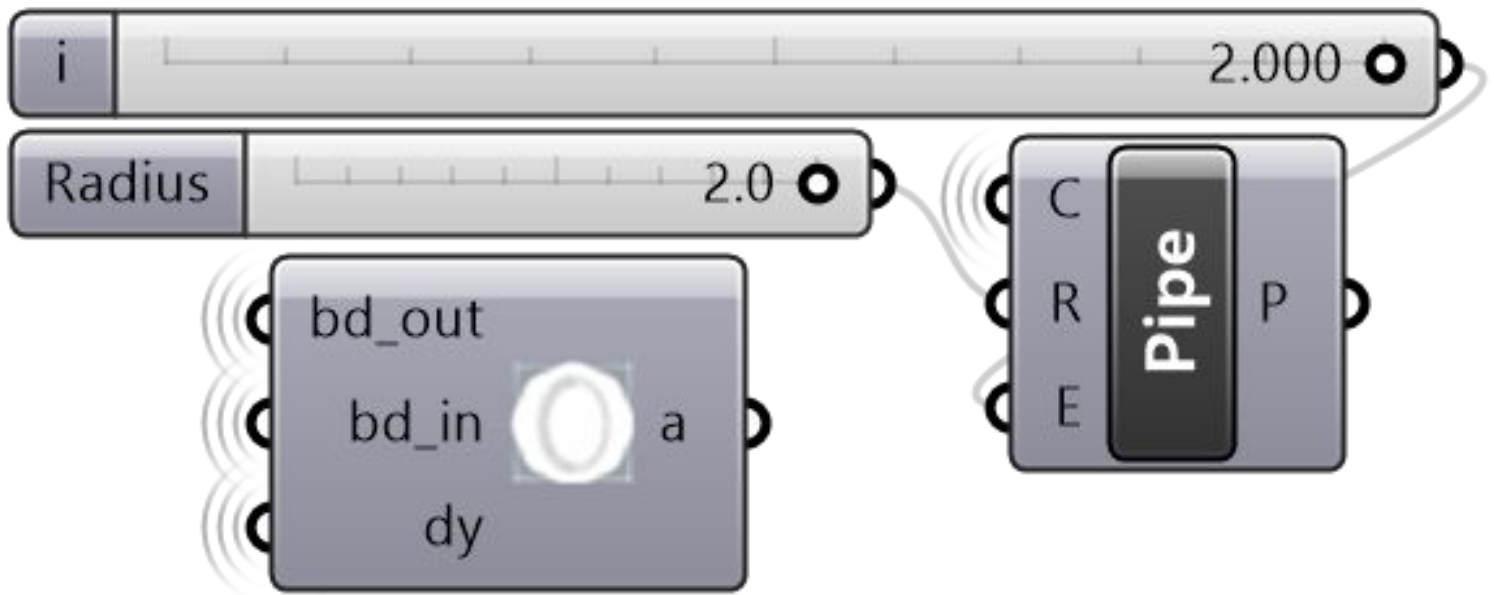
There are a limited number of current FreeCurveShape Options, you can draw a custom curve on the Rhino Canvas and add another “Geometry” component to the User Customized Shapes list.

Note: you will have to add to the dropdown menu domain.

Notices for current version:

- 1. The customized curve should be drawn on the XZ plane.
- 2. The bounding box of the curve should have its left-bottom corner placed at the original point.
- 3. There could be bugs for some non-convex shapes, but overall it should be working well.

GlaDes2 UI: Frame Material Thickness Lens Inset and Thickness



Decide your frame thickness around the lenses.
This should be within 2 to 6 mm.



Decide your rectangular fillet radius.
This should be within 1 to 20 mm.

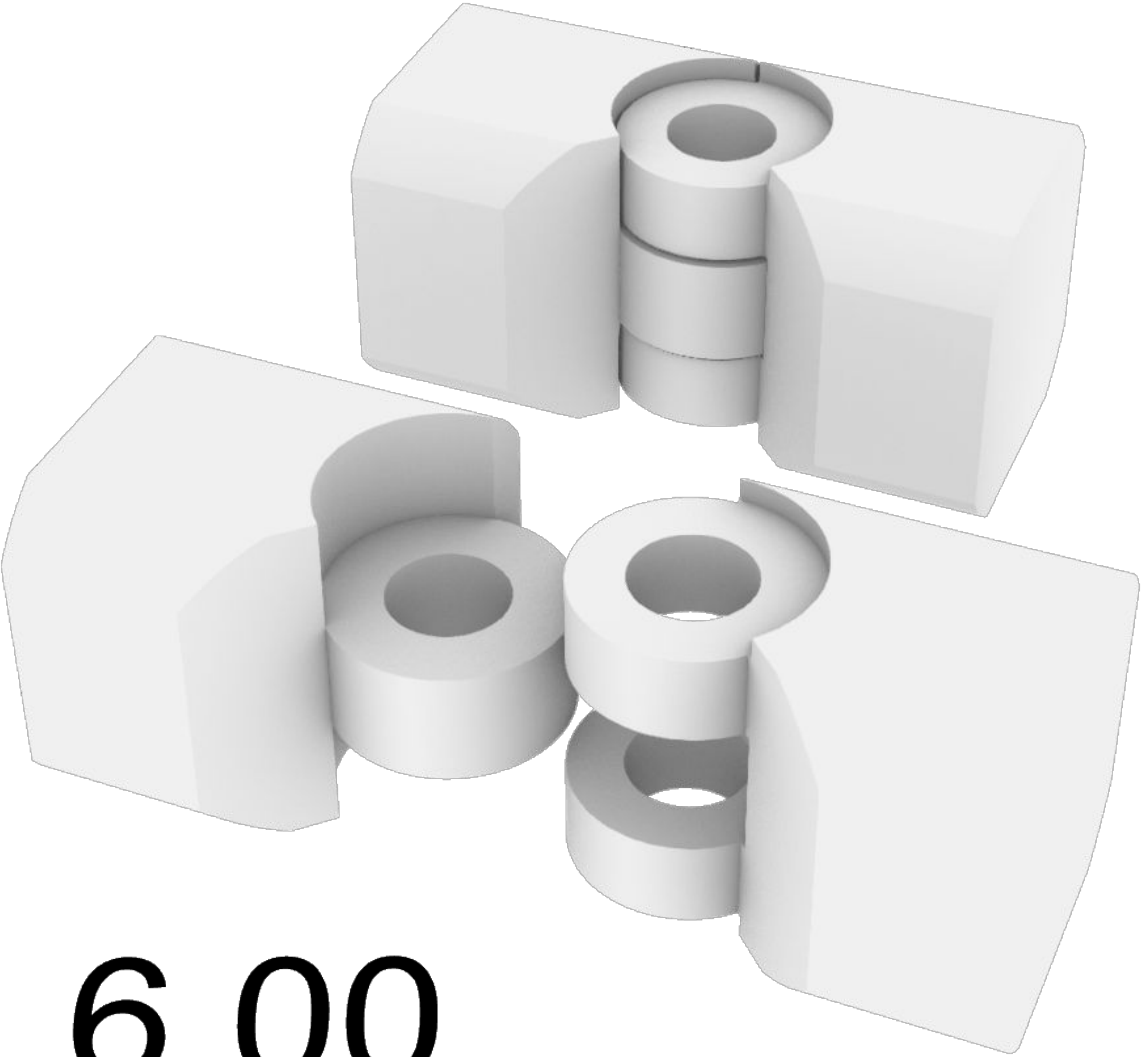
Only available for 1-Rectangular Shape Option



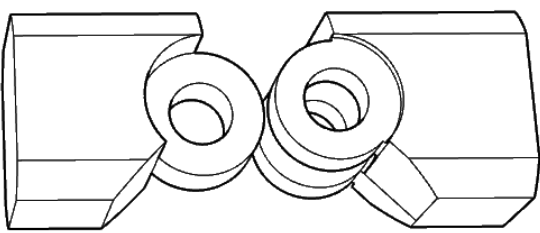
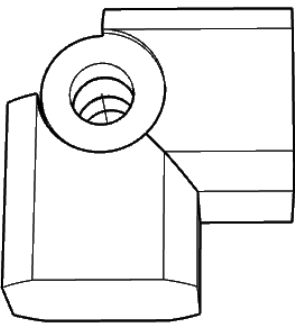
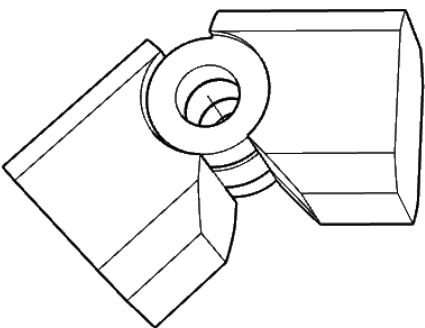
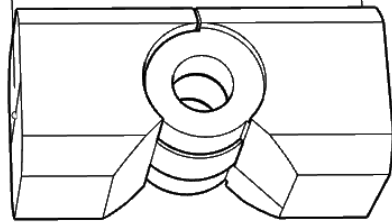
Decide the thickness of your lens glasses.



GlaDes2 UI: Hinges



6.00



GlaDes2 UI: Lens and Frame Preview Display Color Export and Production Notes

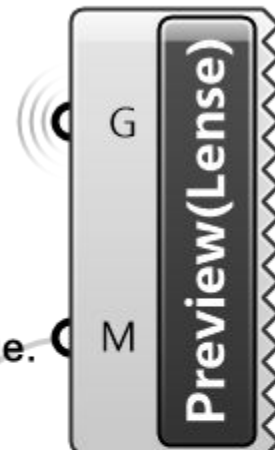
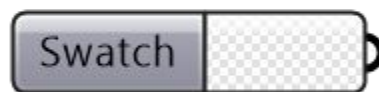
The prescription problem:

- Currently, a flat template for sunglasses can be retrieved. Can be made from a wide variety of materials such as mica, polarized film, acrylic etc. \$8-45 a pair.
 - Lasercut or paper templates
- Prescription lenses are not currently integrated- however given the desired shape an optometrist should be able to determine the minimum lens thickness and border, as well as mill the end product. This would be a bit of work, but together it IS possible.
- Unfortunately; there is a large discrepancy in pricing, circularly polarized filters laser cut or via a paper template can be as low as \$15 but it should be expected that prescription lenses alone might exceed \$140 USD!
- Manual steps; hinge splice (temp), select separate components for export.
- STEP or STL output decision (recommend both.)
- Lenses; Illustrator or SVG for laser-cutting or print templates
- Many 3D printing houses can fulfil this order, but high resolution is required.

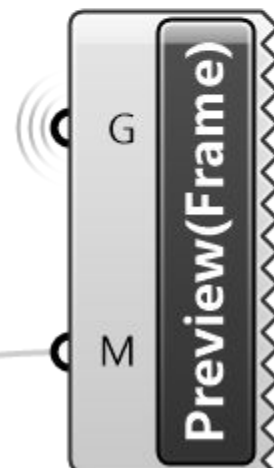
Output Parameters

Frame Rendering

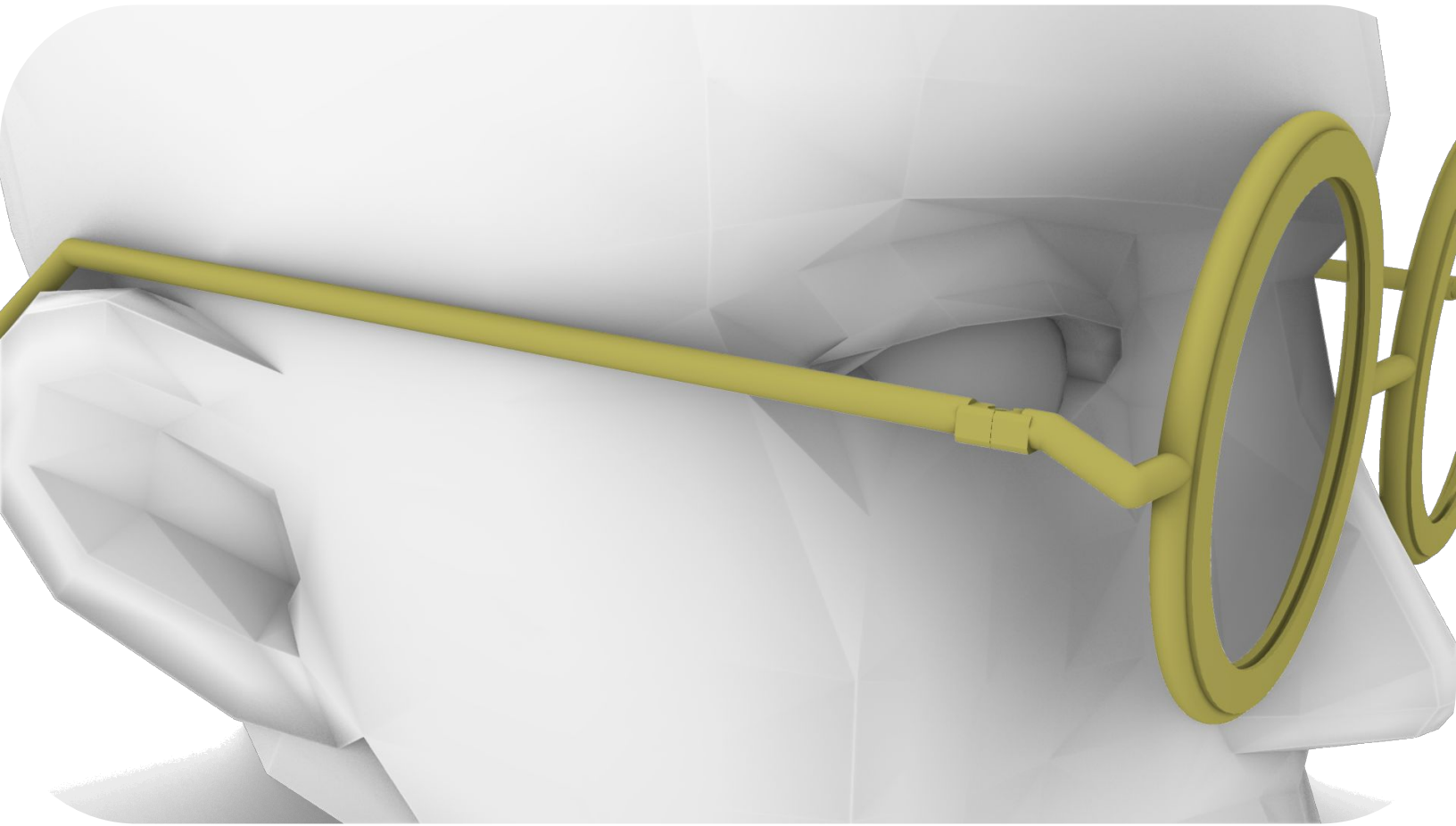
Decide your lenses color.
Please don't change the alpha value.



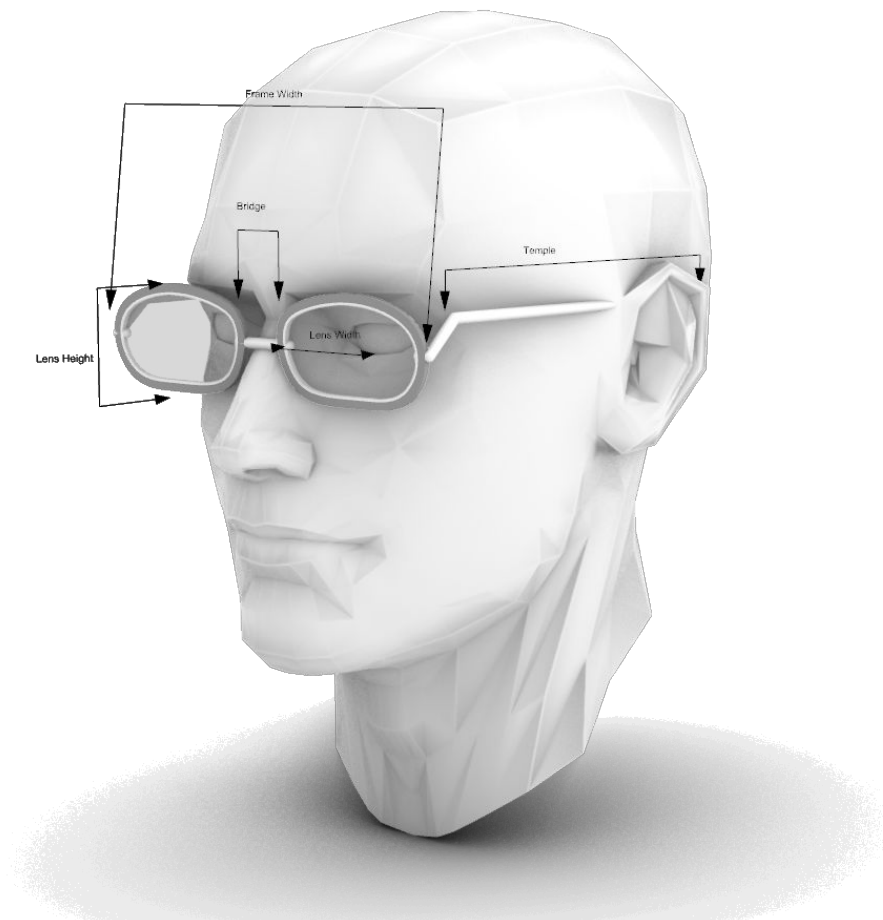
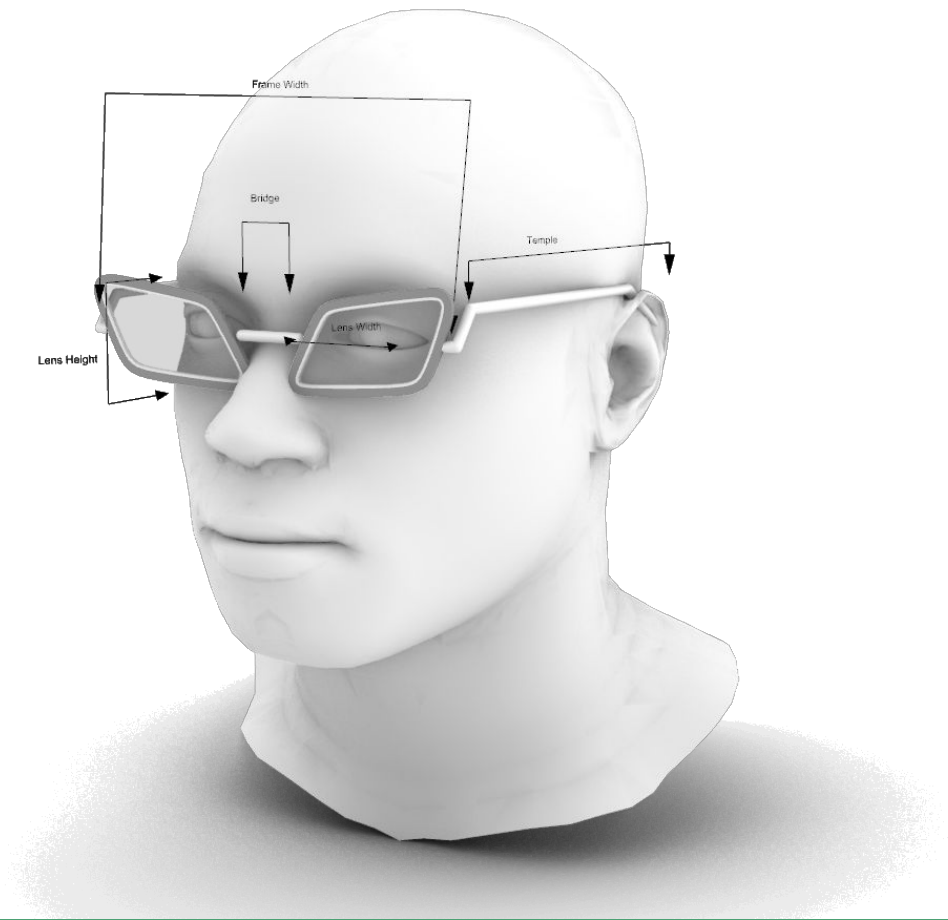
Decide your frame color.



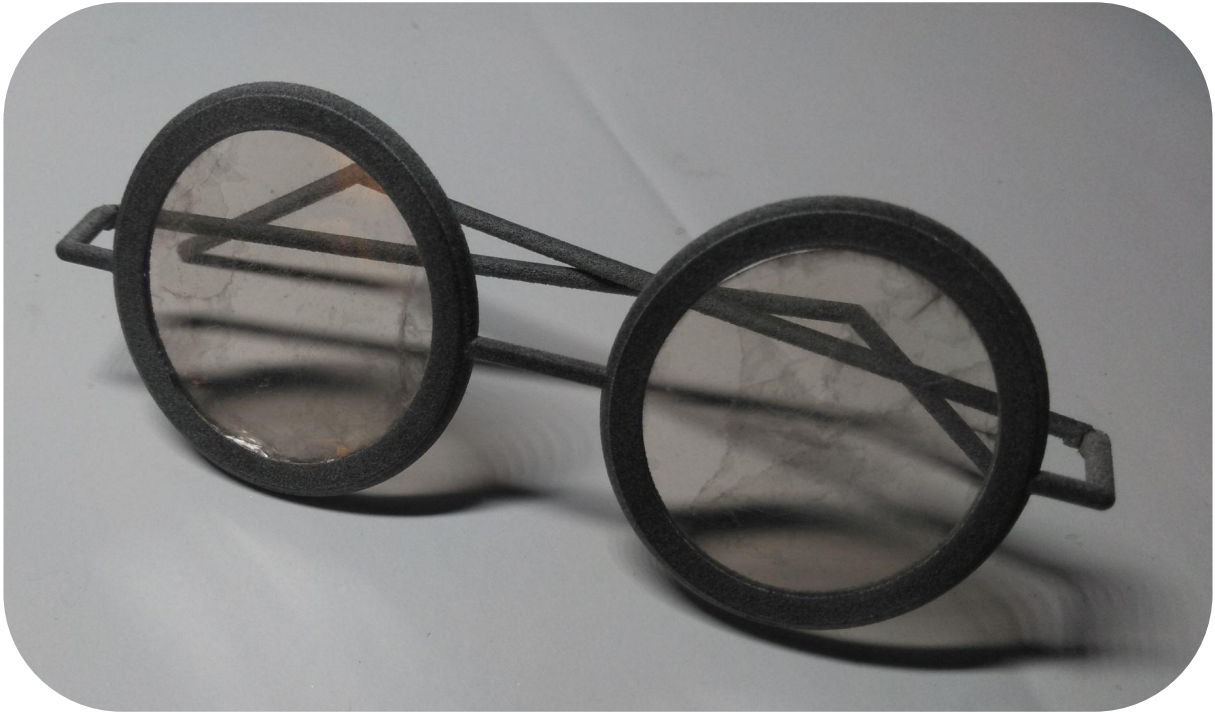
GlaDes2: Results



GlaDes2: Results Continued



GlaDes2: Printed Test Frame



GlaDes2: Printed Test Frame Cont.



TRONIX3D

Primary lenses are mica for flexibility, half is linear polarizer for $\frac{1}{4}$ wave plate transformation of light.

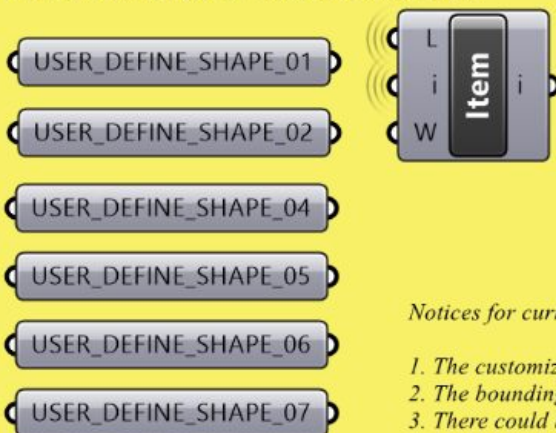
GlaDes2: Recap and Future Trajectory

Objectives and changes for GlaDes3:

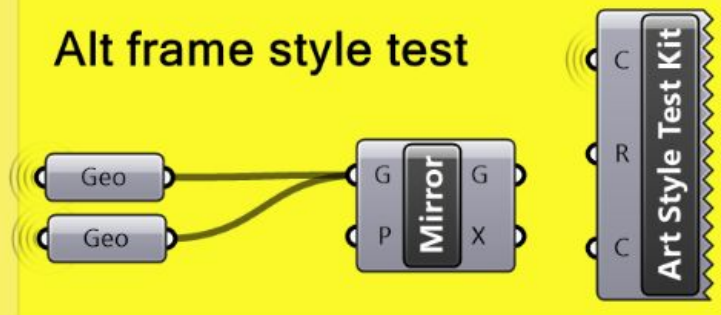
- Import 3D scan of custom head or live view mirror
- Auto head positioning in frame work-space
- Manual head scaling/positioning for stock options
- Simpler export workflow
- Streamlined hinge variations, print in place
- Nose pad options
- UI based lens shape editor
- GHplayer integration
- Lens Sweep (backwards flex) control
- Curved lens/prescription lens for export to optometrist
- Dimension based temple adjustment

User Customized Shapes

Please use the prepared 7 curves as a demo trial.



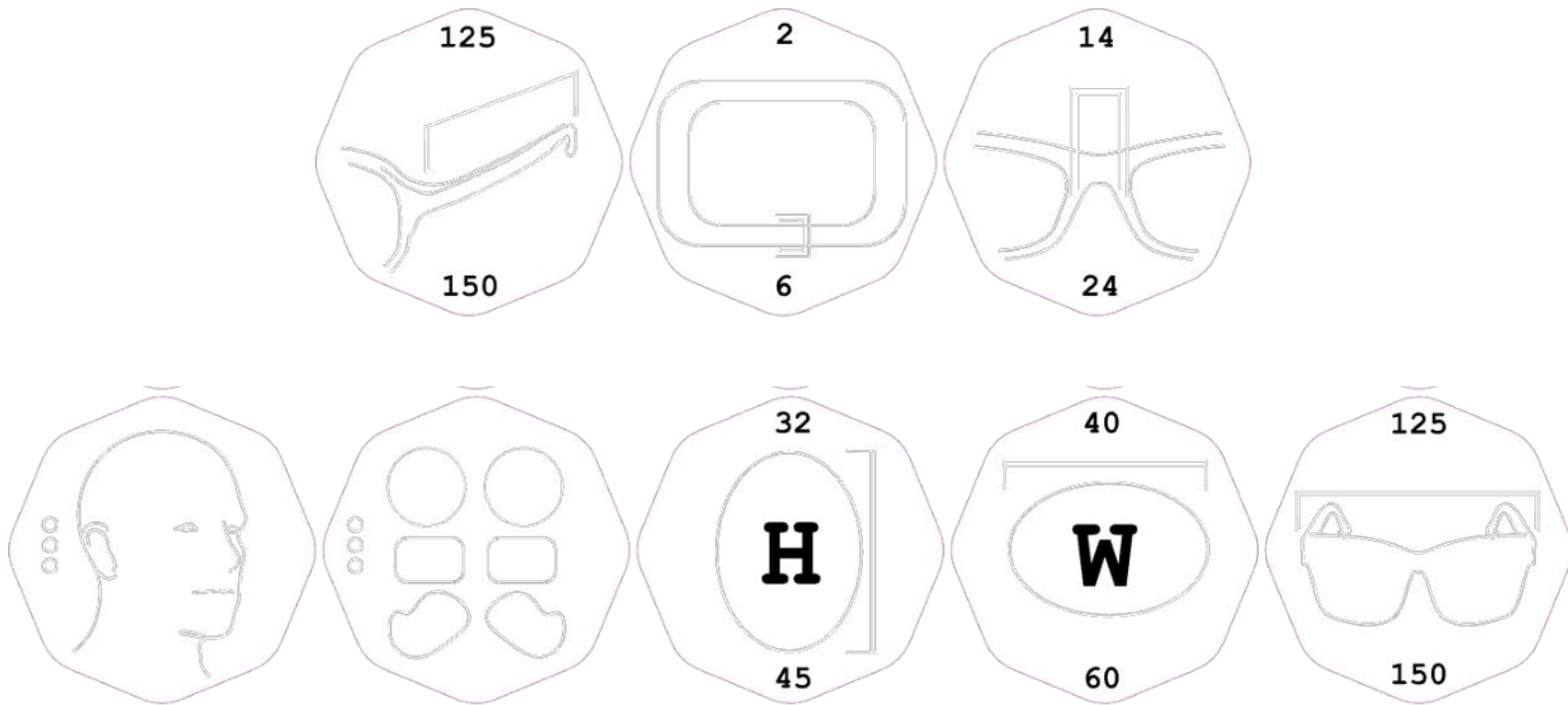
Alt frame style test



Notices for current version:

1. The customized curve should be drawn on the XZ plane.
2. The bounding box of the curve should have its left-bottom corner placed at the original point.
3. There could be bugs for some non-convex shapes, but overall it should be working well.

GlaDes2: Recap and Future Trajectory Cont.



- Further divide script into base elements with relationship cues, more modules
- Frame shape alternatives, square or variable thickness surfaces based on material selection
- Live theoretical raw material price calculation
- Lens seating gap for installation ease
- Fillets and other parametric features to assist in assembly
- Density optimization and reinforcement at junctions
- Final formatting appropriate for food for rhino servers and usage.

Additional Information - Public Data, Contacts



Data hosting; Hackaday

-Hackaday Page:

<https://hackaday.io/project/188577-glades2>

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