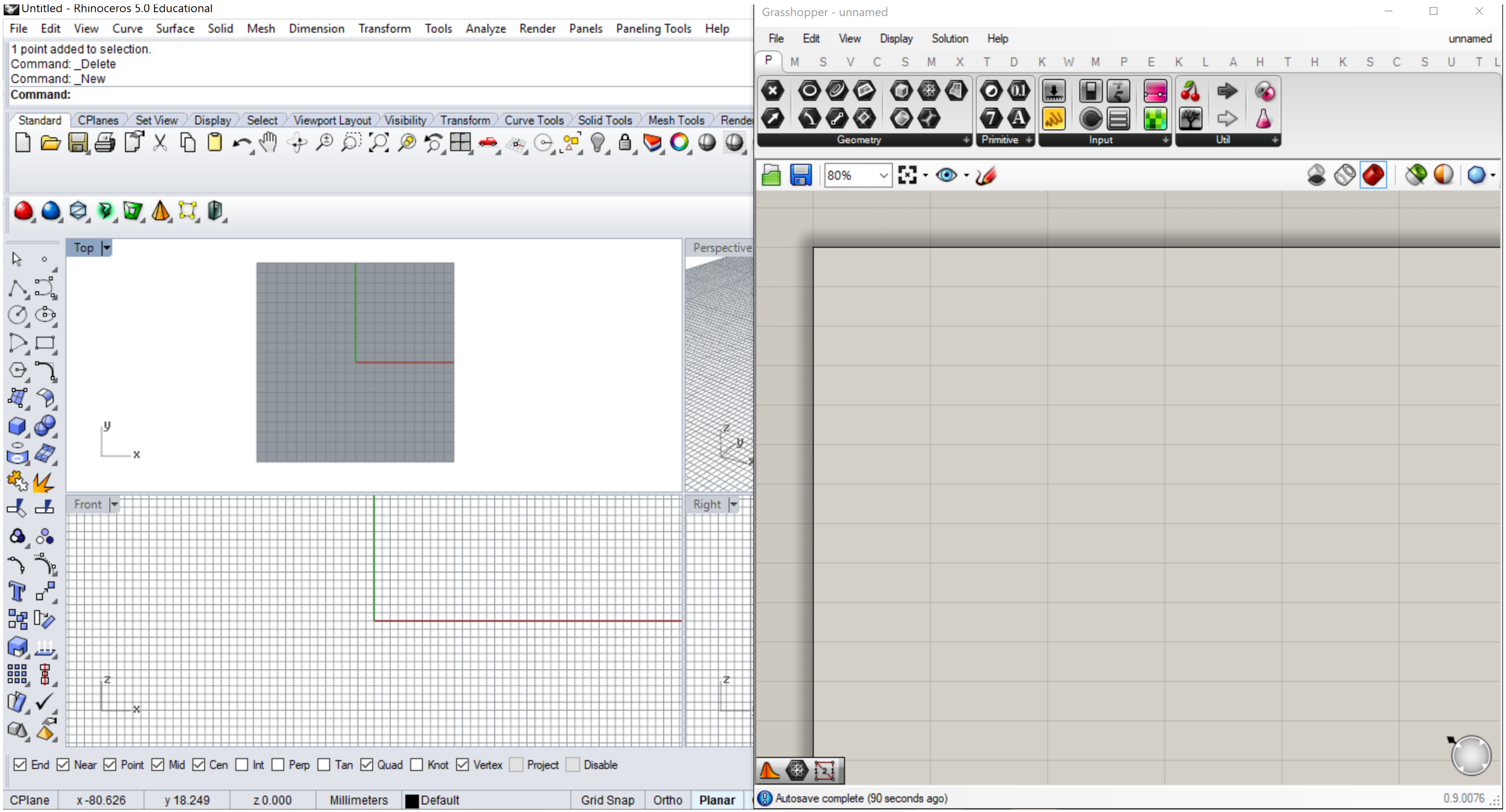
L03:Grasshopper Introduction

*“For designers who are exploring new shapes using generative algorithms,***Grasshopper®** *is a graphical algorithm editor tightly integrated with Rhino’s 3-D modeling tools. Unlike RhinoScript, Grasshopper requires no knowledge of programming or scripting, but still allows designers to build form generators from the simple to the awe-inspiring.”*

http://www.grasshopper3d.com/


Untitled - Rhinoceros 5.0 Educational
File Edit View Curve Surface Solid Mesh Dimension Transform Tools Analyze Render Panels Paneling Tools Help
1 point added to selection.
Command: _Delete
Command: _New
Command:
Standard CPlanes Set View Display Select Viewport Layout Visibility Transform Curve Tools Solid Tools Mesh Tools
Top
Perspective
Front
Right
End Near Point Mid Cen Int Perp Tan Quad Knot Vertex Project Disable
CPlane x -80.626 y 18.249 z 0.000 Millimeters Default Grid Snap Ortho Planar
Grasshopper - unnamed
File Edit View Display Solution Help
unnamed
Geometry Primitive Input Util
80%
Autosave complete (90 seconds ago)
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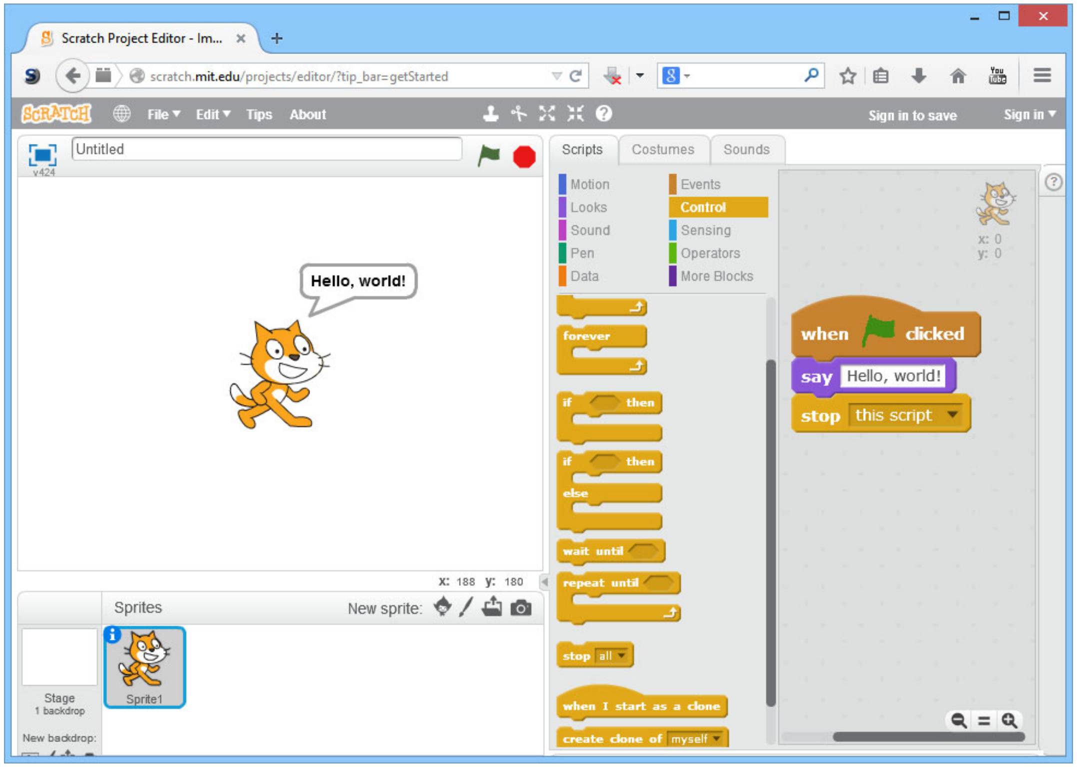
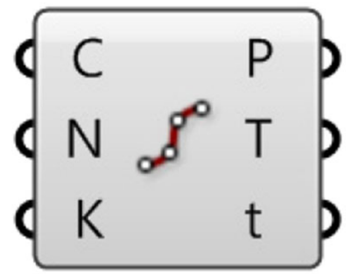
“In computing, a visual programming language (VPL) is any programming language that lets users create programs by manipulating program elements graphically rather than by specifying them textually.”
Wikipedia



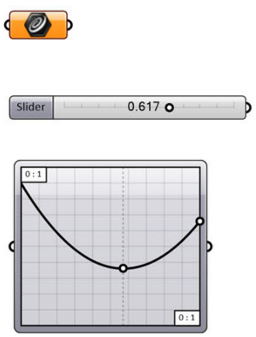
Code

```
List<Point3d> pt = new List<Point3d>();
List<double> ts = new List<double>();
double tMax = x.Domain.Max;
double tMin = x.Domain.Min;

double step = (tMax - tMin) / y;
double t = tMin;
for (int i = 0; i < y; i++)
{
  ts.Add(t);

  pt.Add(x.PointAt(t));

  t = t + step;

}
```

Encapsulate the code into component



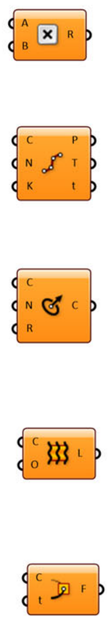
Parameters



PARAMETERS ARE THINGS YOU CAN CHANGE AND ADJUST: GEOMETRY,NUMBERS

+

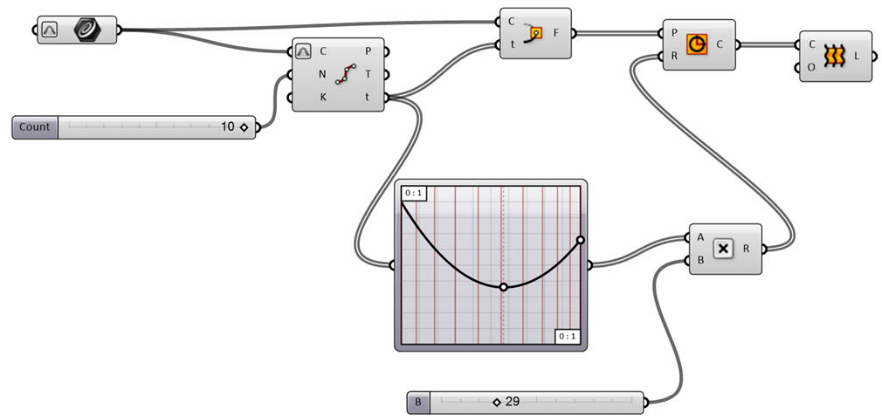
Components



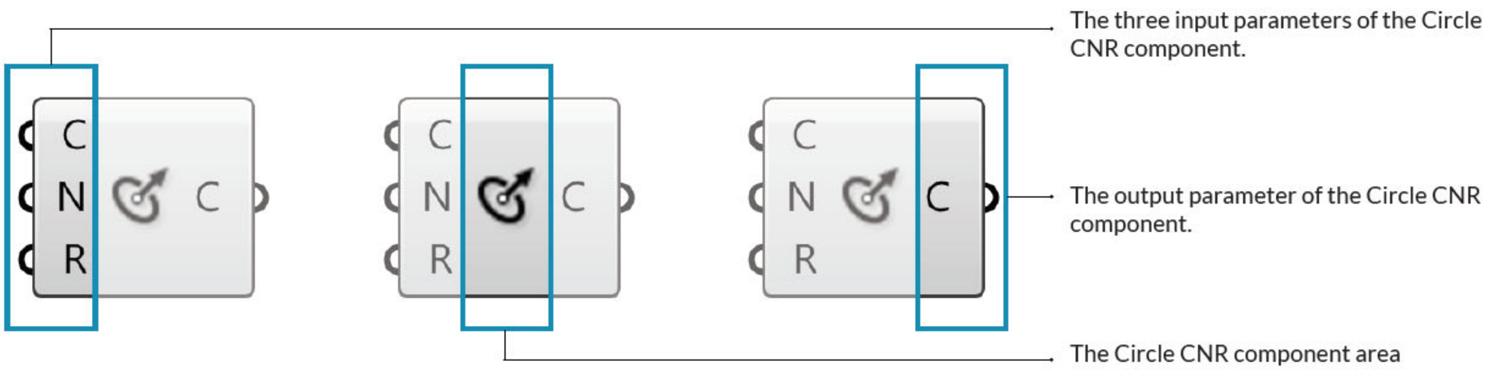
COMPONETS PERFORMS OPERATIONS: MULTIPLICATION, DIVIDE CURVE, LOFT ETC

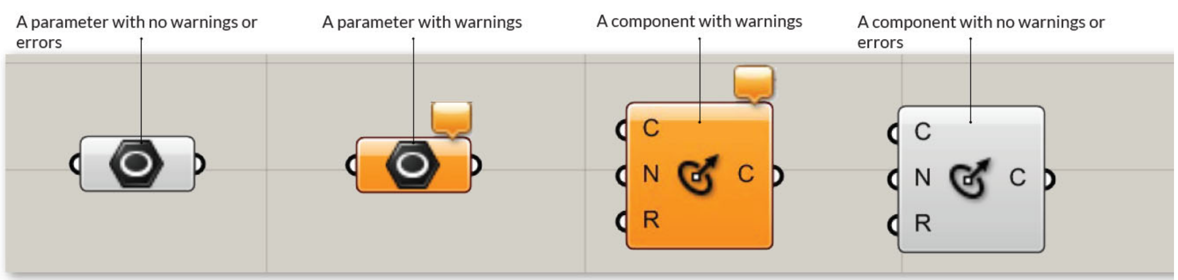
=

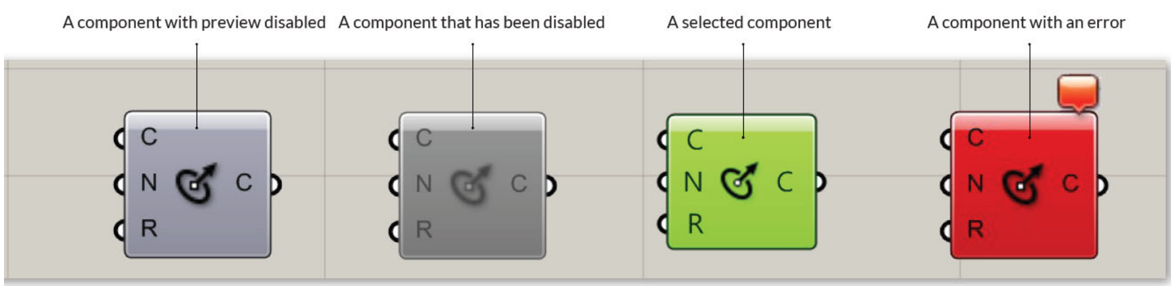
Defintion



TOGETHER THEY MAKE FINE GRASSHOPPER DEFINITIONS


The three input parameters of the Circle CNR component.
The output parameter of the Circle CNR component.
The Circle CNR component area

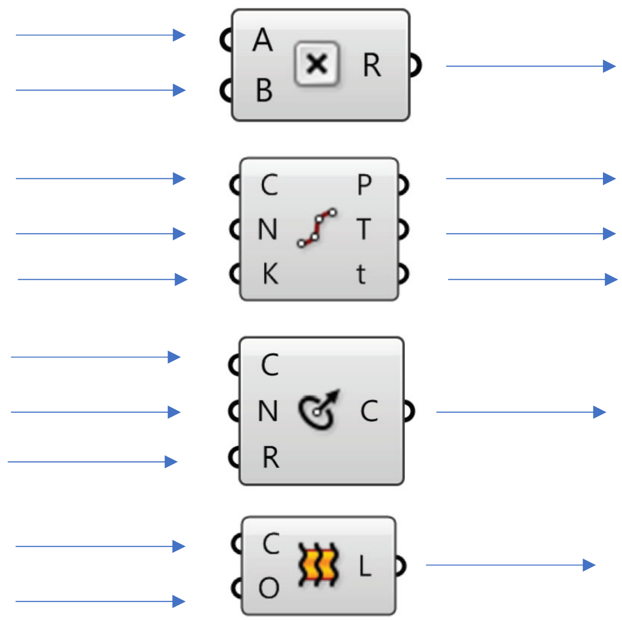

A parameter with no warnings or errors
A parameter with warnings
A component with warnings
A component with no warnings or errors


A component with preview disabled
A component that has been disabled
A selected component
A component with an error

INPUT DATA

GEOMETRY
- POINTS
- CURVES
- SURFACES

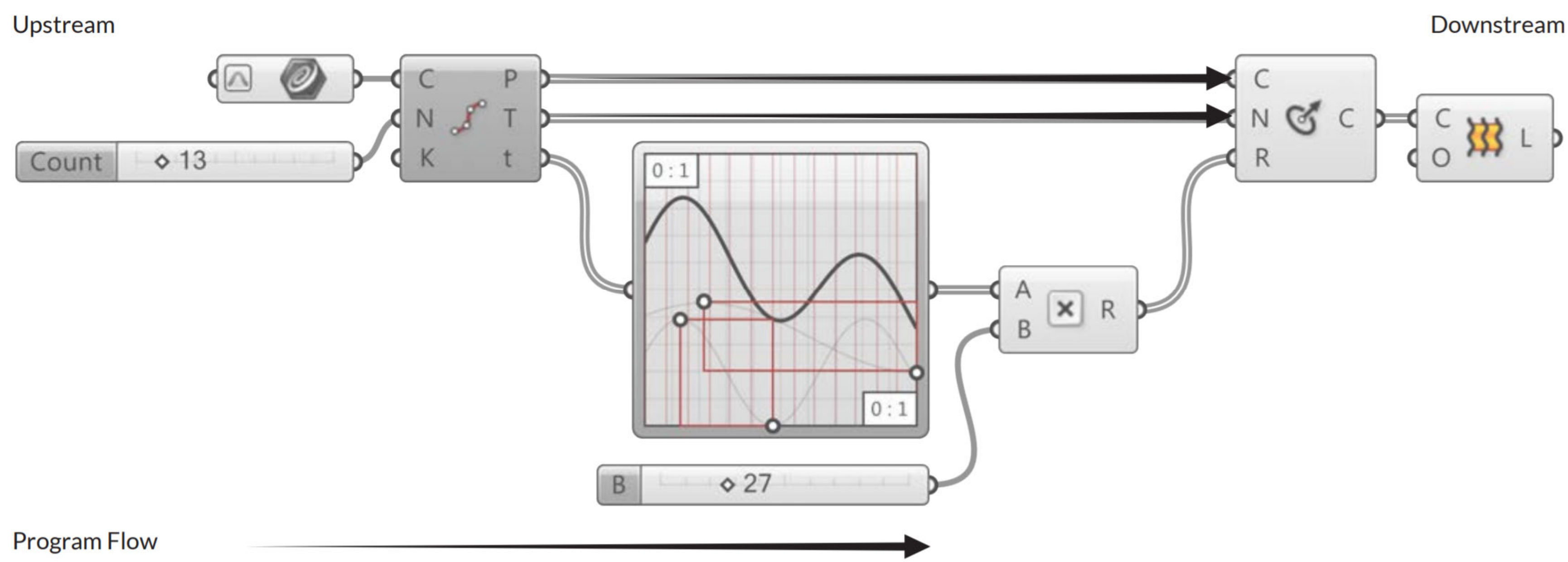
VECTORS
NUMBERS
PLANES
ETC



OUTPUT DATA

GEOMETRY
- POINTS
- CURVES
- SURFACES

VECTORS
NUMBERS
PLANES
ETC


Upstream
Downstream
C
N
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13
0 : 1
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A
B
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27
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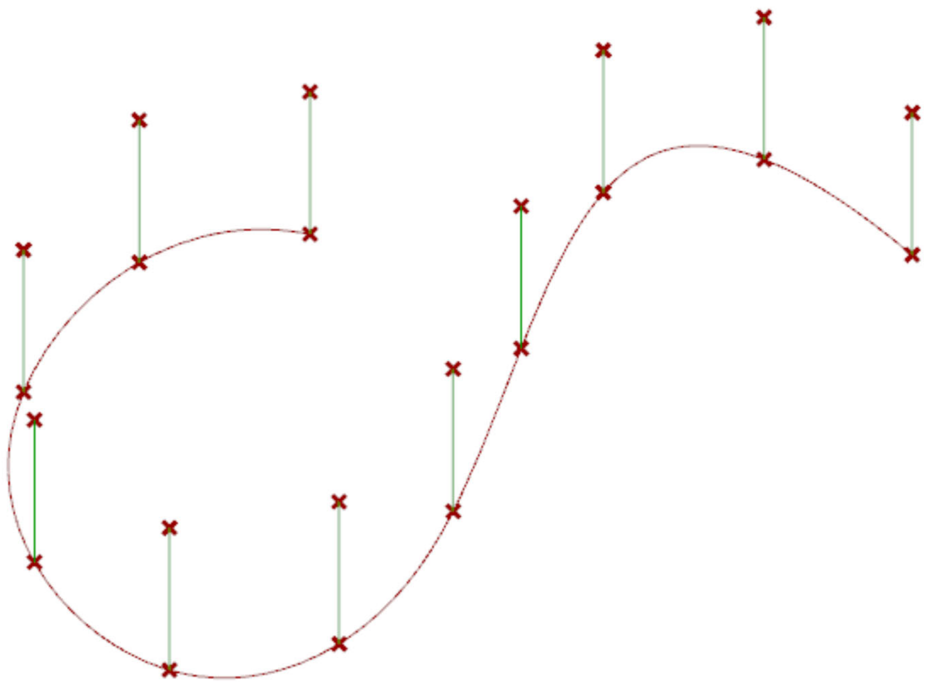
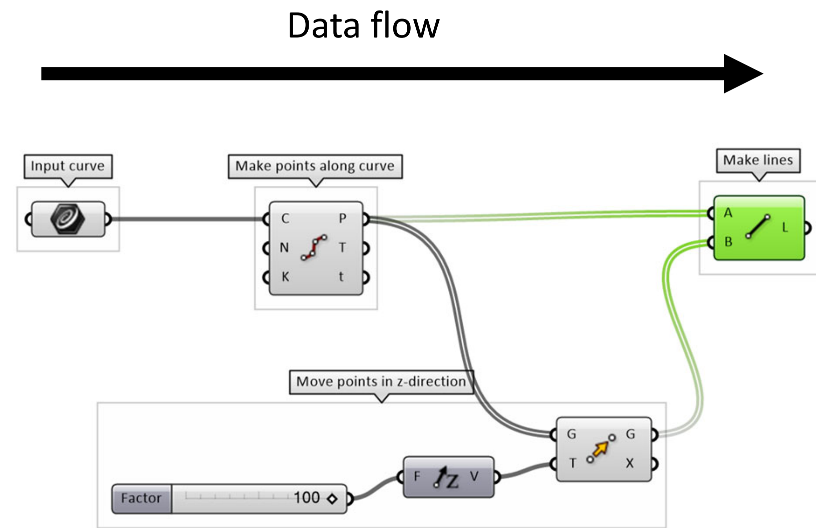
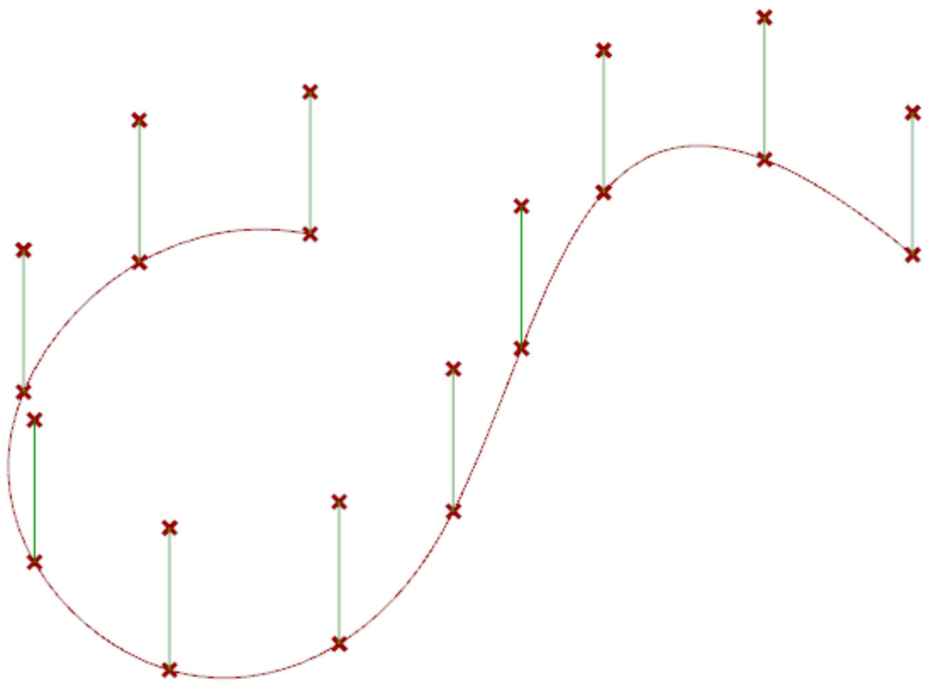
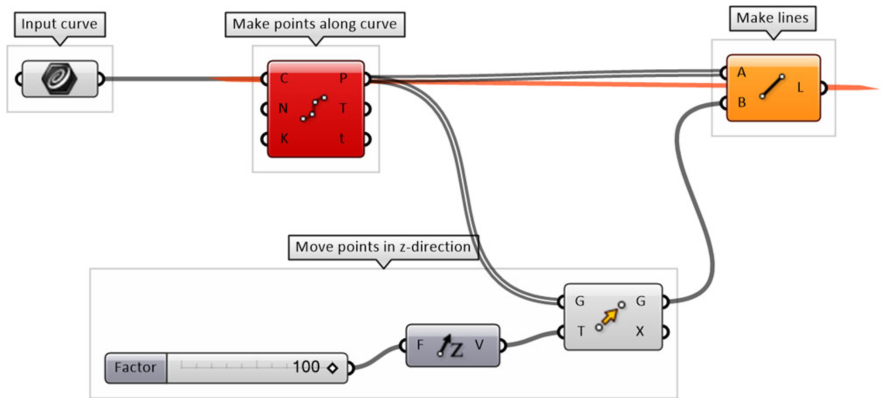
Program Flow




Data flow
Input curve
Make points along curve
Make lines
Move points in z-direction
Factor
100





Input curve
Make points along curve
Make lines
Move points in z-direction
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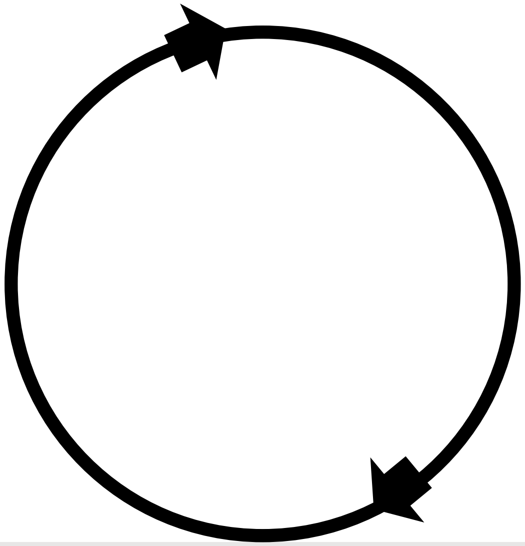
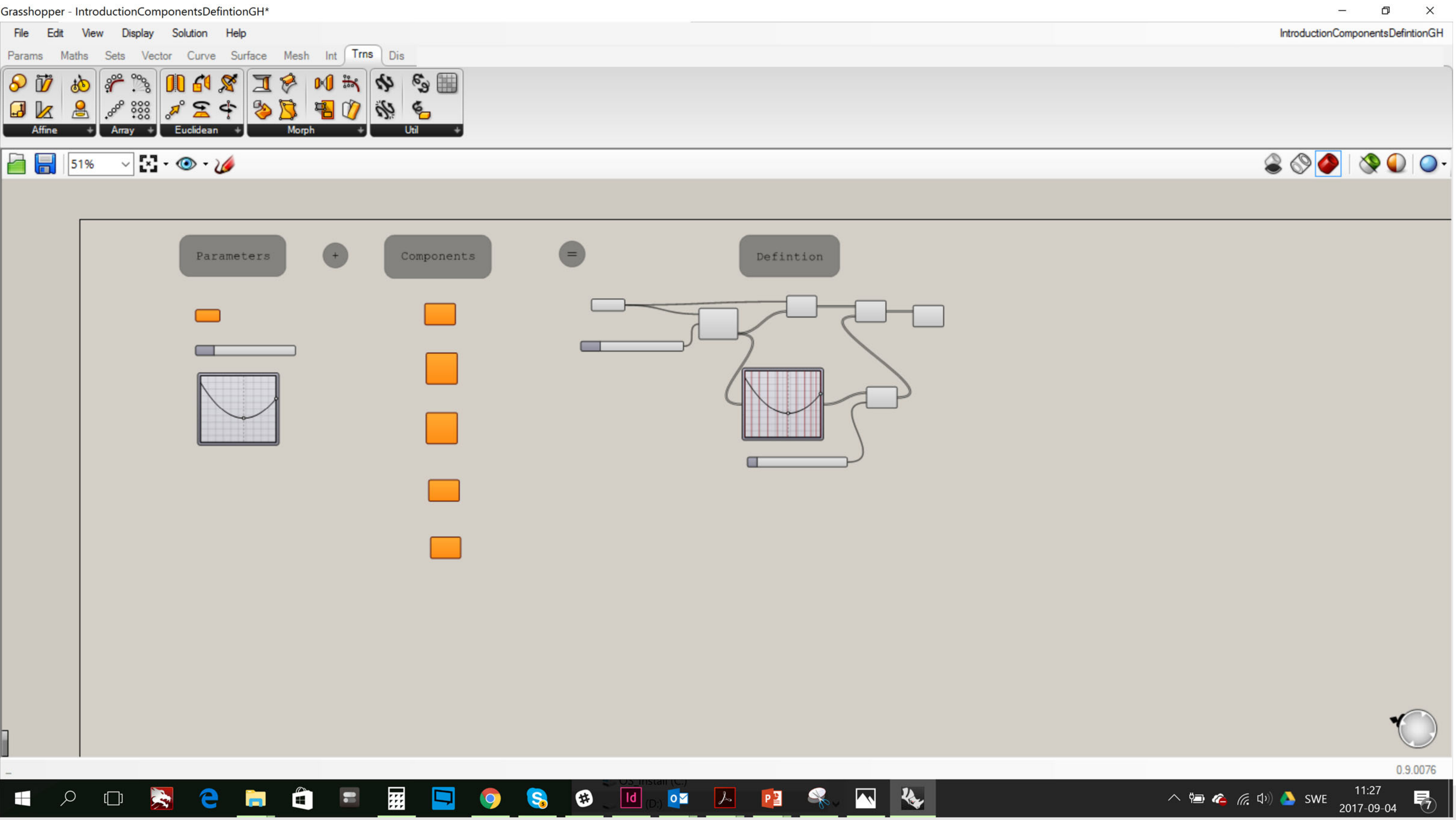
100




Grasshopper - IntroductionComponentsDefintionGH*
File Edit View Display Solution Help
IntroductionComponentsDefintionGH
Params Maths Sets Vector Curve Surface Mesh Int Trns Dis
Affine Array Euclidean Morph Util
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Parameters
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Components
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Defintion
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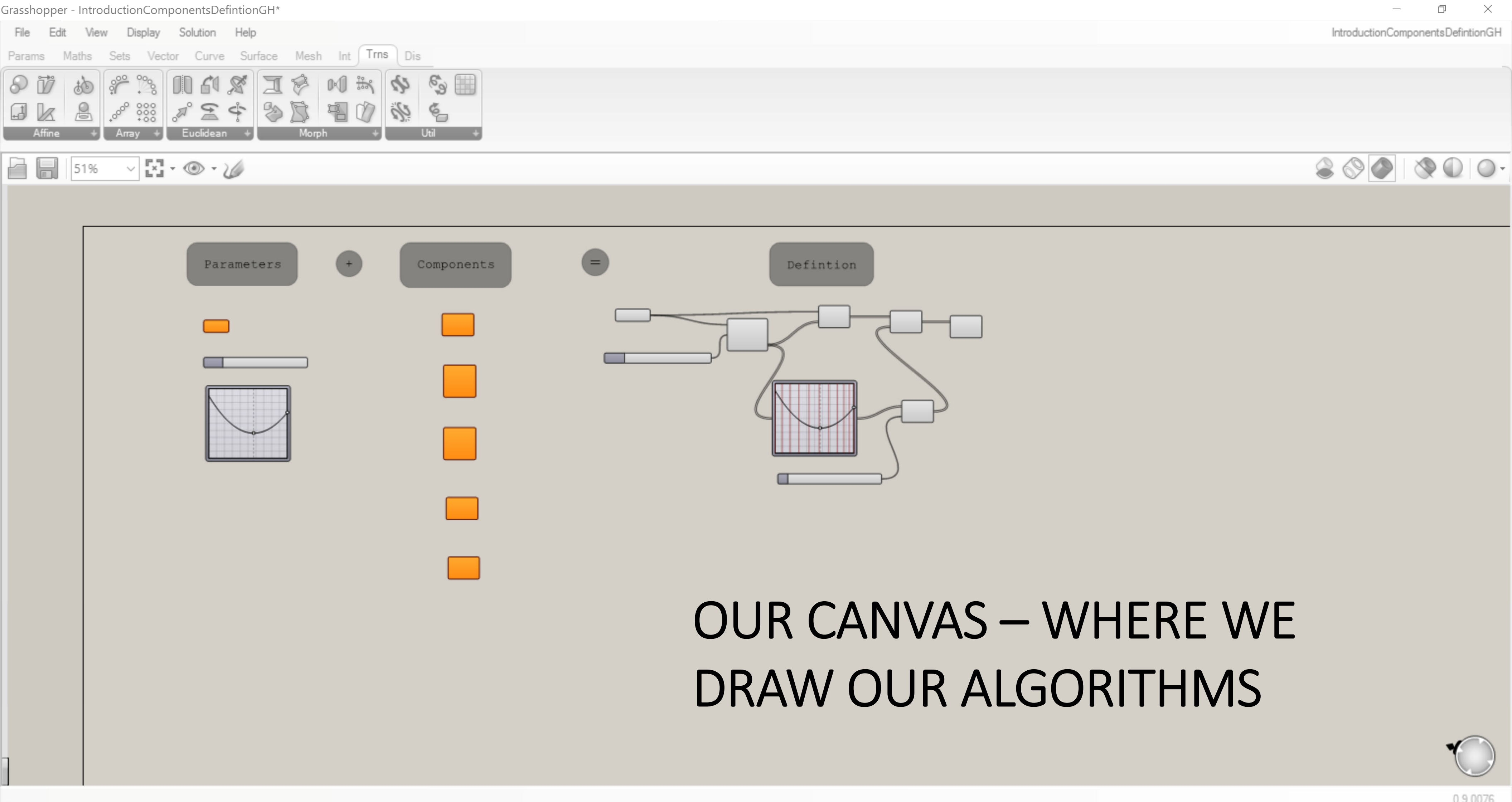
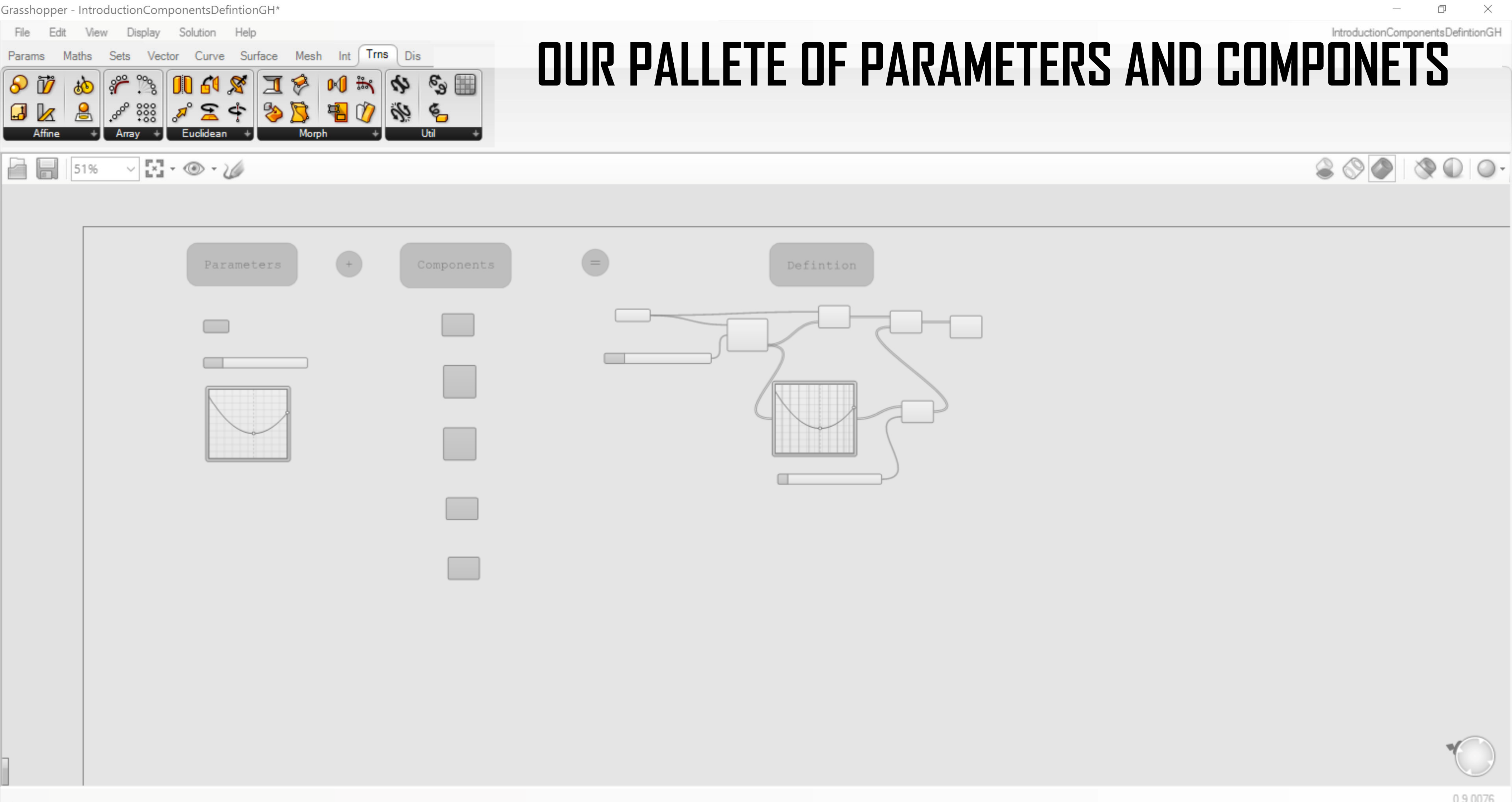


OUR CANVAS – WHERE WE DRAW OUR ALGORITHMS

OUR PALLETE OF PARAMETERS AND COMPONETS




Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb PanelingTools
Geometry Primitive Input Util
Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb
Analysis Freeform Primitive Util
Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb PanelingTools
Domain Matrix Operators Polynomials Script Time Trig Util
Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb PanelingTools E Kangaroo2 Kangaroo LunchBox
Analysis Primitive Triangulation Util
Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb
List Sequence Sets Text Tree
Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb
Mathematical Physical Region Shape
Params Maths Sets Vector Curve Surface Mesh Int Trns Dis
Field Grid Plane Point Vector
Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb
Affine Array Euclidean Morph Util
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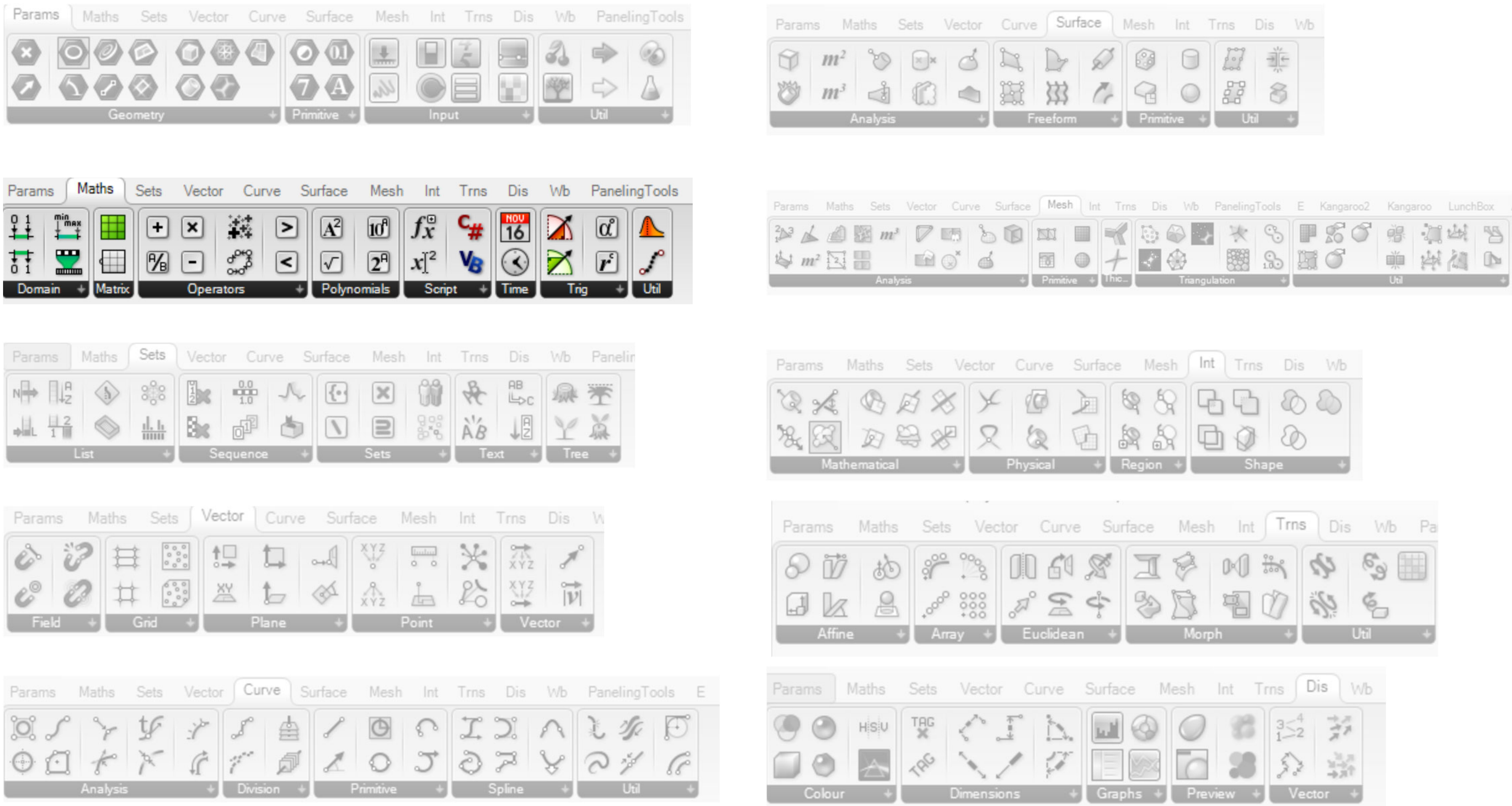
Analysis Division Primitive Spline Util
Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb
Colour Dimensions Graphs Preview Vector


Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb PanelingTools
Geometry Primitive Input Util
Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb PanelingTools
Domain Matrix Operators Polynomials Script Time Trig Util
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Field Grid Plane Point Vector
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Analysis Division Primitive Spline Util
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Analysis Freeform Primitive Util
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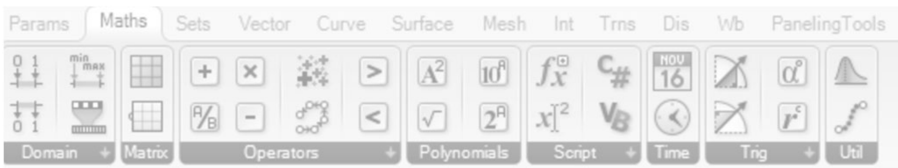
Affine Array Euclidean Morph Util
Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb
Colour Dimensions Graphs Preview Vector


Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb PanelingTools
Geometry
Primitive
Input
Util

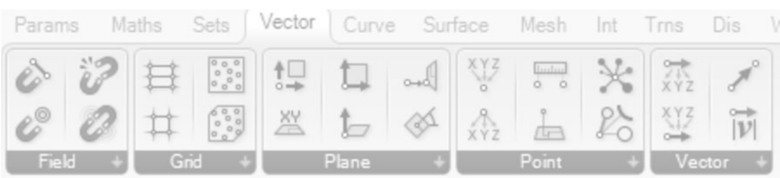

Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb
Analysis
Freeform
Primitive
Util


Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb PanelingTools
Domain
Matrix
Operators
Polynomials
Script
Time
Trig
Util


Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb PanelingTools E Kangaroo2 Kangaroo LunchBox
Analysis
Primitive
Triangulation
Util


Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb
List
Sequence
Sets
Text
Tree


Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb
Mathematical
Physical
Region
Shape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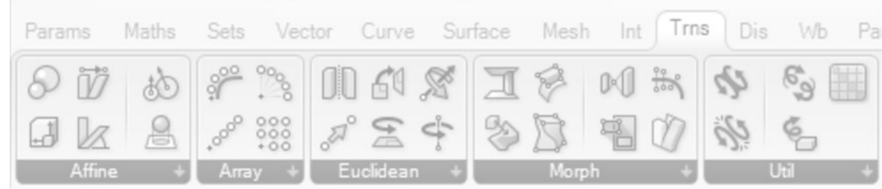
Grid
Plane
Point
Vector


Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb
Affine
Array
Euclidean
Morph
Util


Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb PanelingTools E
Analysis
Division
Primitive
Spline
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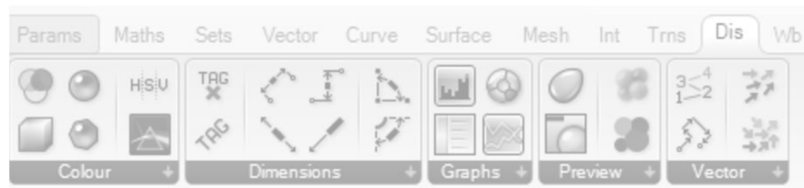
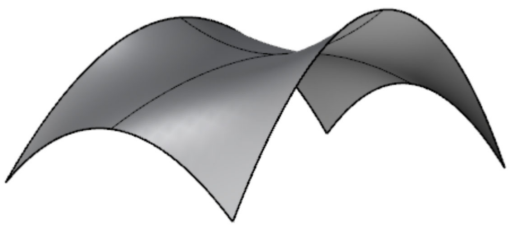
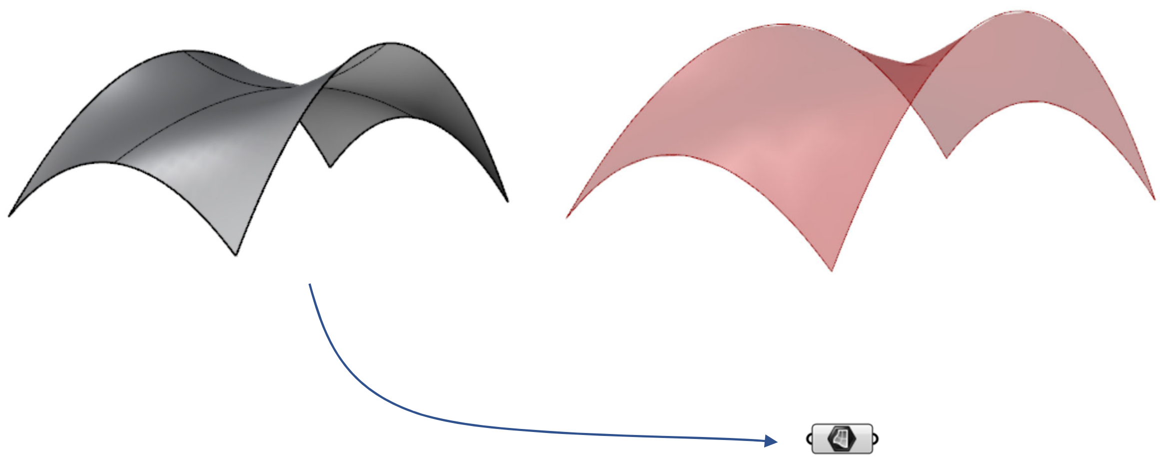

Params Maths Sets Vector Curve Surface Mesh Int Trns Dis Wb
Colour
Dimensions
Graphs
Preview
Vector

RHINO GEOMETRY



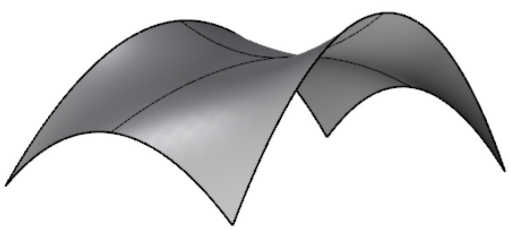
RHINO GEOMETRY

GRASSHOPPER GEOMETRY

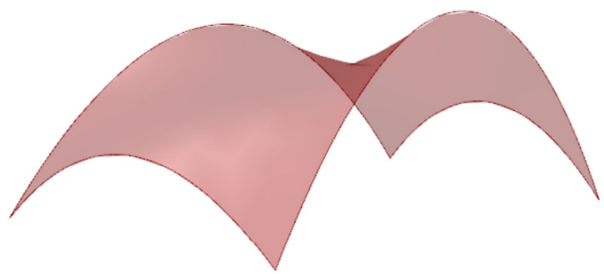


COPY OF THE RHINO
GEOMETRY AND REFERNECE
IT TO GRASSHOPPER

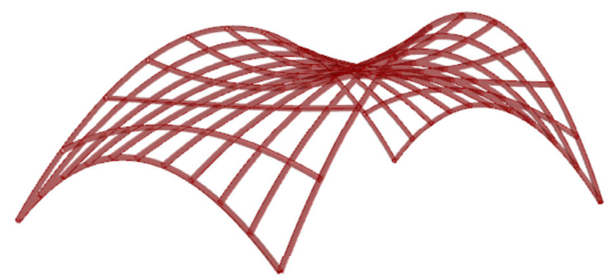
RHINO GEOMETRY

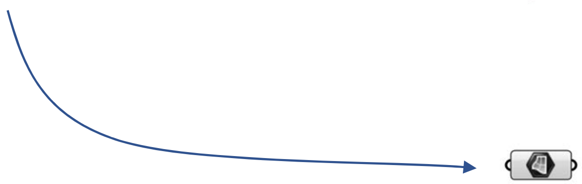


GRASSHOPPER GEOMETRY

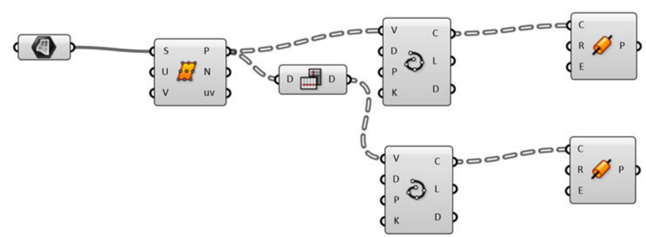


NEW GEOMETRY GENERATED IN GRASSHOPPER

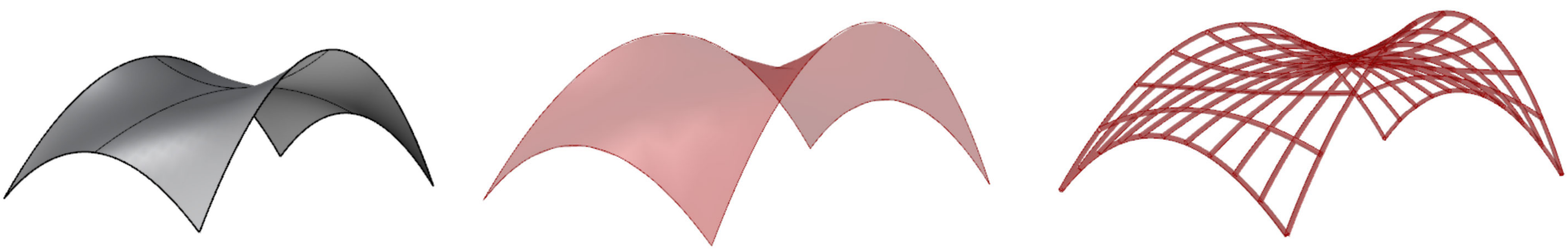




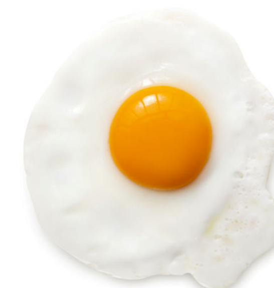
COPY OF THE RHINO
GEOMETRY AND REFERNECE
IT TO GRASSHOPPER

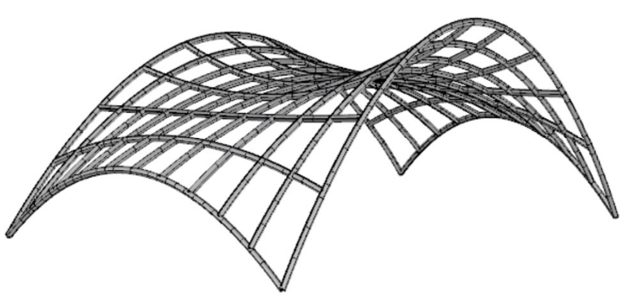


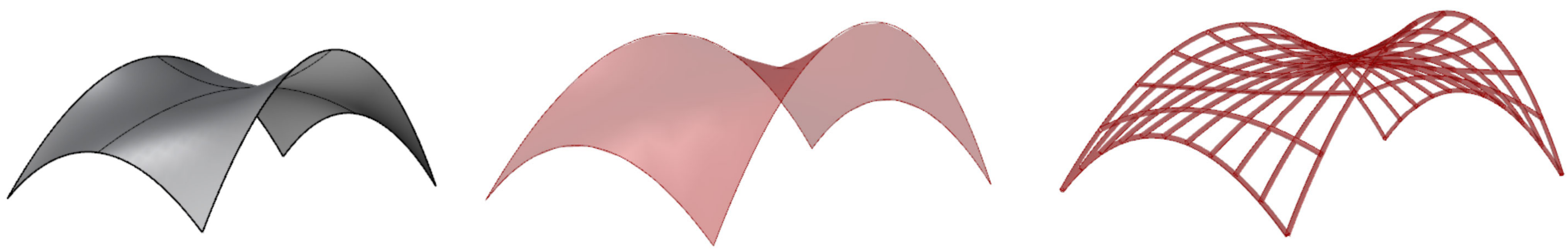
USE THE OBJECT IN
GRASSHOPPER AS BASIS FOR
YOUR DESIGN



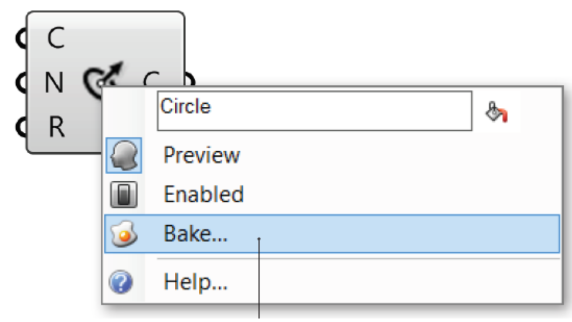
BAKE THE GEOMETRY TO TRANSFORM
GRASSHOPPER GEOMETRY INTO RHINO GEOMETRY

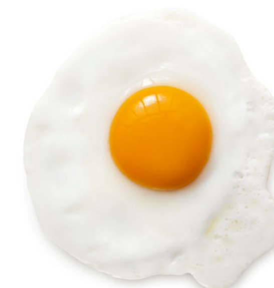


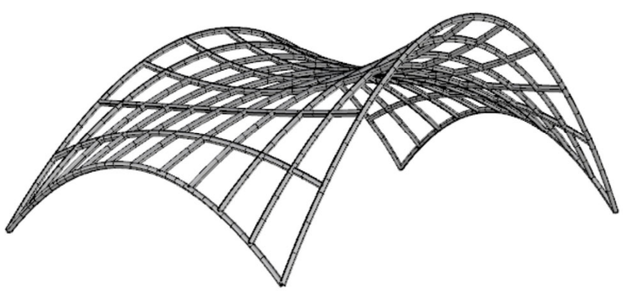




BAKE THE GEOMETRY TO TRANSFORM
GRASSHOPPER GEOMETRY INTO RHINO GEOMETRY







From RHINO5 – Hope it works the same in RHINO6

Menu shortcuts are customizable, but there are a some special keys and mouse-button combinations that trigger specific functions in the Grasshopper canvas.

Always:

- RMB+Drag = Pan left/right/up/down
- RMB+Ctrl+Drag = Zoom in/out
- Scroll Wheel = Zoom in/out
- MMB+Click = Wheel menu
- Spacebar = Wheel menu
- LMB+Alt+Drag = Split objects (aka 'The Moses Tool')

While over an empty canvas spot:

- LMB+Drag = selection rectangle
- LMB+Shift+Drag = addition selection rectangle
- LMB+Ctrl+Drag = removal selection rectangle
- RMB+Click = Canvas menu

While over an object:

- LMB+Drag = Drag selected objects
- LMB+Shift+Drag = Drag selected objects along 45-degree guides
- LMB+Drag+Alt = Copy all dragging objects
- LMB+Click = Either select one object or do nothing if object is already selected
- LMB+Shift+Click = Add an object to the selection
- LMB+Ctrl+Click = Remove an object from the selection
- LMB+Ctrl+Shift+Click = Toggle the selection state
- LMB+Ctrl+Alt = Info mode
- LMB+Ctrl+Shift+Alt = Save info mode as image
- RMB+Click = Object context menu

While over an input/output grip:

- LMB+Drag = Create a new wire
- LMB+Shift+Drag = Create a new wire without erasing old wires
- LMB+Ctrl+Drag = Erase an existing wire by tracing over it
- LMB+Ctrl+Shift+Drag = Move all existing wires to some other grip
- LMB+Drag+RMB = Create a new wire without exiting the wire tool
- LMB+Drag+RMB+Shift = Add a wire without exiting the wire tool
- LMB+Drag+RMB+Control = Remove a wire without exiting the wire tool

While over a component icon on the toolpanels:

- LMB+Shift+Click = Create a component aggregate