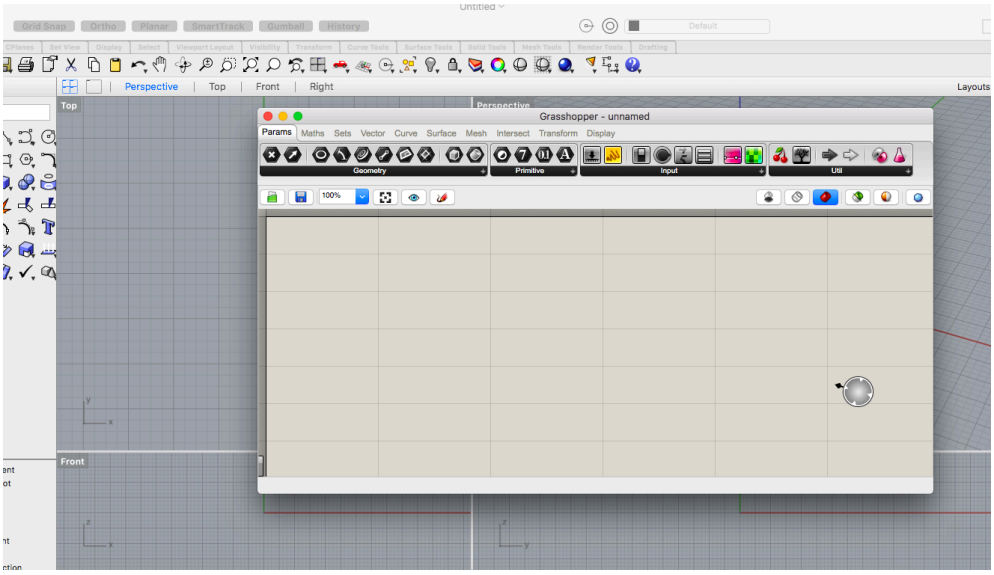
3D Printing & Parametric Design

LWHS - 2023-2024

******Submit Documentation of each tutorial on your google site, include: Screenshots of the grasshopper file & Rhino Rendering. Include one sentence about your thoughts/challenges on each tutorial ******

Introduction to Grasshopper

1) Open Rhino
2) Type in the command line Grasshopper
3) A canvas like the one below should appear



4) This is called **canvas**, and it is where you'll build your programs, called **scripts**.

5) Each object and operation in Rhino is represented by a box called **component** (there are components corresponding to rhino primitive objects like spheres and cylinders, components corresponding to Rhino transformations like revolve and translate and components for building one object from others such as loft.

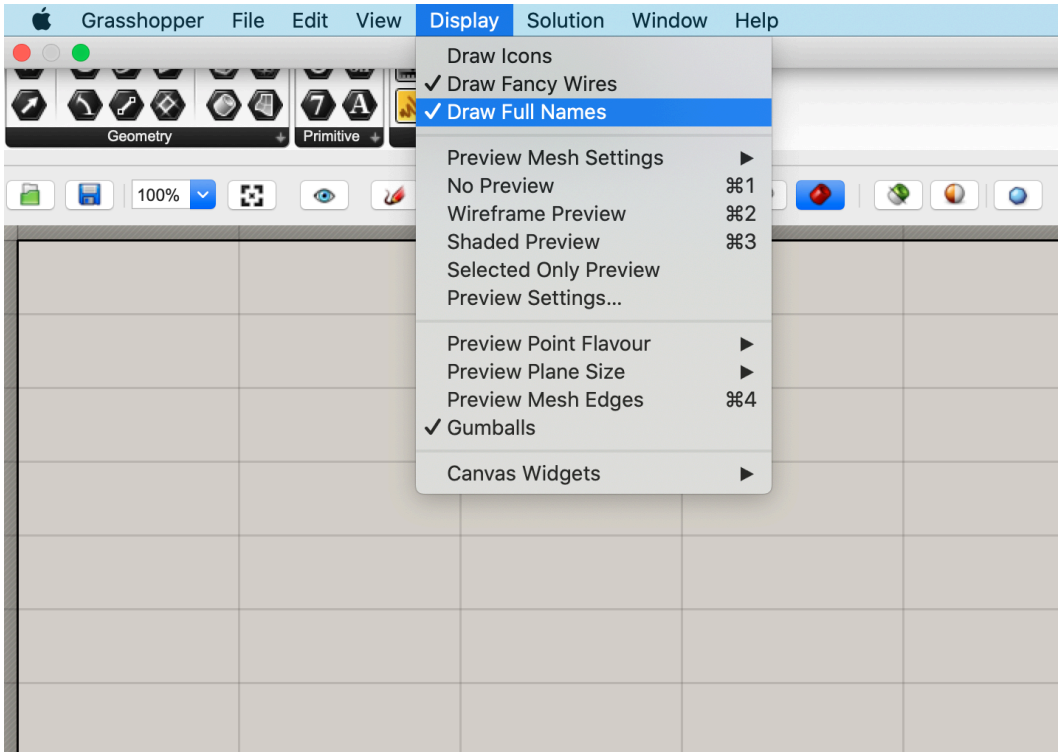
6) To build in Grasshopper script, you simply drag components onto the canvas and connect them with “wires”

7) The input and output to each component is either an object (sphere..), a piece of data (number) or an operation (rotation)

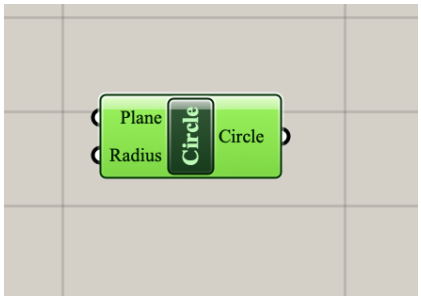
8) Formation always left to right (Wires connected to the left side of a component represent a flow of input data and wires connected on the right represent outputs.

Grasshopper Basics | Setting points

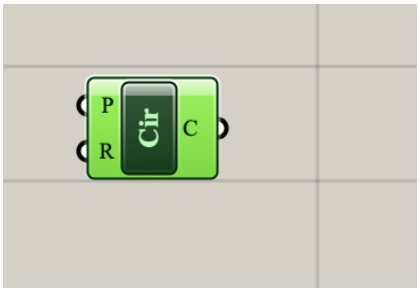
Before getting started: Go to the Display tap and click on Draw Full Names. This will make sure all names are shown in your components.



EXAMPLE:

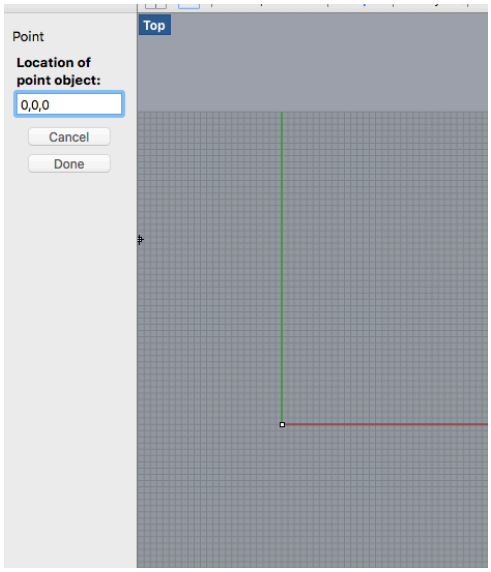


VS.

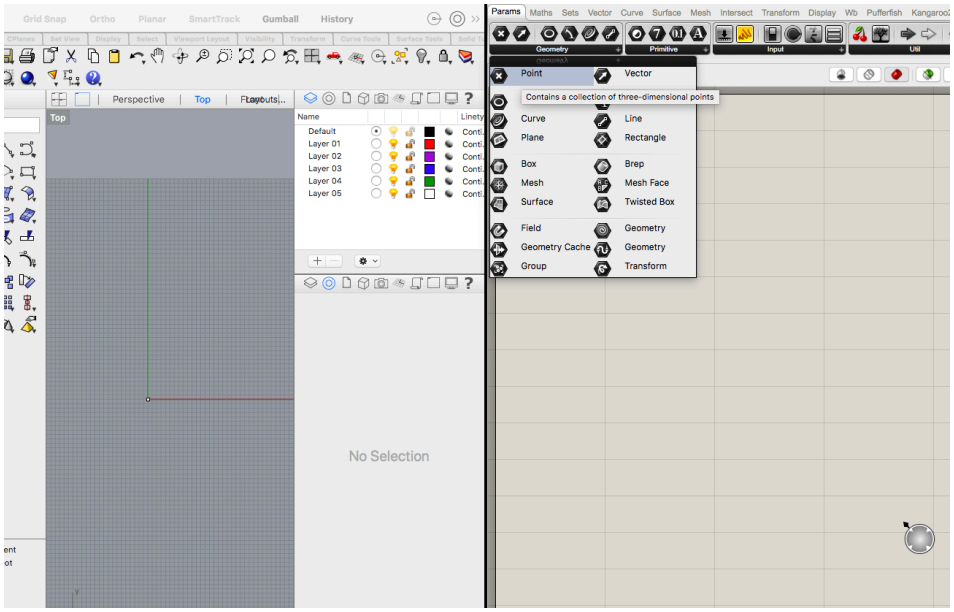


#1 | Importing points from Rhino to Grasshopper

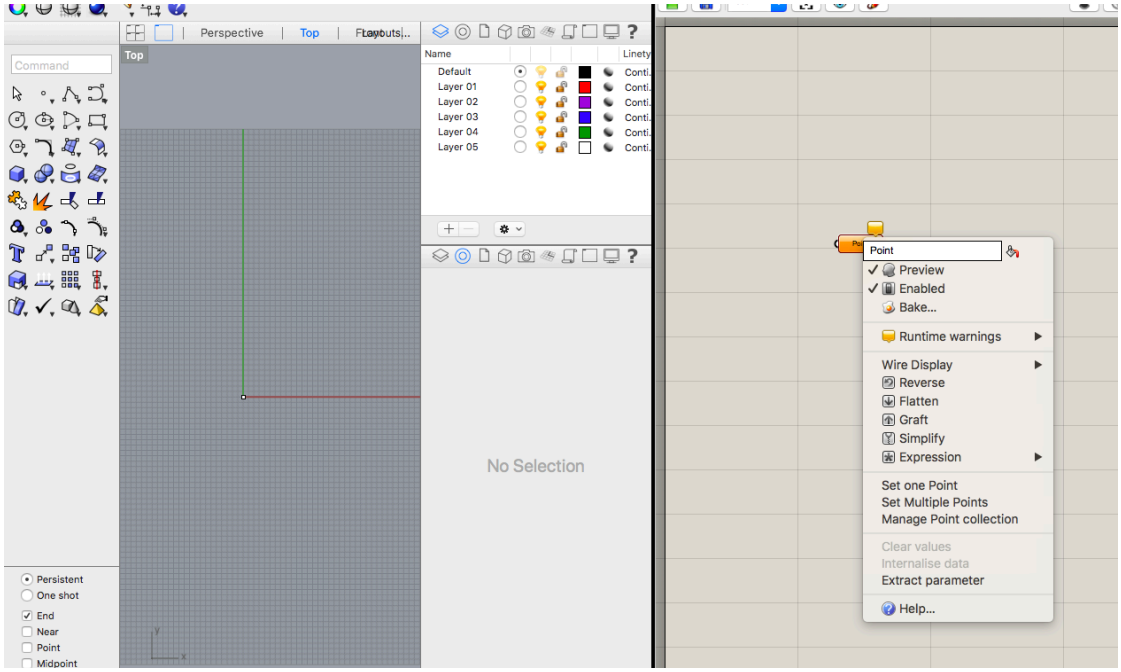
1) Create a point in Rhino at (0,0,0)



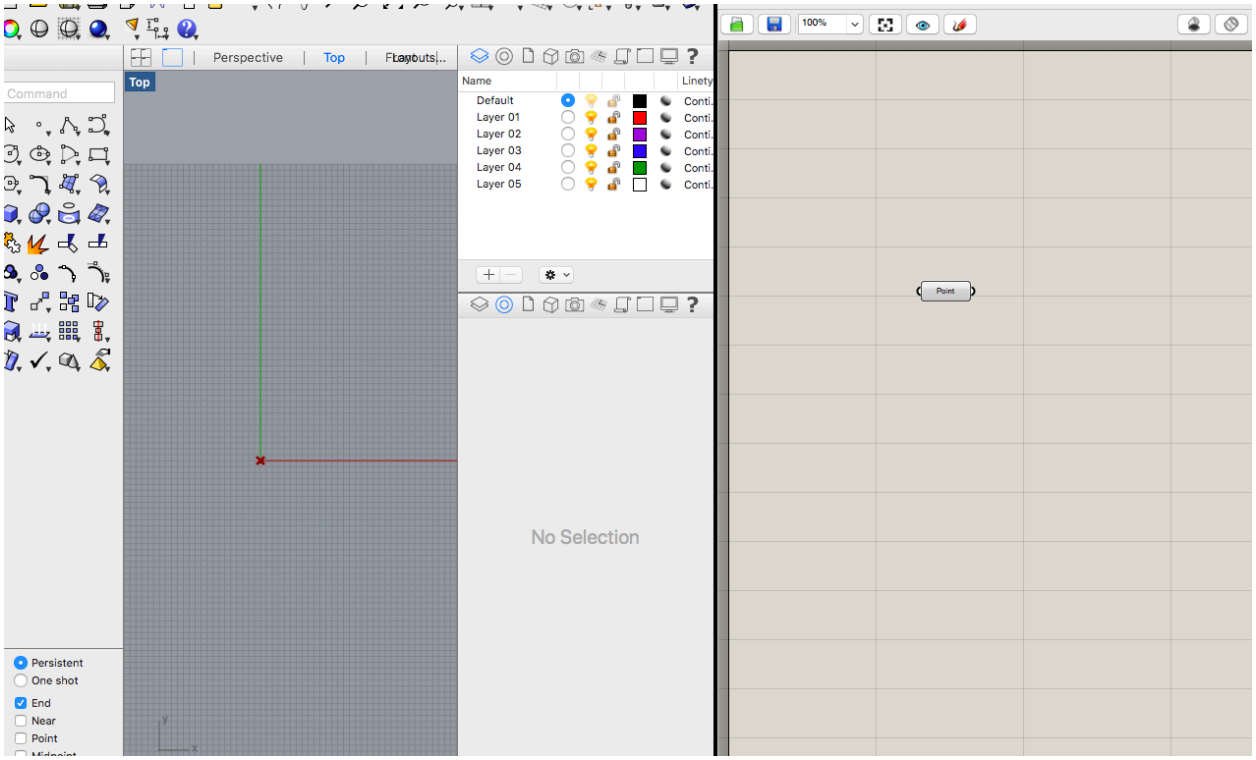
2) Import the point into grasshopper by clicking on the **Params** tab and dragging the **Point** component onto the canvas



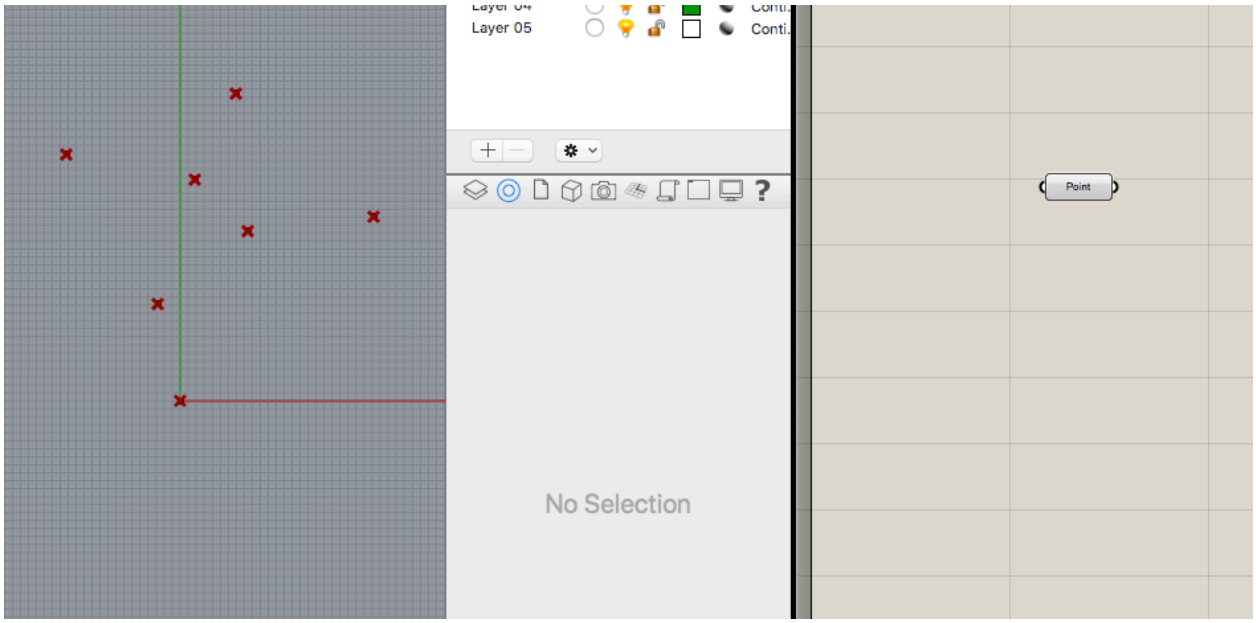
3) Now, click on the **Point component** in grasshopper. When the scroll down menu appears click on set one point.



4) Then select the point you created in Rhino. The point in Rhino should turn into a green or red x.
5) Create a second point, choose whatever coordinate you want to use.



Repeat the steps above but set multiple points. (Instead of creating one point in Rhino create multiple points & in step 3 select set multiple points instead of one point)



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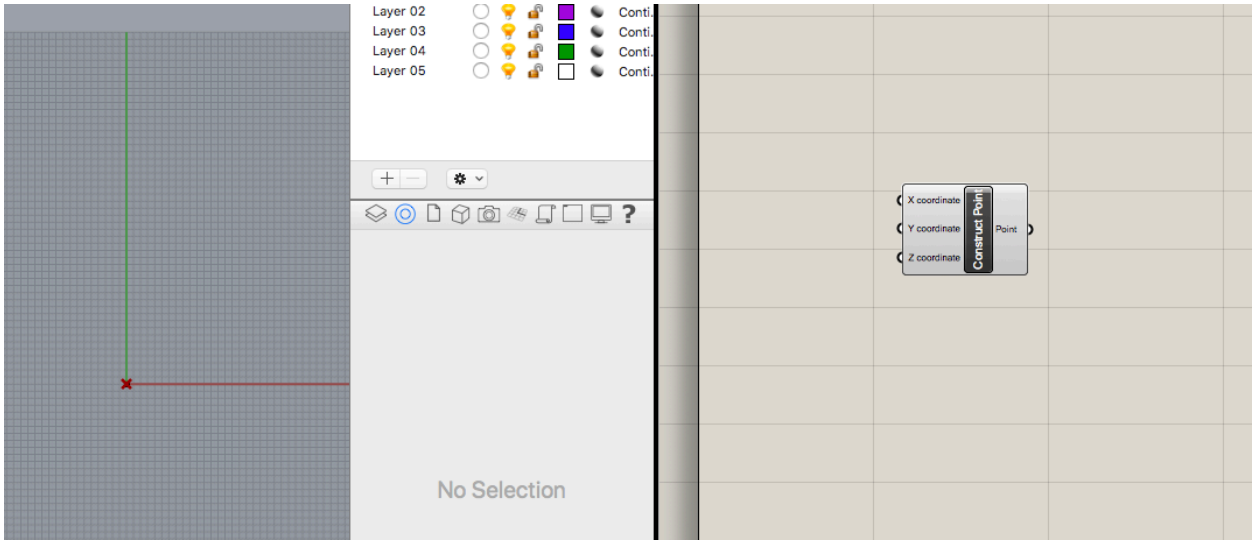
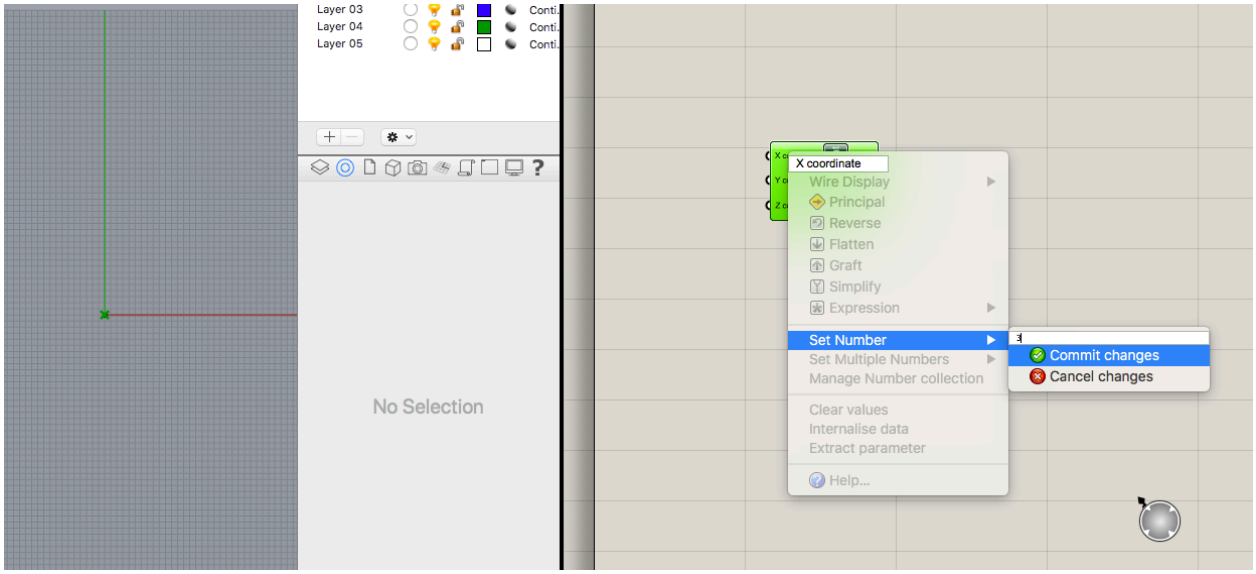
#2 | Create your point directly in grasshopper

1) Click on the **Vector Tab** and drag the component **Construct Point** onto the canvas. This component automatically creates a point at (0,0,0)

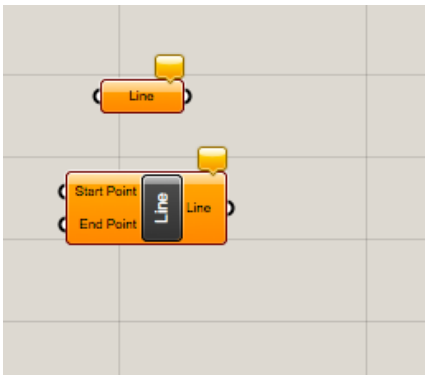


2) You can change the location of the point by changing the X,Y, Z coordinates. You can change each value by clicking on each input. Give it a try!

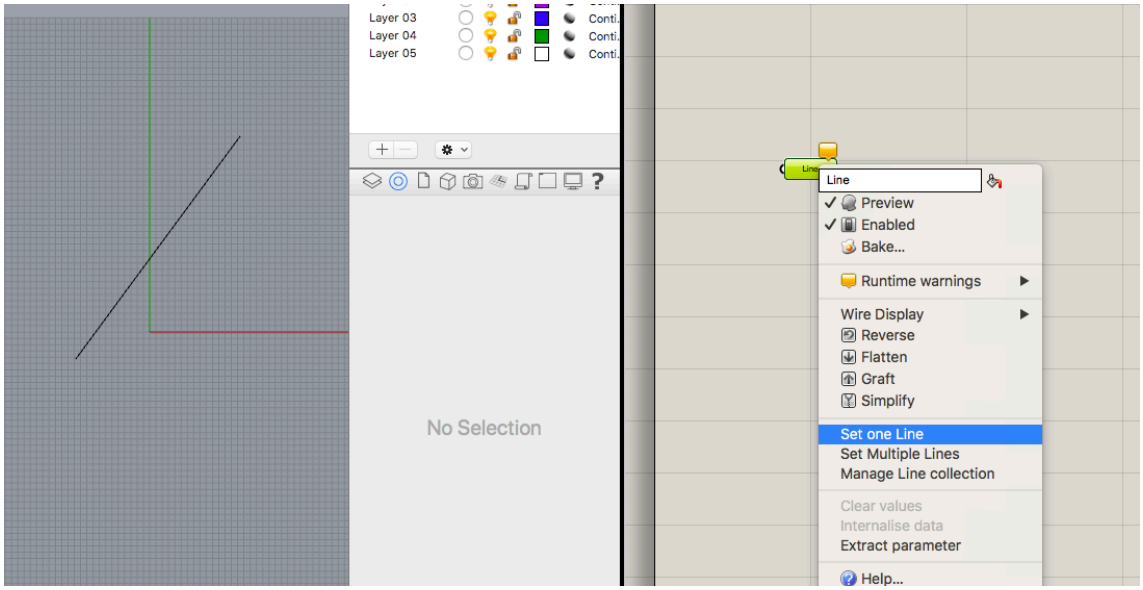


Grasshopper Basics | Params

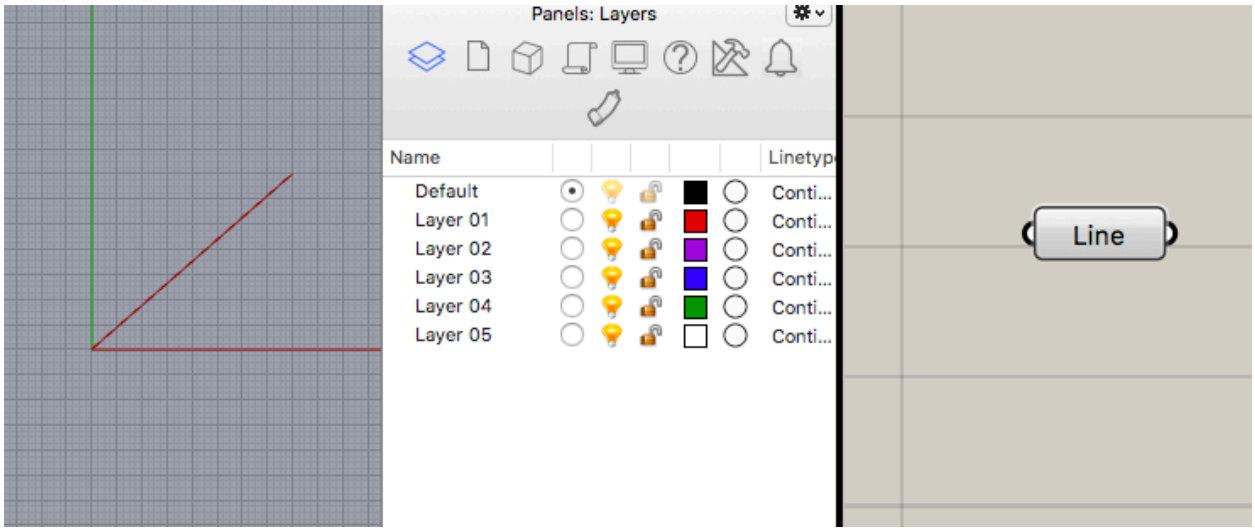
1) There are two main **Line** components in Grasshopper. The first component from the picture below can be used by directly drawing your line in Rhino. The second component creates a line directly in Grasshopper based on the starting point and the end point.



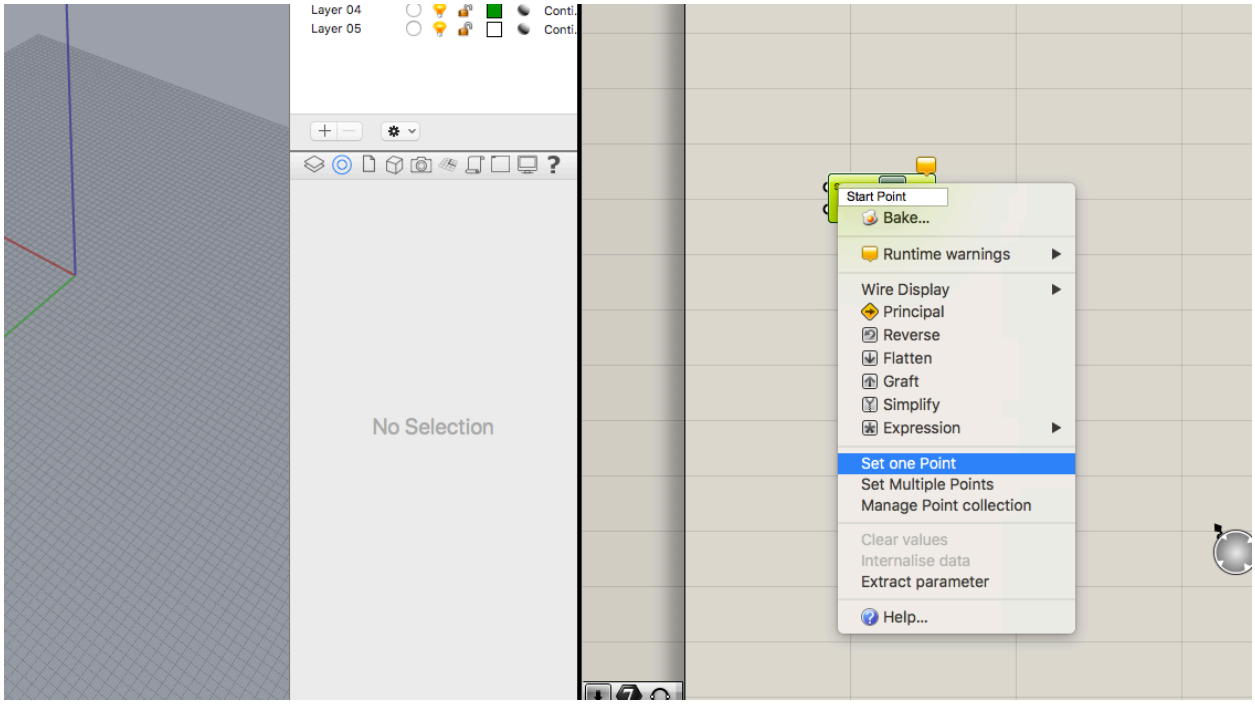
2) Drag a Line Component onto the canvas (The first from above)
3) Click on the **Line** Component and select set one line



4) Click on the start and end of your desired line in Rhino or you can plug in coordinates Start of line (0,0,0) & end of line (8,7,0). The line should turn red or green



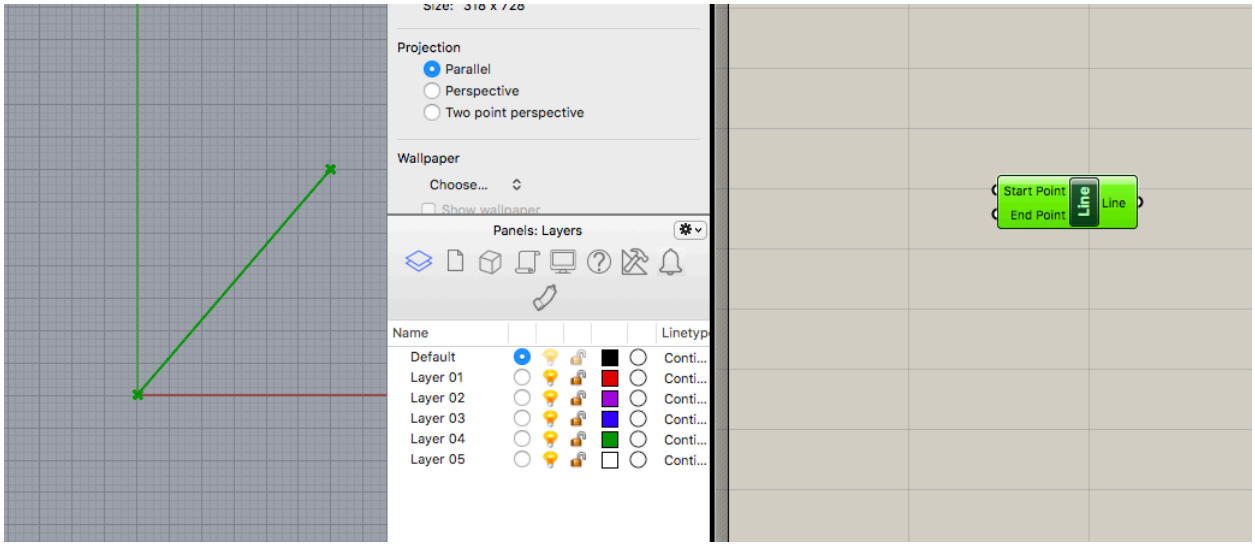
5) The Second component has two inputs, the start and end of the point
6) Drop a **Line Component** (Second one from the picture on step 1) from the Curve Tab, Primitive panel



7) Click on the start point input of the **Line Component.** Click on set one point. Set the coordinates for the starting point of the line. Type the coordinates (0,0,0)

8) Click on the end point input and click on set one point to set the coordinates for the starting point of the line. Type the coordinates to (6,7,0)

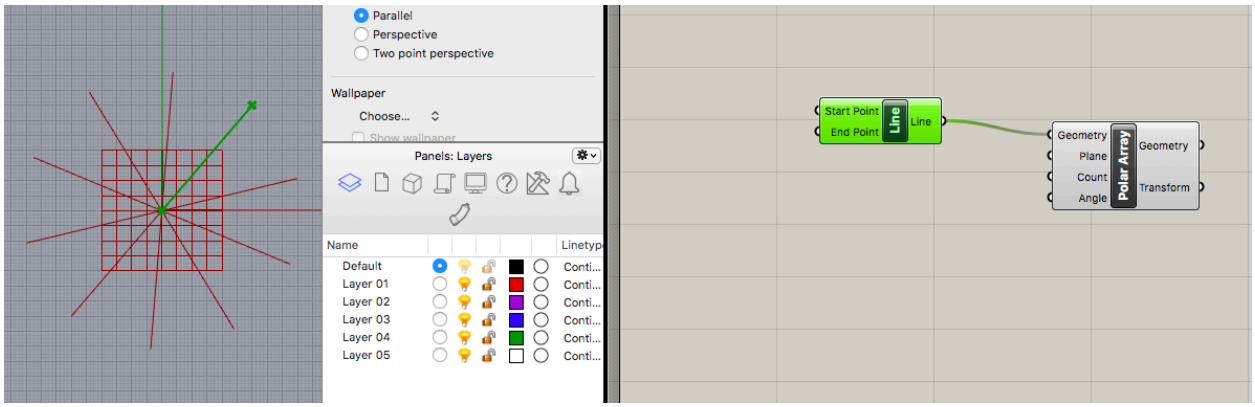
9) Your component should turn green.



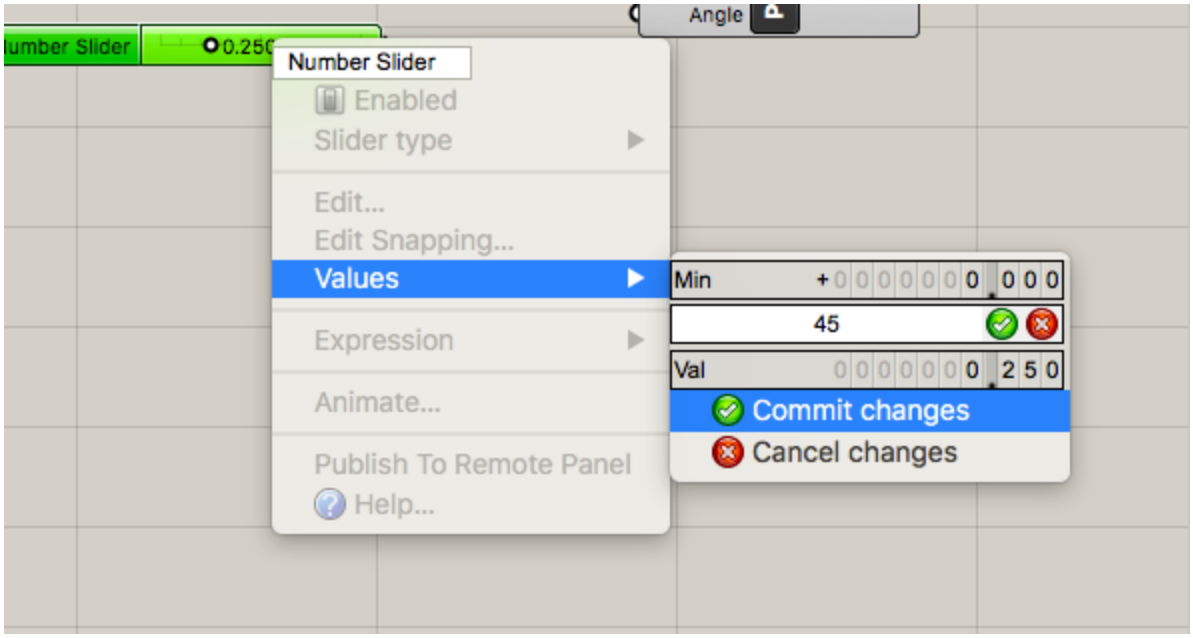
Polar Array using Grasshopper

10) Let's use the line you just created above or create a new line

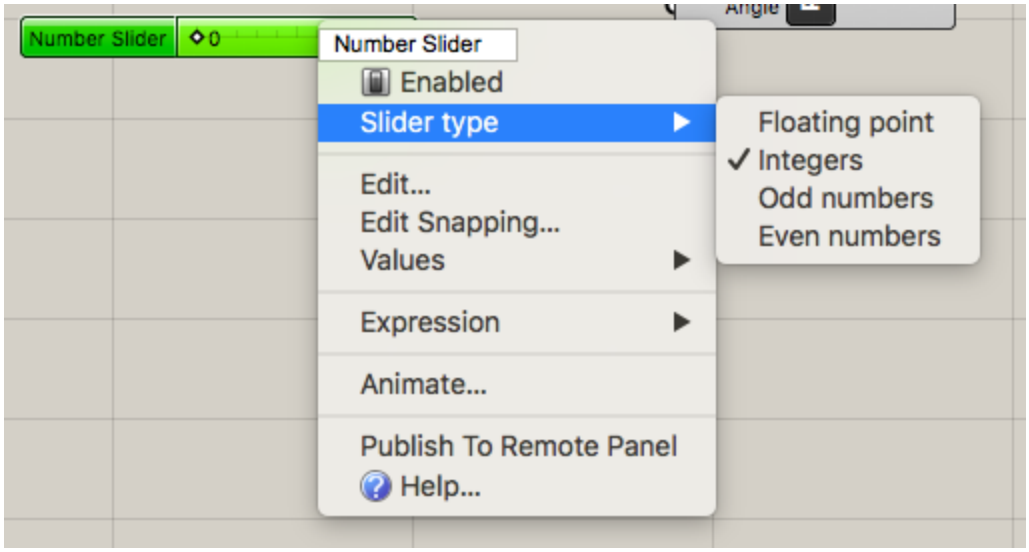
11) Drop in a **Polar Array Component** and connect the output of the **Line Component** to the Geometry input of the **Polar Array Component**



12) Drop a **Number slider** component. Set its values by clicking on the component and selecting Values. Now set the maximum to 45 and minimum to 0. Make sure you click on commit changes.



13) Now, click on the Number Slider Component again and on the menu select slider type. Select integers.



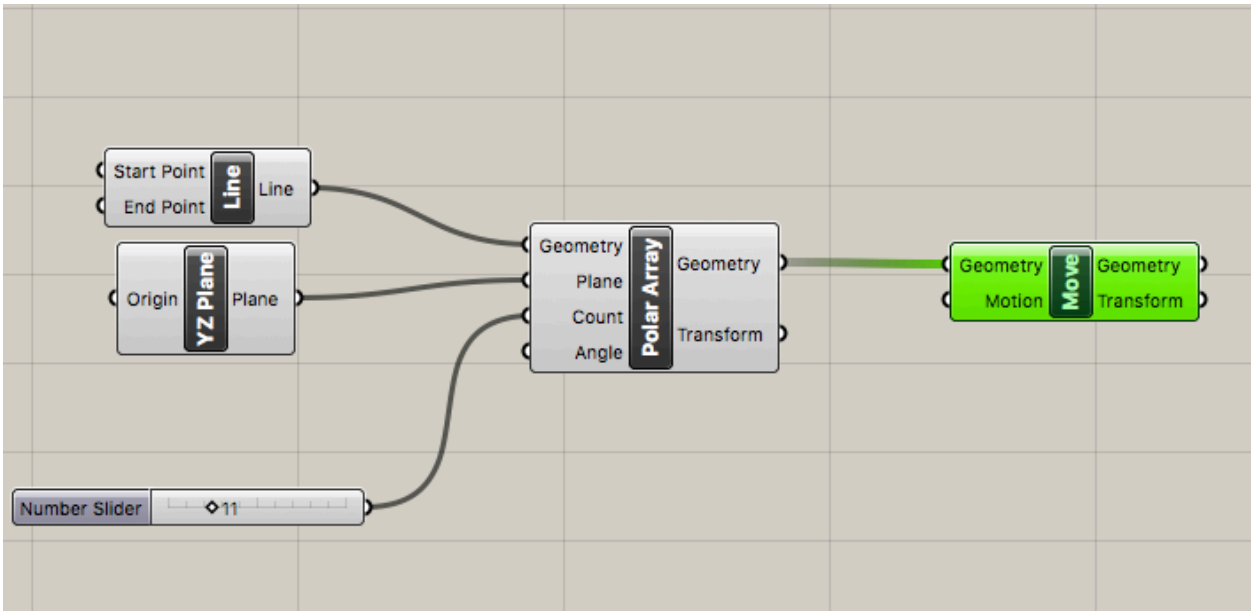
14) Connect the output of the number slider to the Count input of the **Polar Array component**

15) Drop any of the following components

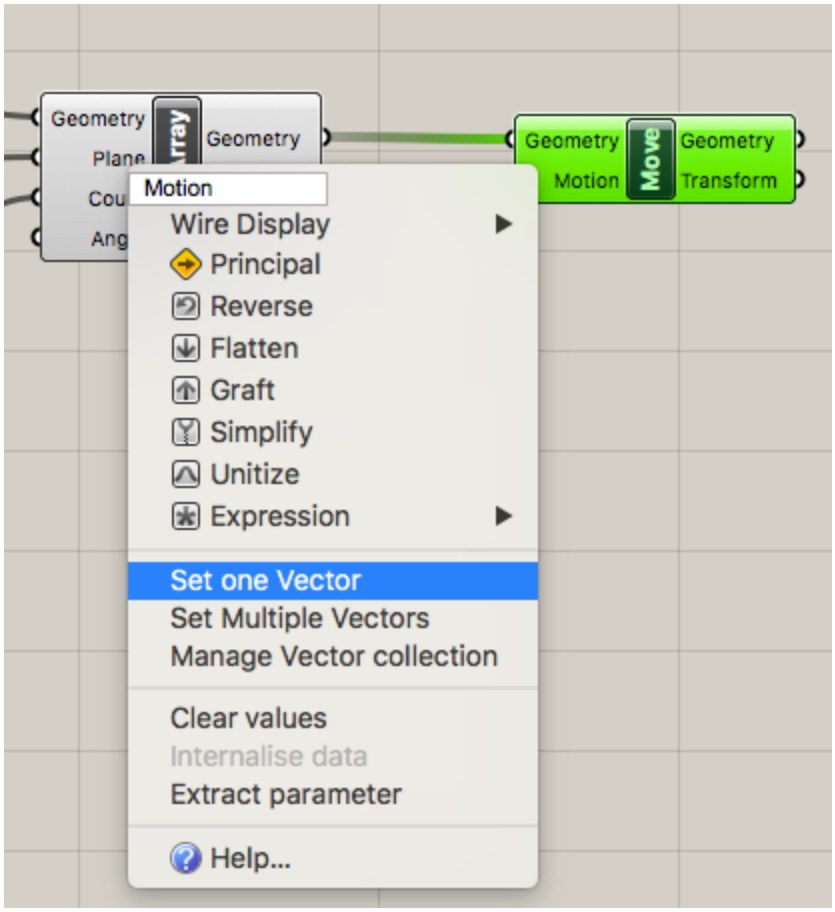
16) Connect the output of the Plane component to the input of Plane of the **Polar Array Component.** Try it with the other two planes.

17) Drop in Move component

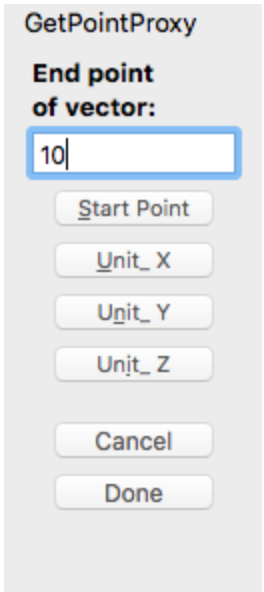
18) Connect the Geometry output of the **Polar Array component** to the Geometry input of the move component



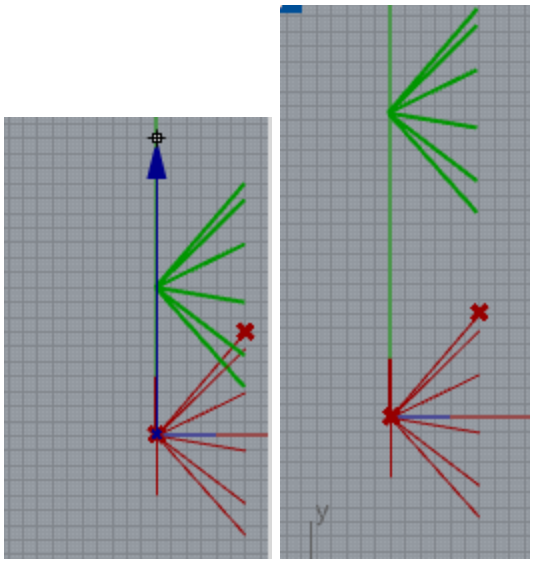
19) Click on the Motion input of the **Move Component** select set one vector



20) A small menu will pop out in Rhino. Type 10 as your End point vector. You can select Unit X,Y,Z to dictate the direction of the move.



21) In addition, you can use the blue arrow in Rhino to select the direction of the move.



22) Now click on your last component in grasshopper and on the menu select Bake

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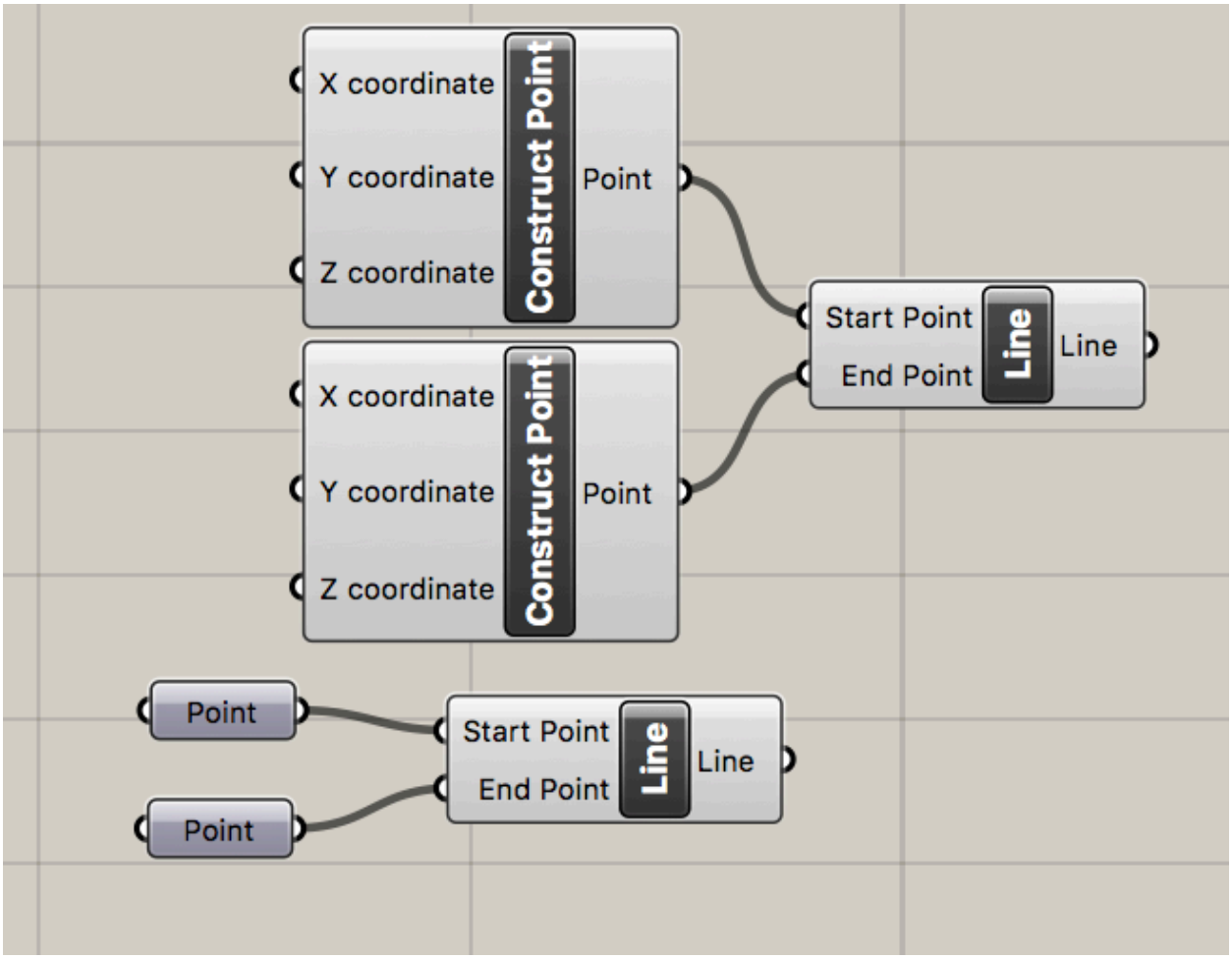
Line with two points

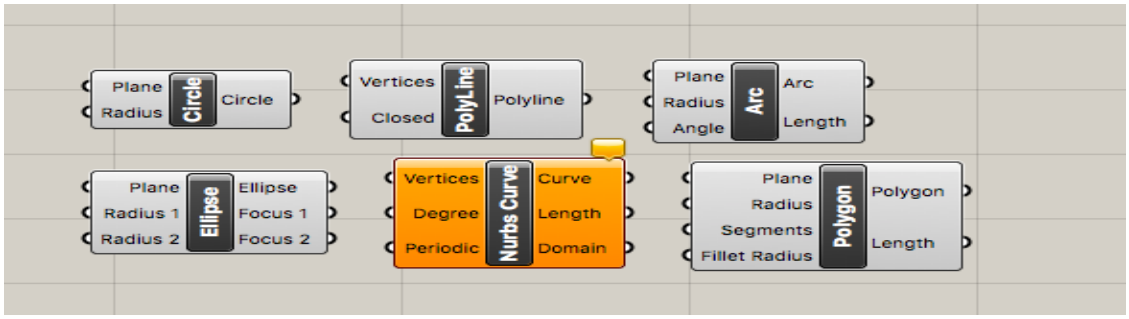
1) Drop two Point components into the canvas.
2) Drop a **Line Component**
3) Connect one of your points to the start point input of the **Line component.** Connect the second point to your end point input of your line component.
4) Try it with Construct point as well. (For this one remember to set your coordinates)



Now create 2 designs of your own using the components above. Be ready to share them in the next class.

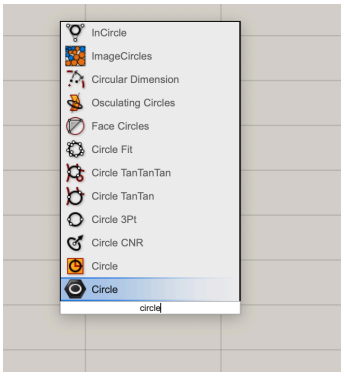
If you are done, use two of the components from below in combination with any of the components used above to create your own design

What are the main takeaways from this tutorial?

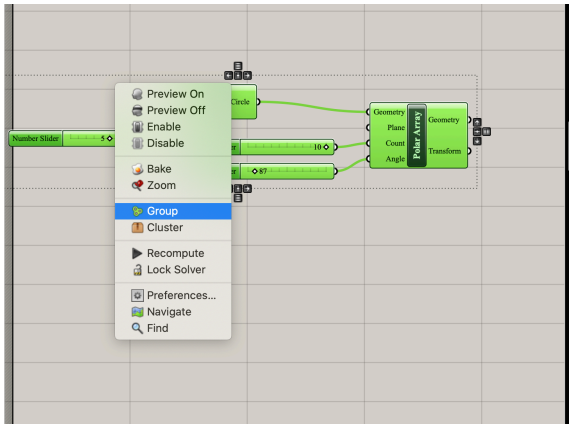


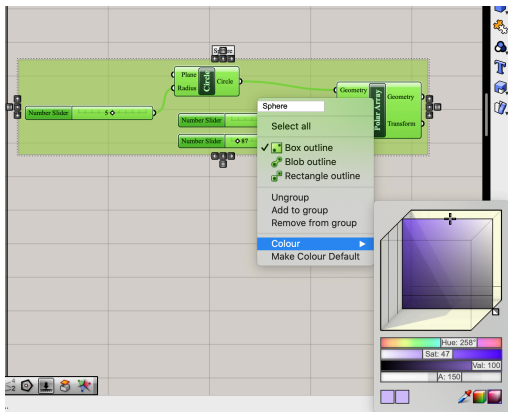
******Tips ******

Search Bar: You can double click anywhere in the Rhino Canvas and a search box will appear. You can type in the name of any component



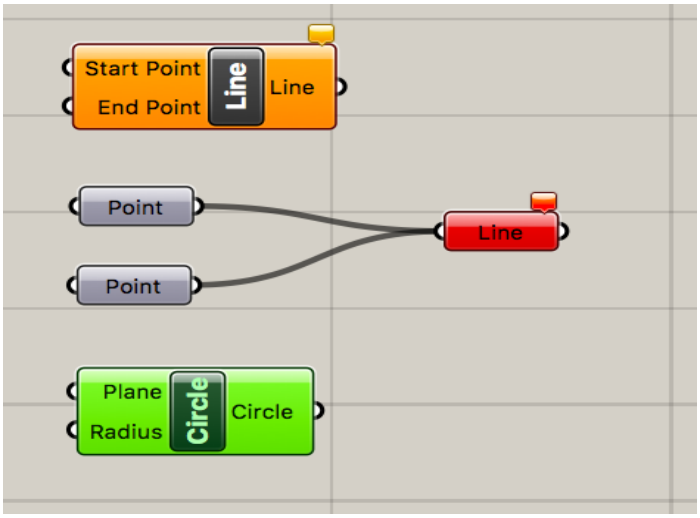
Grouping: You can group components and color code your scripts. This is particularly helpful when your scripts become large and complex. To group components simply select your components and from the menu select group. You can change the color and add a title.





GRASSHOPPER INDEX

*****The components turn yellow when there is no data, if a component turns red it means something is wrong with your input, if a component turn green everything is good****



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