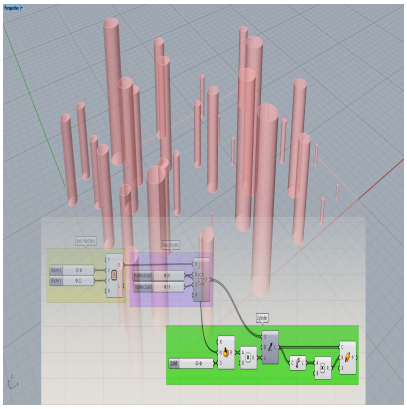
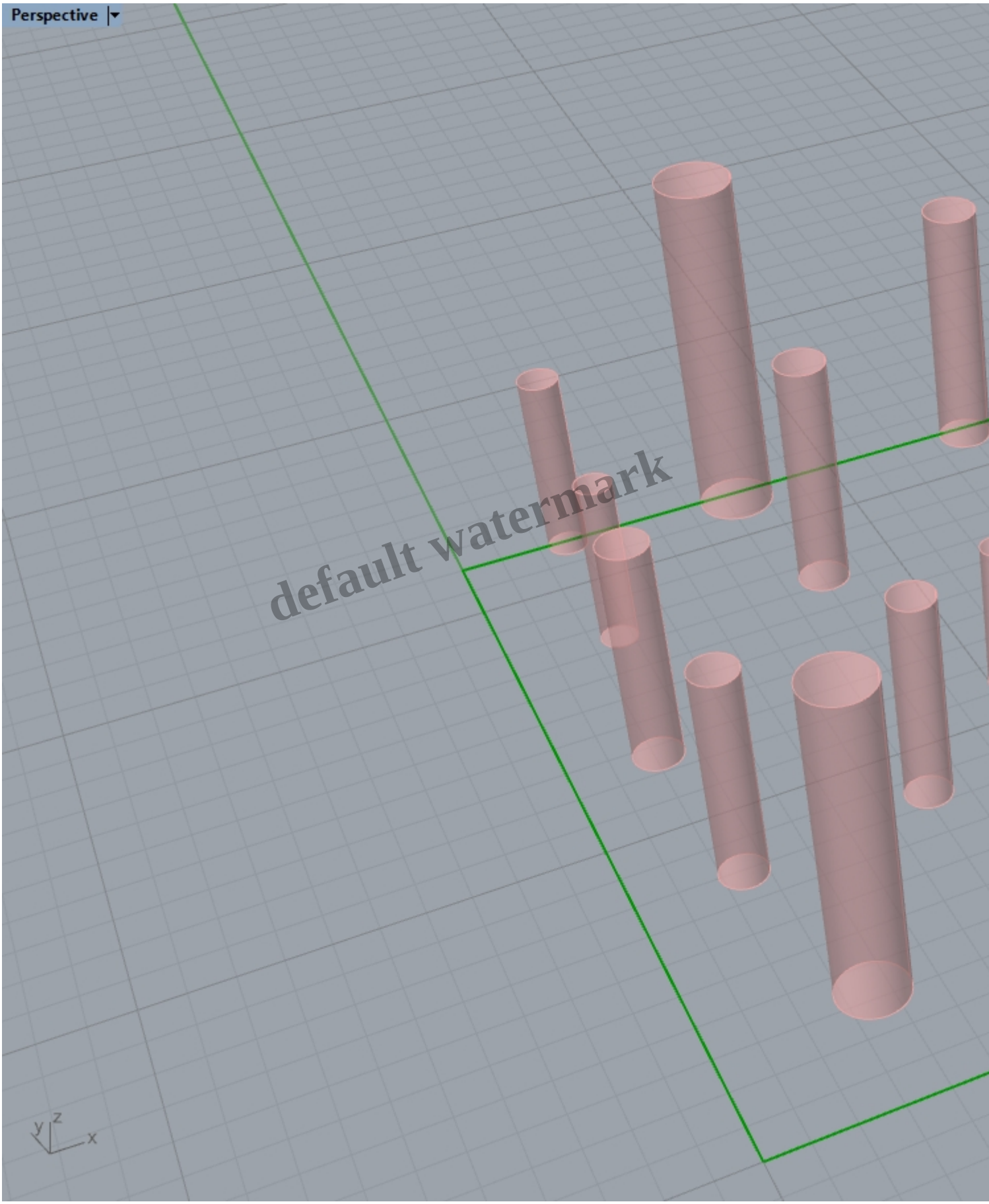
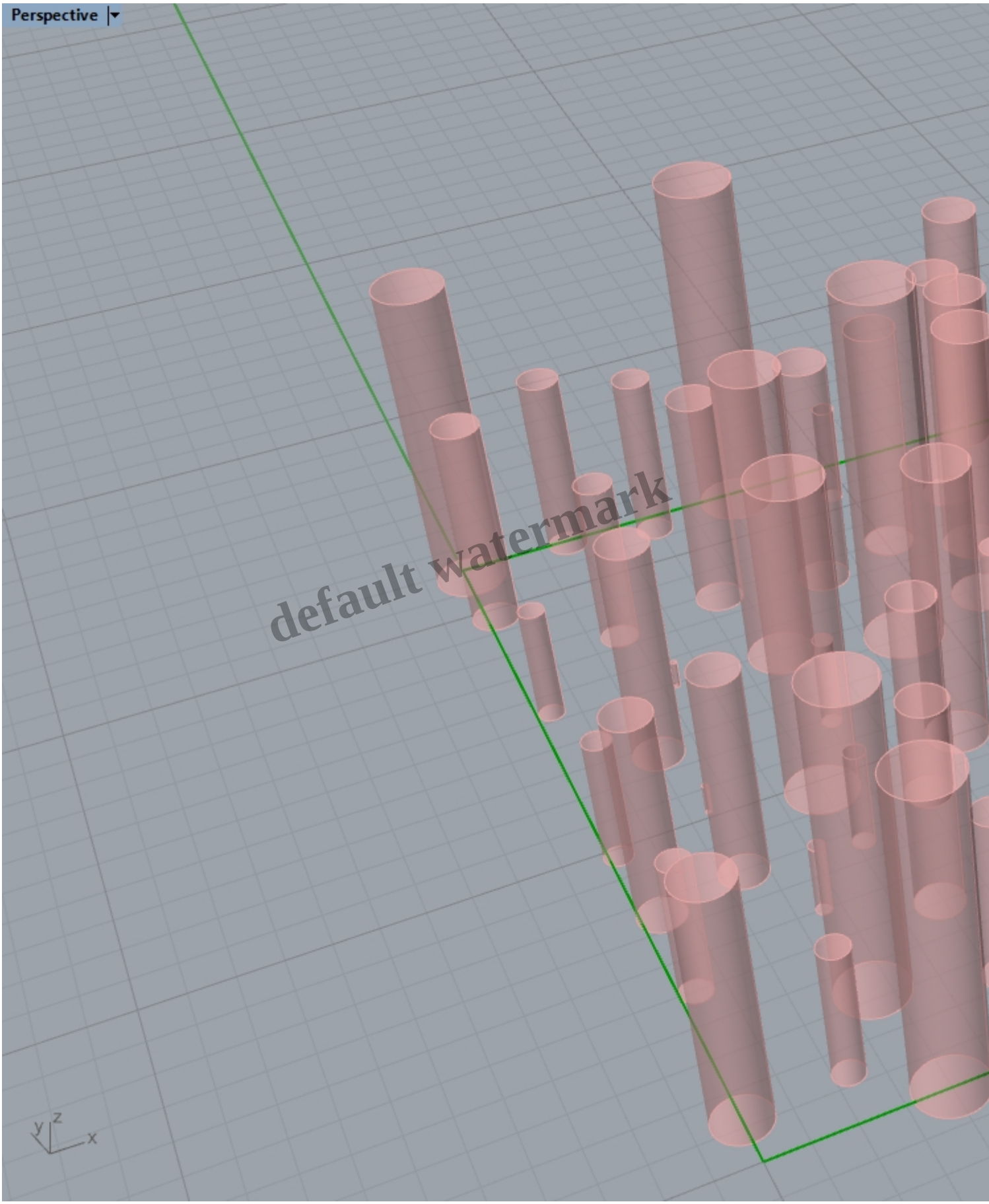


Rhino Grasshopper: Random Geometry Distribution

Description

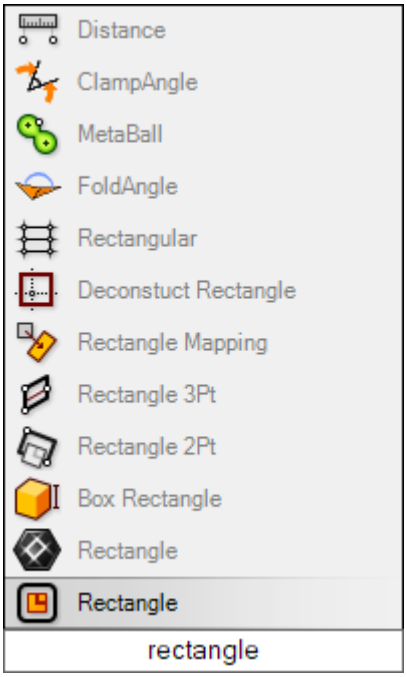
I wondered if I could produce the kind of random geometry in *Rhino Grasshopper* that I can generate with *Cinema4D's* cloner tool. As shown in the images above, it's about distributing objects over a defined surface allowing for random positioning, scaling and rotating. Let me show you how it works in Rhino Grasshopper.


Perspective
default watermark
y
z
x


Perspective
default watermark
y
z
x

Create a rectangle

First of all we need a base surface, to keep things simple in this case it will be a regular rectangle. Double-click on the Grasshopper canvas and write *rectangle*:

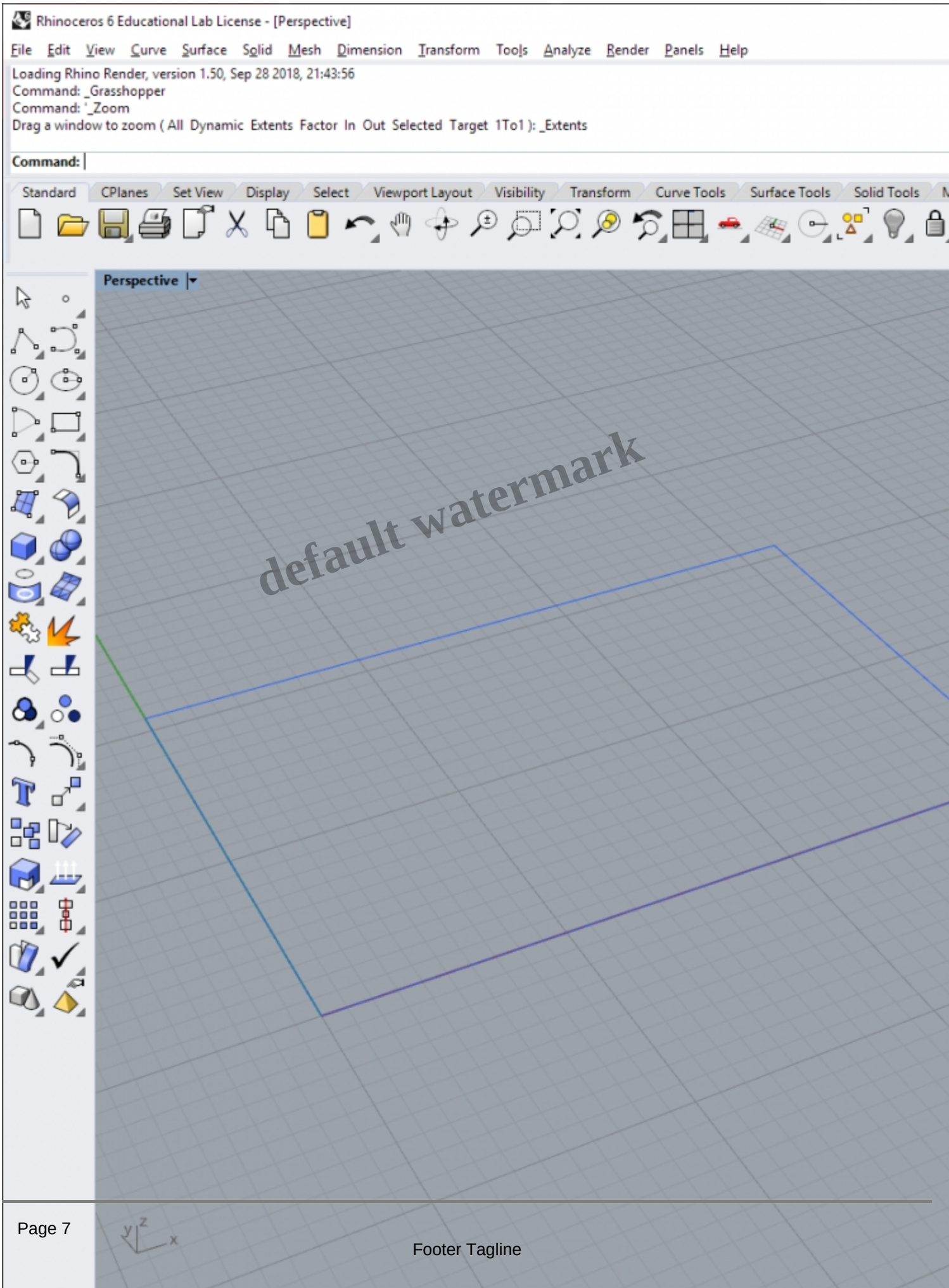


Now that you have your *Rectangle* component produce *2 Number Sliders*. Do this by double clicking on the canvas and write: *1<20<50:*

When you hit *Return* you'll see that GH has produced a number slider showing integers ranging from 1 to 50 and showing 25 as default. As I said above, do this twice and connect the two sliders to the *X* and *Y*-Inputs of the *Rectangle*.

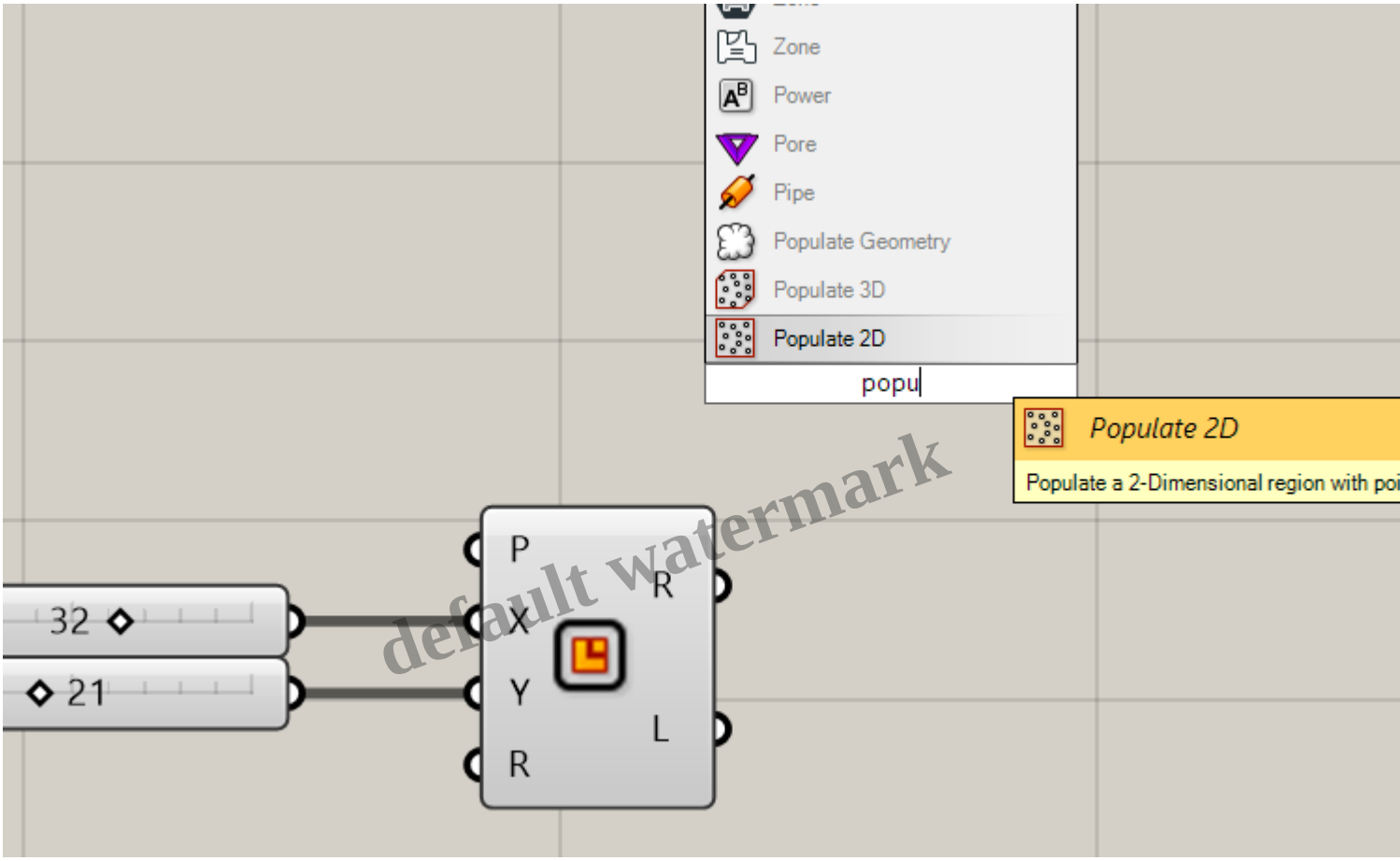
Note: You can also produce one slider only and *Alt*-Drag it to get an exact copy of it. (Start dragging

and *then* press *Alt* – if you press *Alt* first you'll get the Moses effect.) Now you can adjust the base rectangle's size via your new *Number Sliders*:

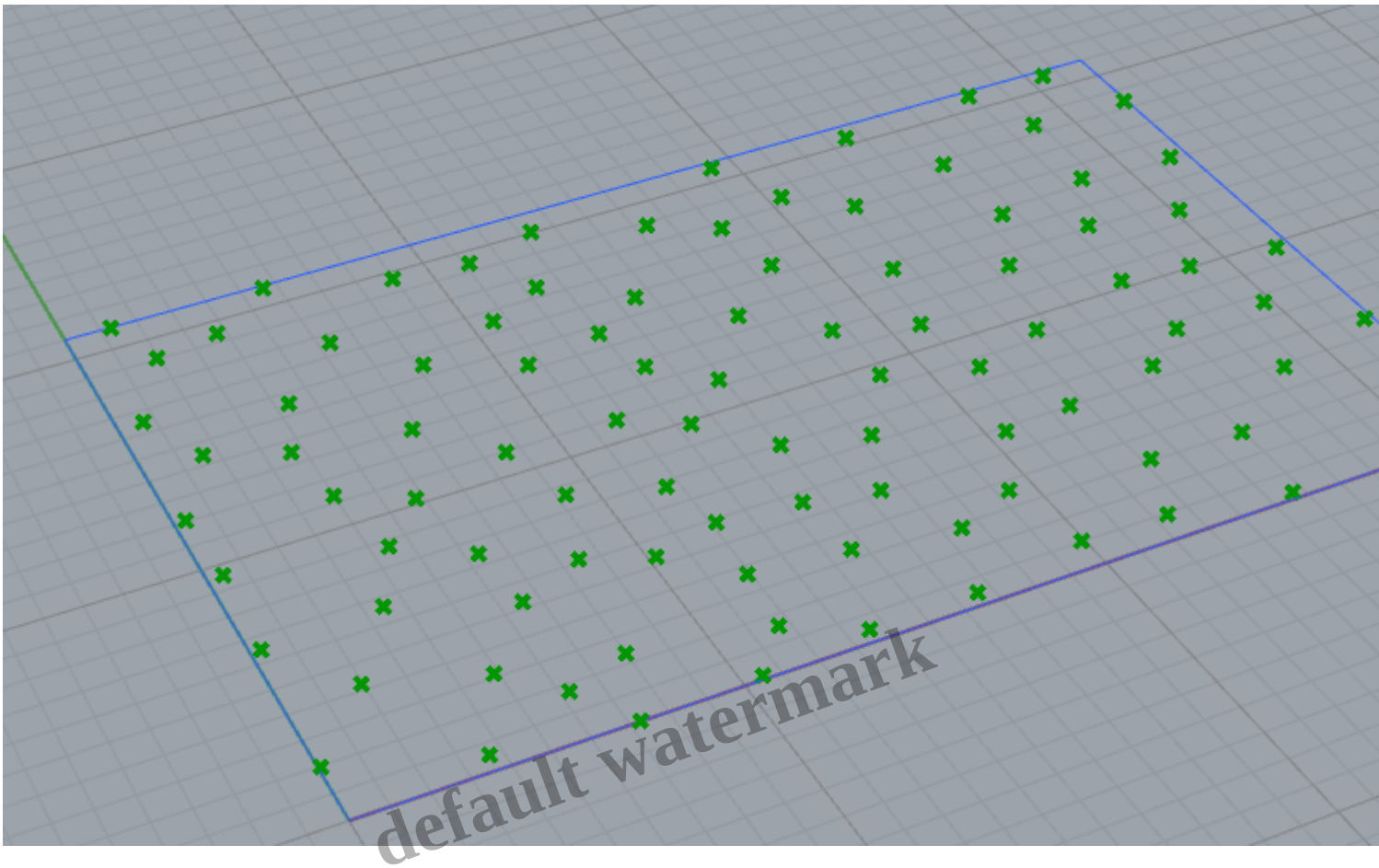

Rhinoceros 6 Educational Lab License - [Perspective]
File Edit View Curve Surface Solid Mesh Dimension Transform Tools Analyze Render Panels Help
Loading Rhino Render, version 1.50, Sep 28 2018, 21:43:56
Command: _Grasshopper
Command: '_Zoom
Drag a window to zoom (All Dynamic Extents Factor In Out Selected Target 1To1): _Extents
Command:
Standard CPlanes Set View Display Select Viewport Layout Visibility Transform Curve Tools Surface Tools Solid Tools
Perspective
default watermark

The Points

To distribute objects on this rectangle we start with points. They will serve as origins for our cylinders. Produce a *Populate 2D*-Component:

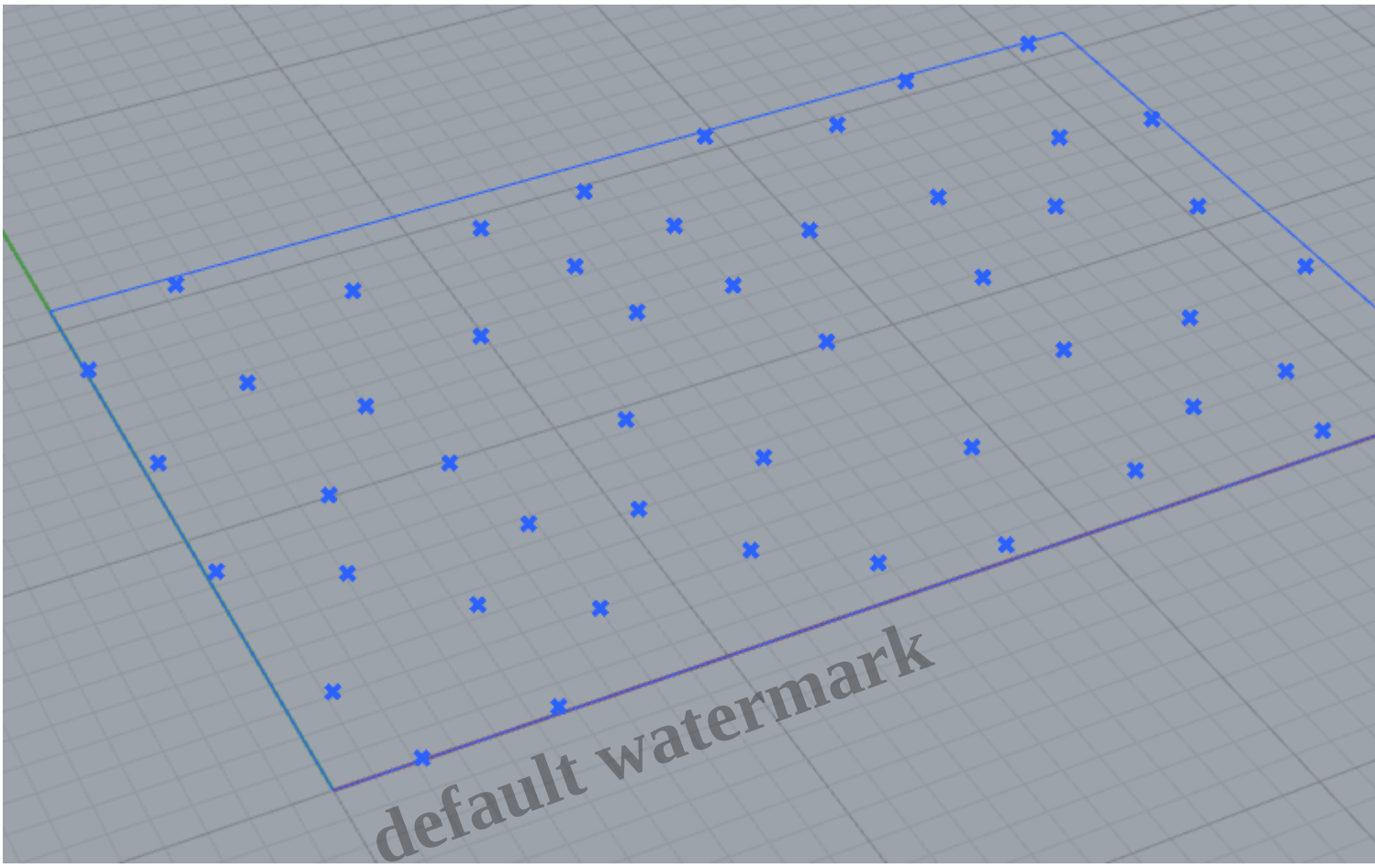


As you see this component produces random points on our *XY-Plane*. And it has an *R-Input* asking for a *Region* to use for its point distribution. Intuition tells you that you'll want to connect your rectangle's *R-Output* to this input. As a result, GH fills your rectangle accordingly:



A tool that distributes objects this way should offer variables for the objects' quantity and distribution pattern. In this case, the according Inputs of our *Populate 2D* component are *N* (for *Count*) and *S* (for *Seed*).

Again, a case for integer *Number Sliders*: Produce 2 more of them and connect them to these *N* and *S* inputs. As a suggestion, for *Count* I chose *1<50<100* and for *Seed 1<25<50*:

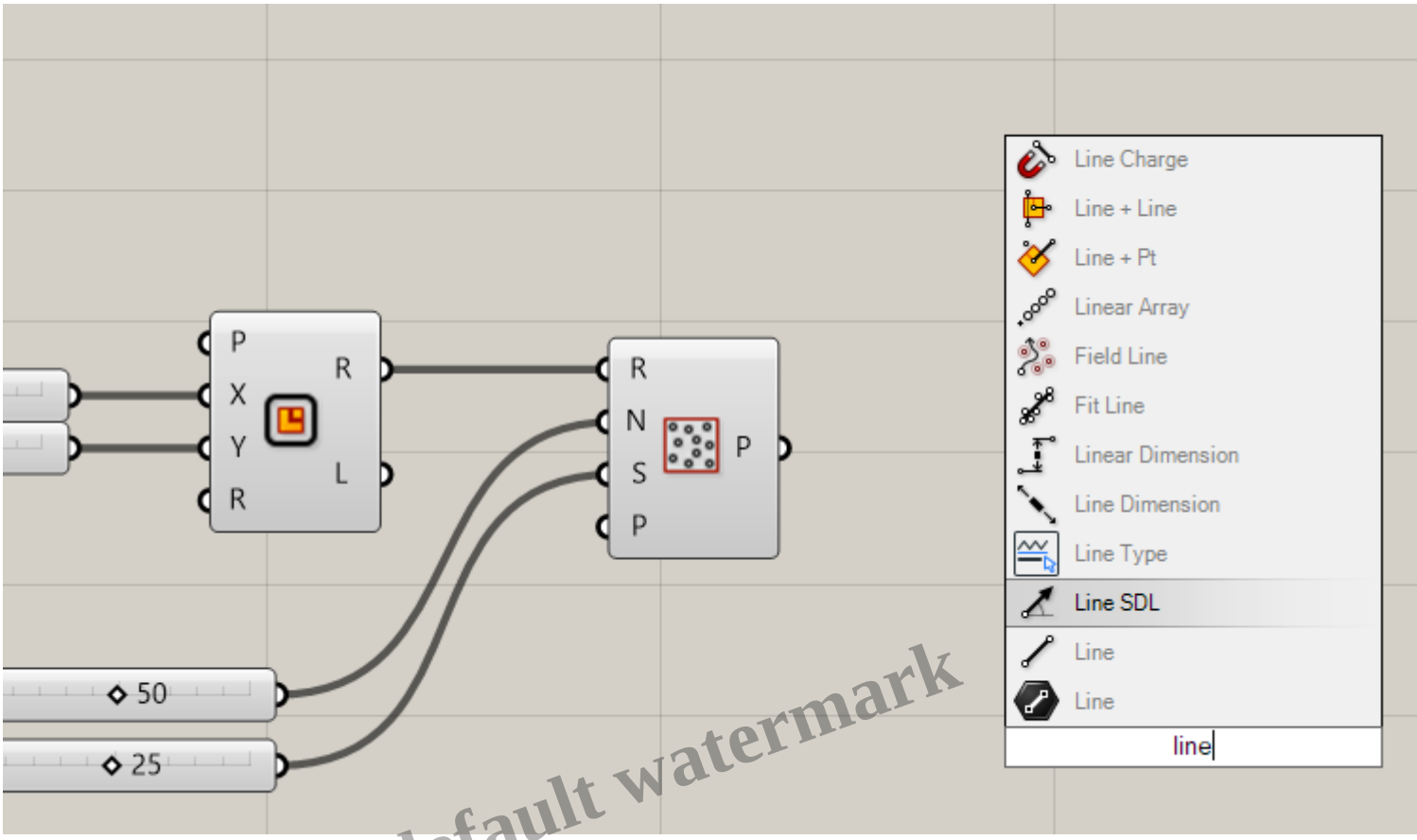


By the way, in case you didn't know: The *Number Sliders* on their left show the names of the inputs they are connected to – automatically.

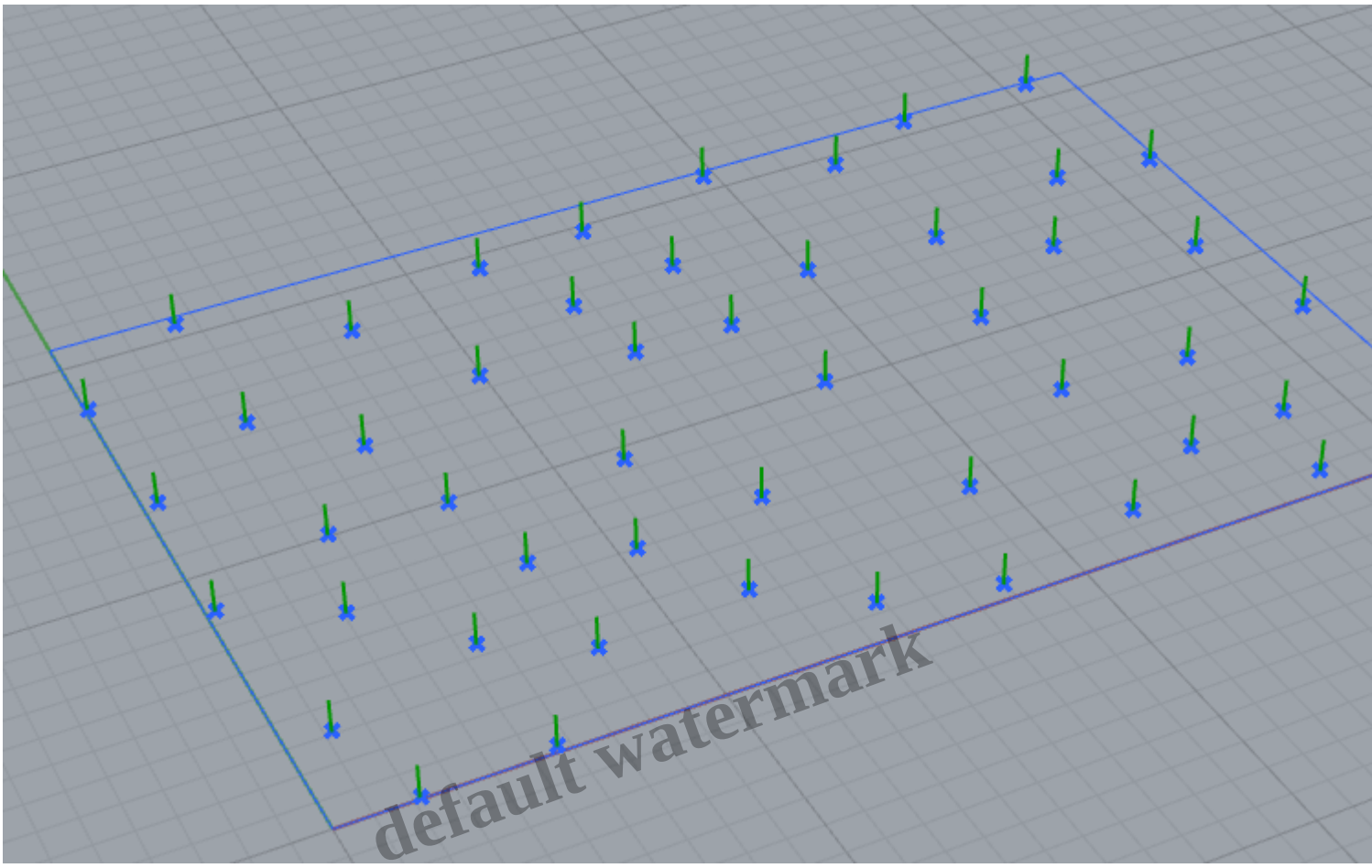
Anyway: Now you may play around with those sliders, producing random point topology on a random-sized base rectangle.

The Cylinder Axes

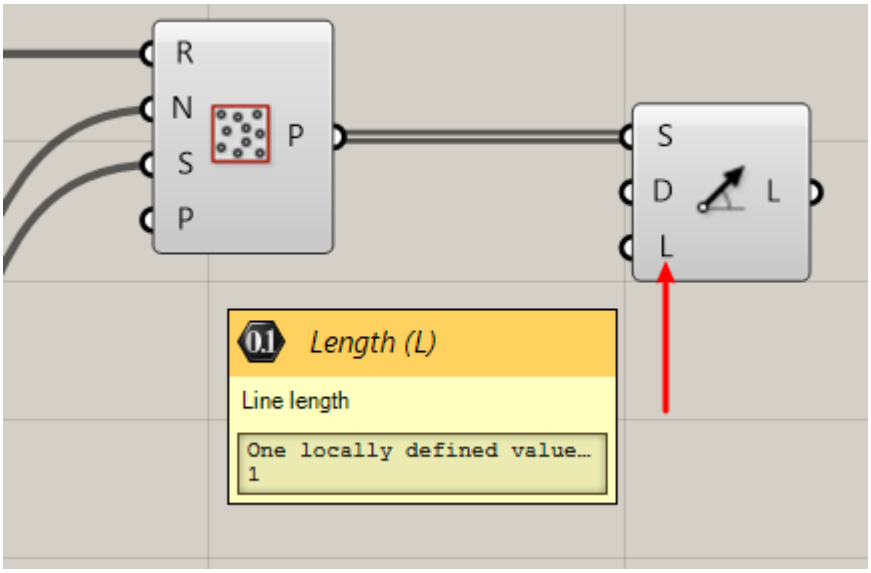
Starting from the points we want to see vertical lines serving as axes for cylinders. So produce a *Line SDL* Component:



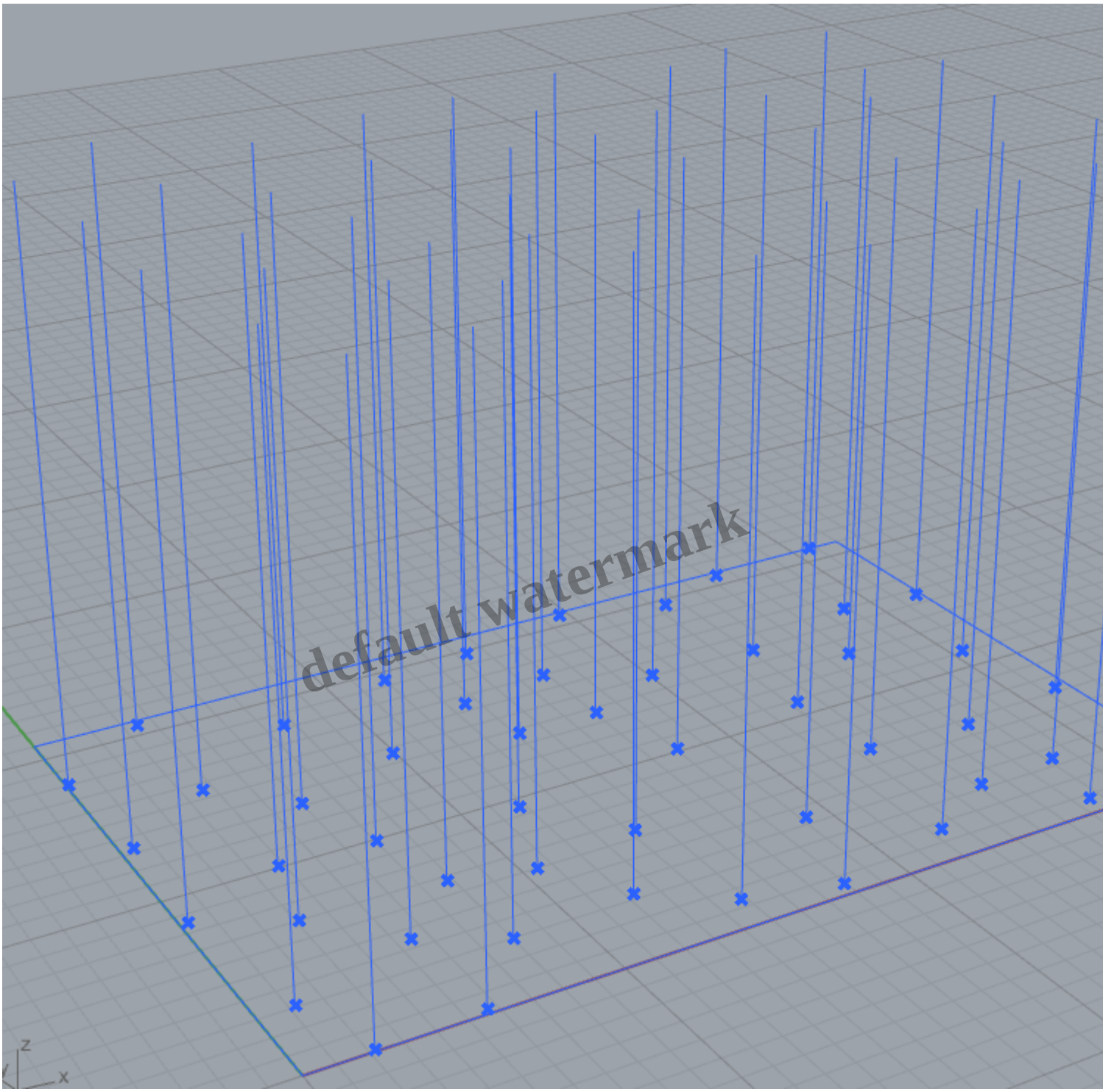
As you can see there a several *Line* components – but *Line SDL* is most suitable for our needs because it requires a *Start Point (S)*, a *Direction (D)* and a *Length (L)* as input. And, as you might imagine, our random points serve as those start points, so connect the *P-Output* of the *Populate* component to the *S-Input* of *Line SDL*. The result is bit disappointing, our cylinder axes appear very short:



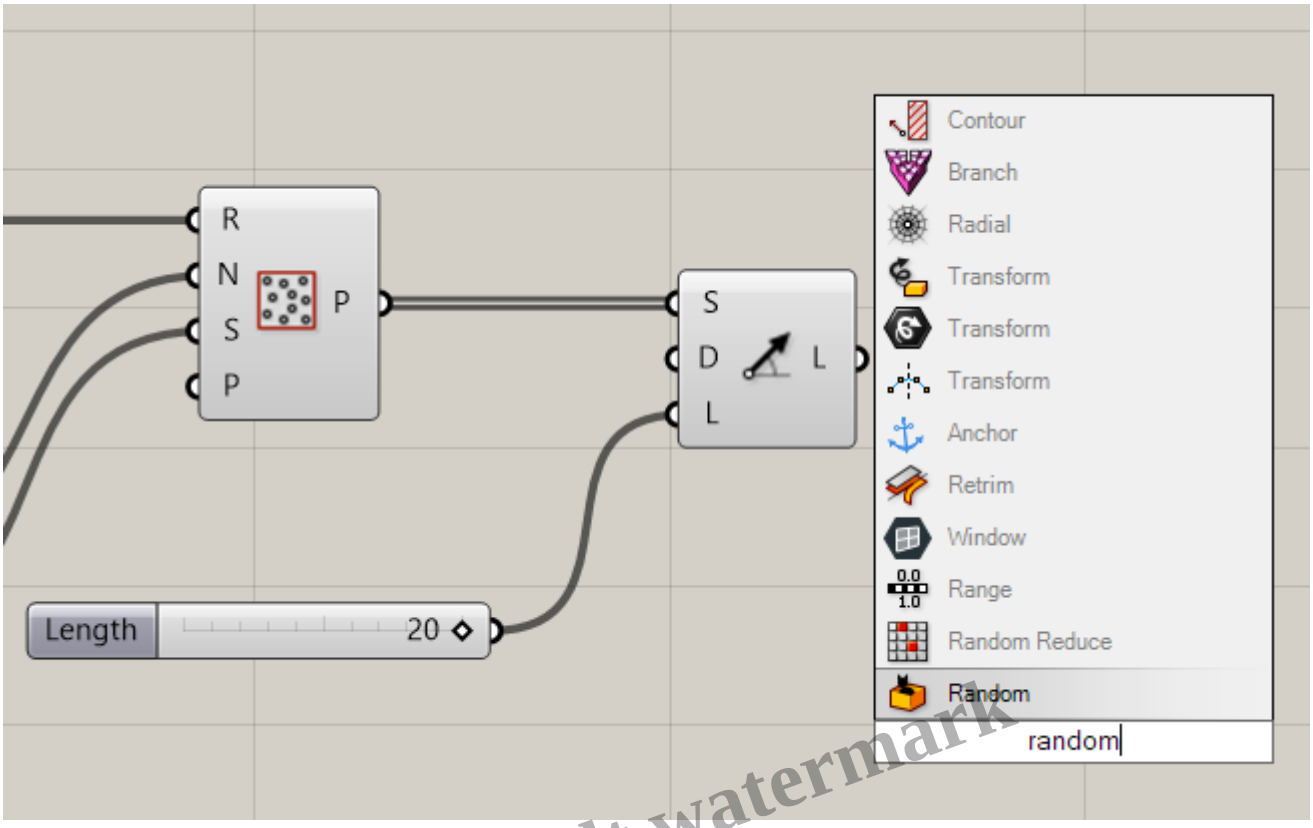
Well, let's do something about that using the *Length* input. When you mouse-hover over the letter *L* Grasshopper tells you the input uses a default value *1:*



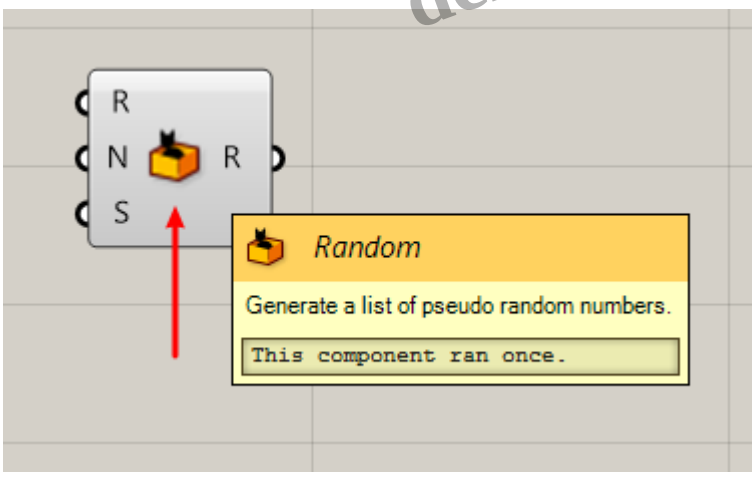
Now obviously *L* could use some more input than that. Place another *Number Slider (1<10<20)* and connect it to *L*. Now you have some decent axes showing up:



You feel the length of the axes could also vary in a random fashion? No problem: Place a *Random* component:

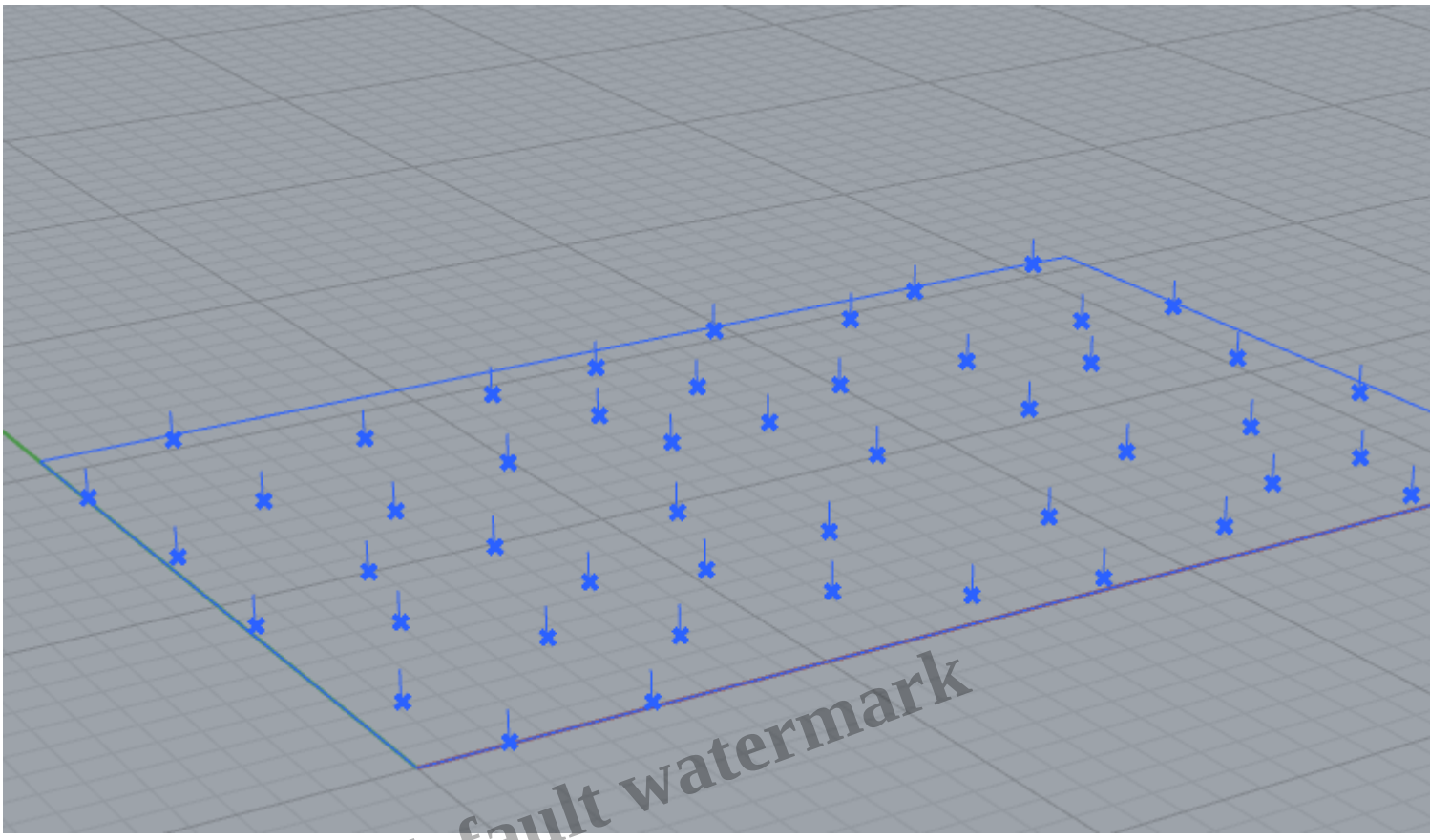


What does it do? It produces a series of random numbers:

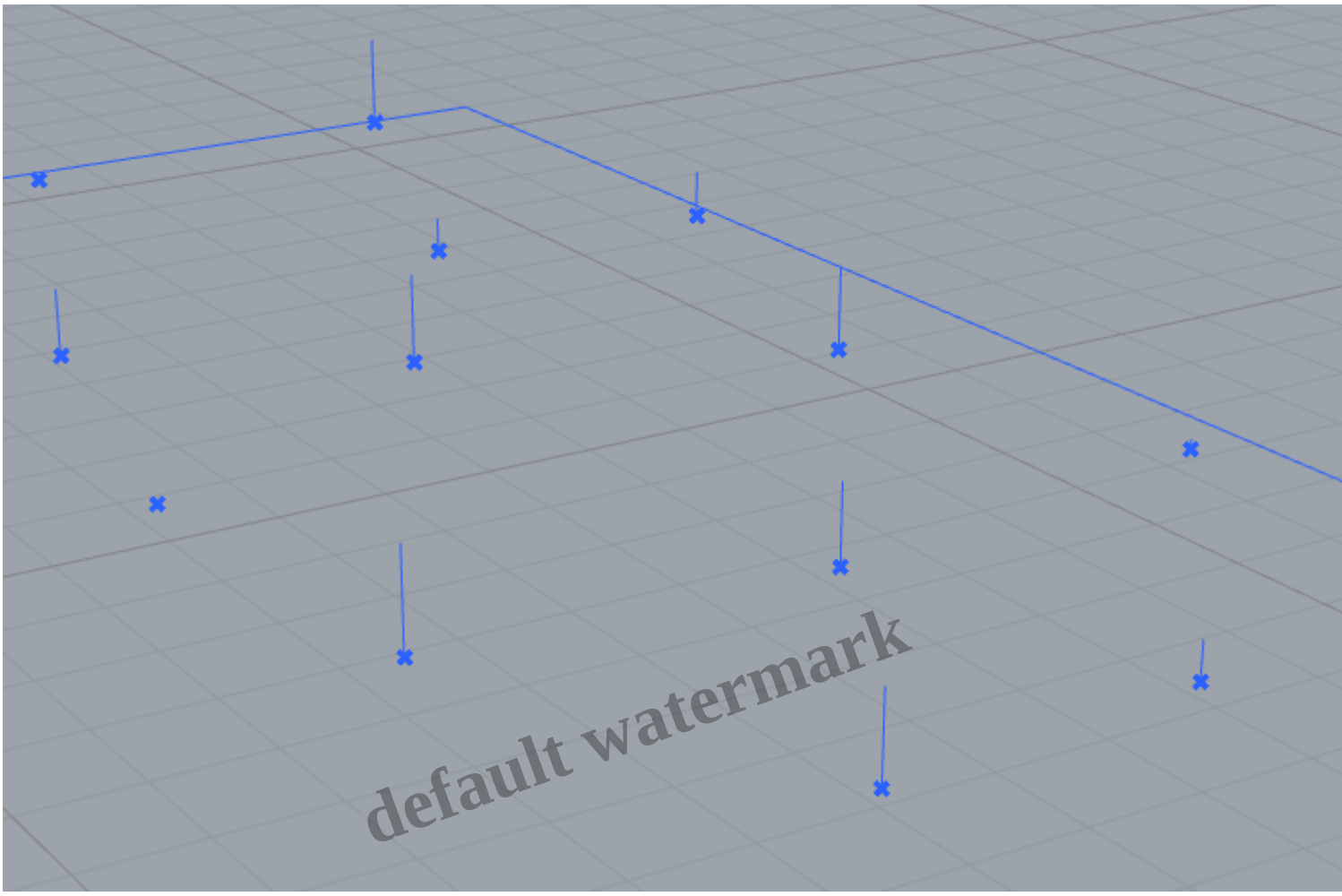


It has 3 inputs: *R (Range of Values), N (Number of Values)* and *S (Seed*, i.e. the random pattern index).

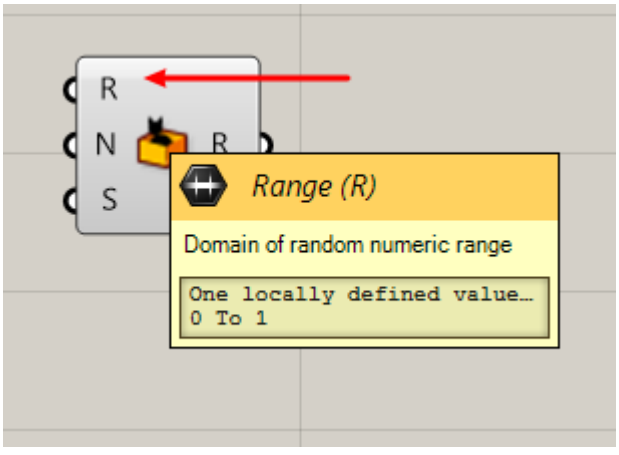
First of all let's connect this *Random* component to our *Line SDL*, via *R* output (*Random*) to *L* input (*Line SDL*). When you do this the *Number Slider* gets disconnected automatically:



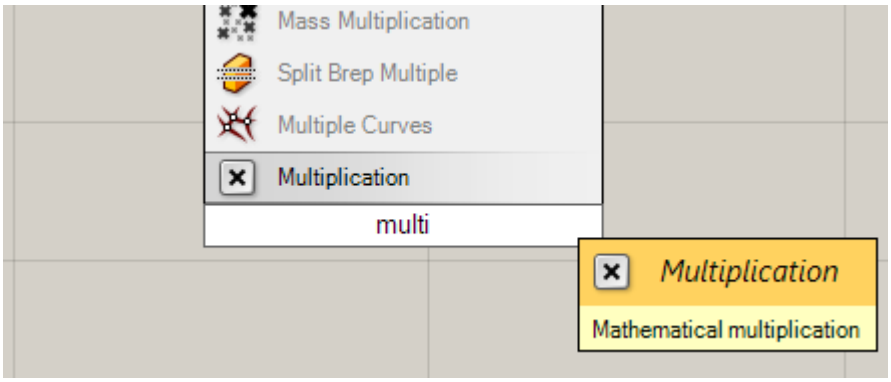
Up to now there is no randomness to be observed, because the *Number* input of our *Random* component is set to *1* (=no Variation). To set higher values you might come up with the idea to have as many variations as you have lines. The solution is to connect the *Populate Count Number Slider* to the *N* input of the *Random* component. Now the line lengths differ:



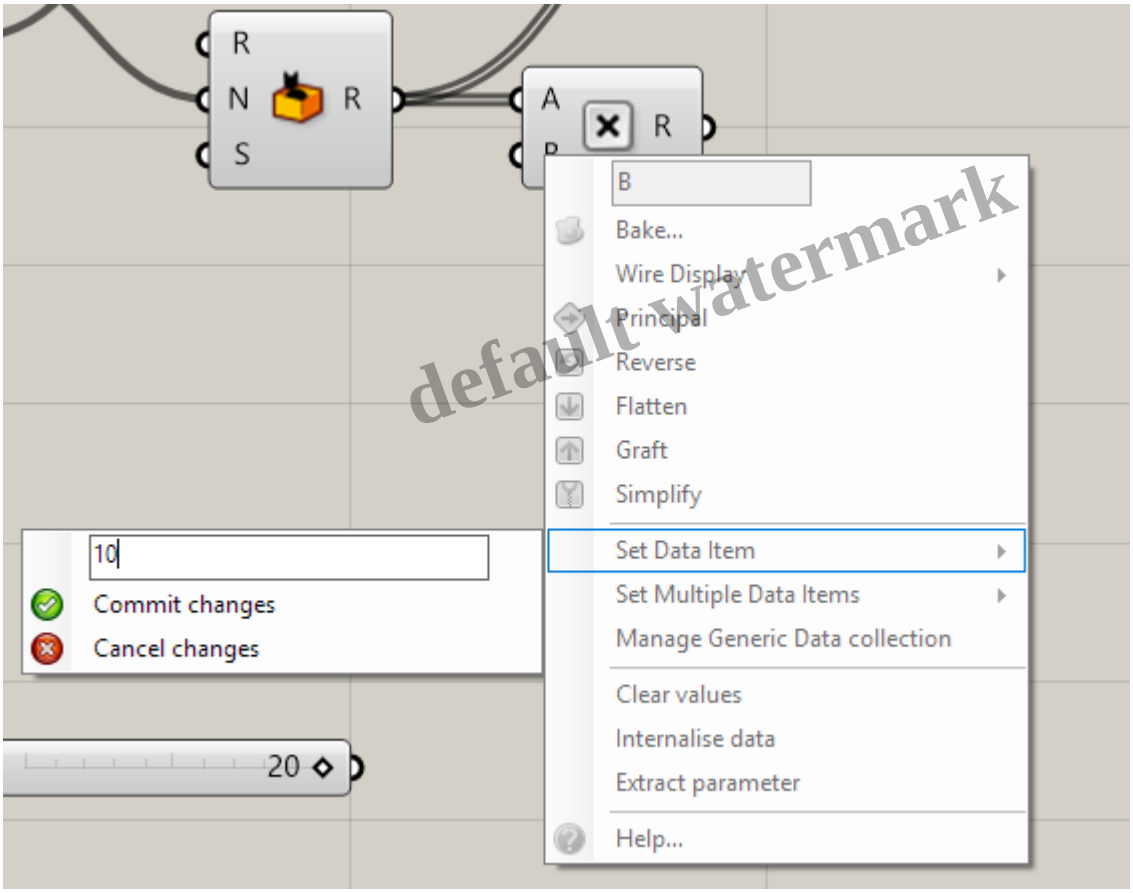
Now for the overall length of the lines. The *Random* component's *Range* default is *0 to 1:*



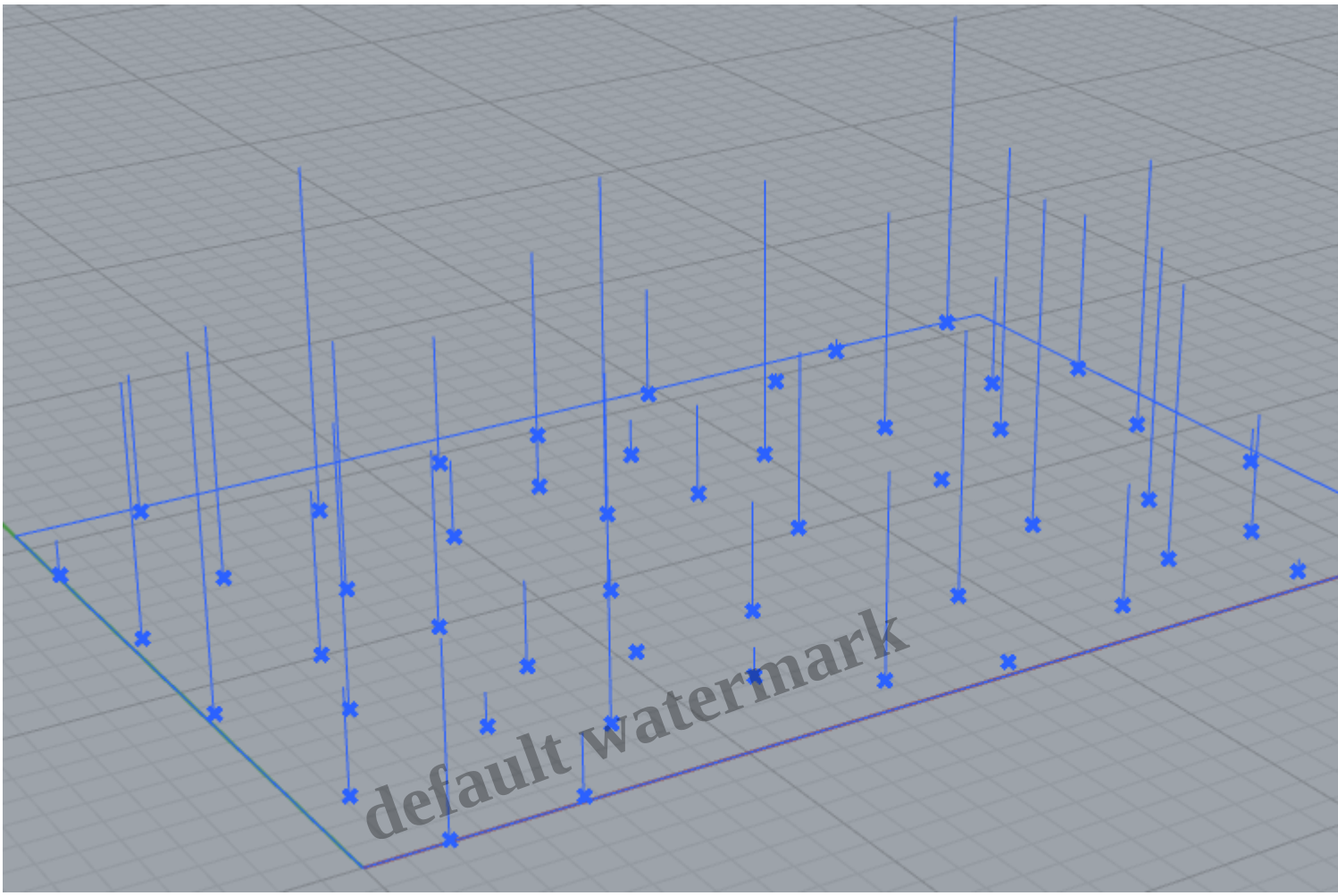
As we see, that produces very short lines. Now instead of changing the *Range* within the *Random* component I suggest using the random values as a factor for a multiplication, i.e. with *10*. In order to do that, produce a *Multiplication* operator:



Plug the *Random* output into the *A* input of the *Multiplication* operator. Set *B* input to *10*, via right-click on *B – Set Data Item:*



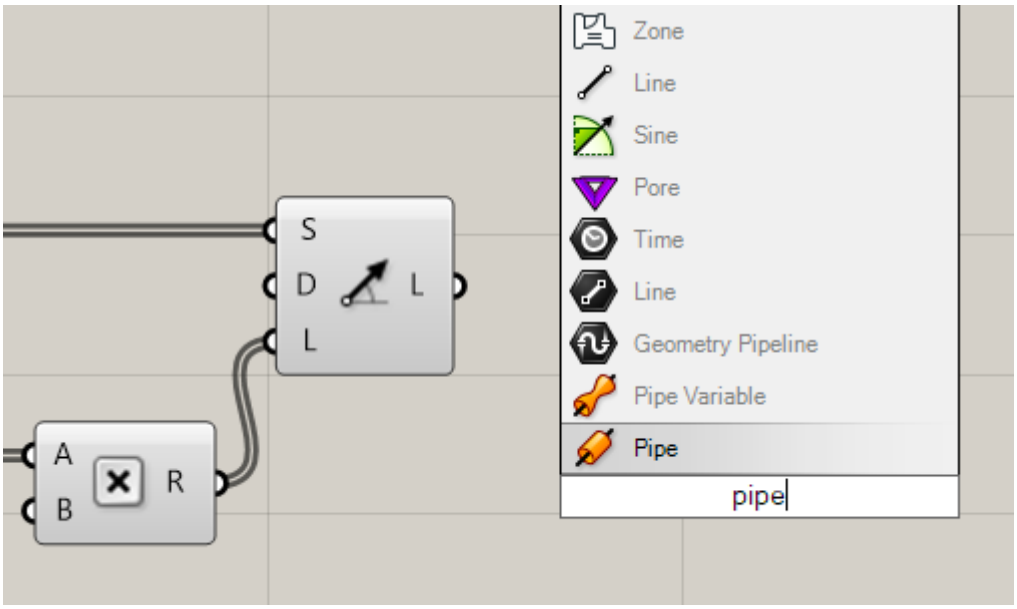
Now to utilize the multiplication result plug the *R* output into the *Line SDL's Length* input:



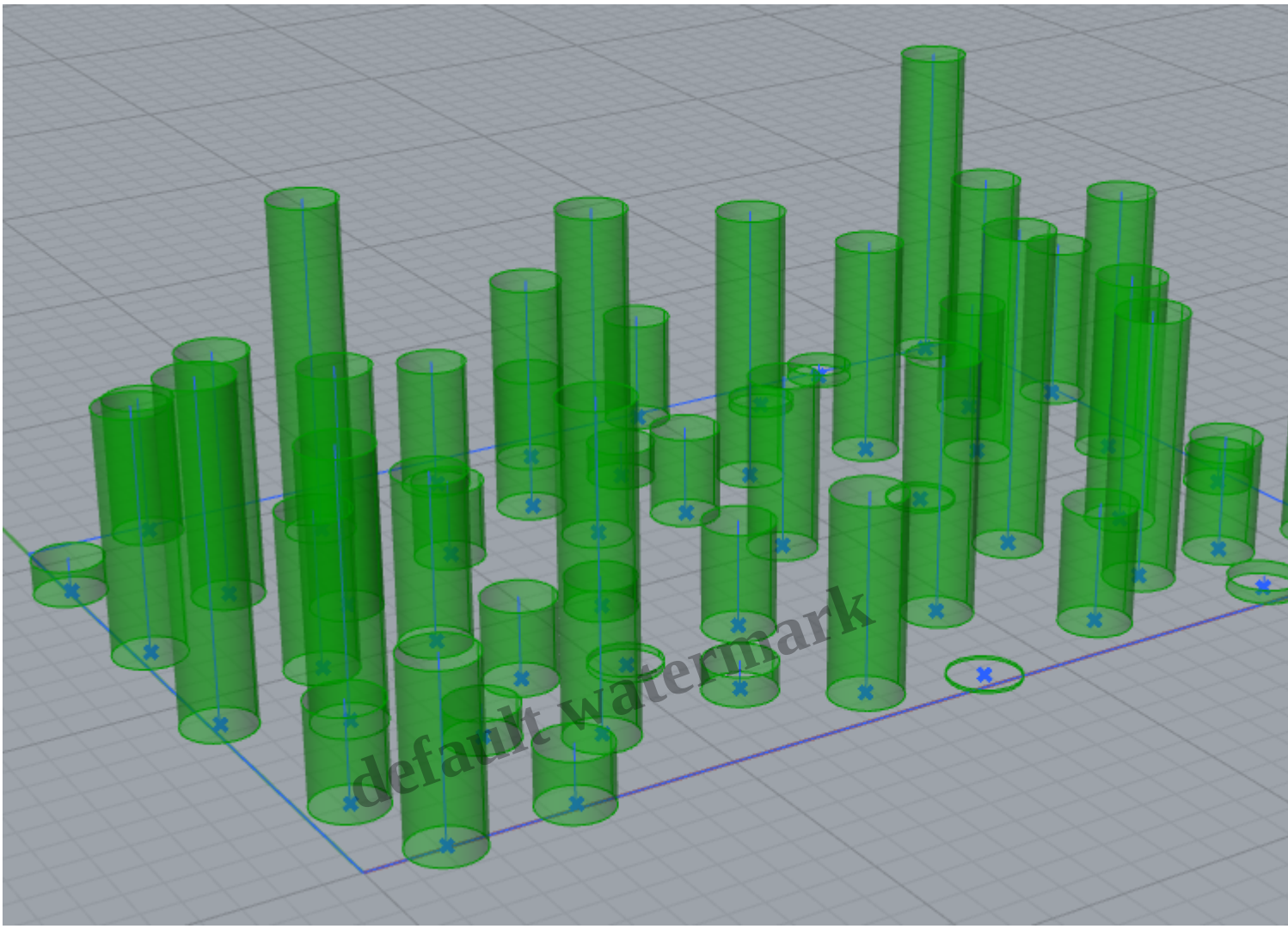
As you see the lines have grown. Staying with the default *Random Range* from *0 to 1* was actually a good thing – by adding a *Multiplication* operator with a suitable *B* value we can scale up our lines as we like.

Finally, the Cylinders

To get some 3D around our lines we use the *Pipe* component:

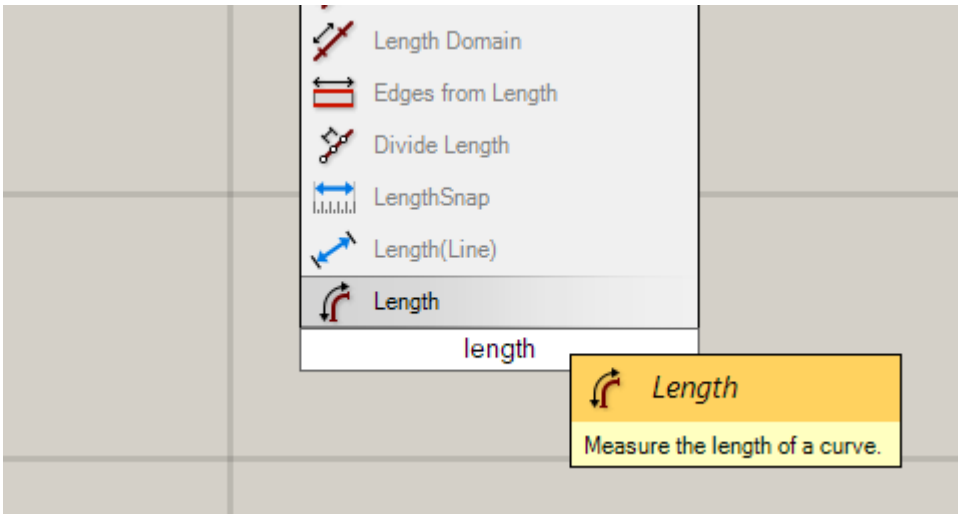


Pipe produces a cylindrical extrusion along a curve. So first of all you'll want to connect the *Pipe's C (Curve)* input to our *Line SDL* output. In Rhino's preview our lines have changed into a bunch of cylinders:

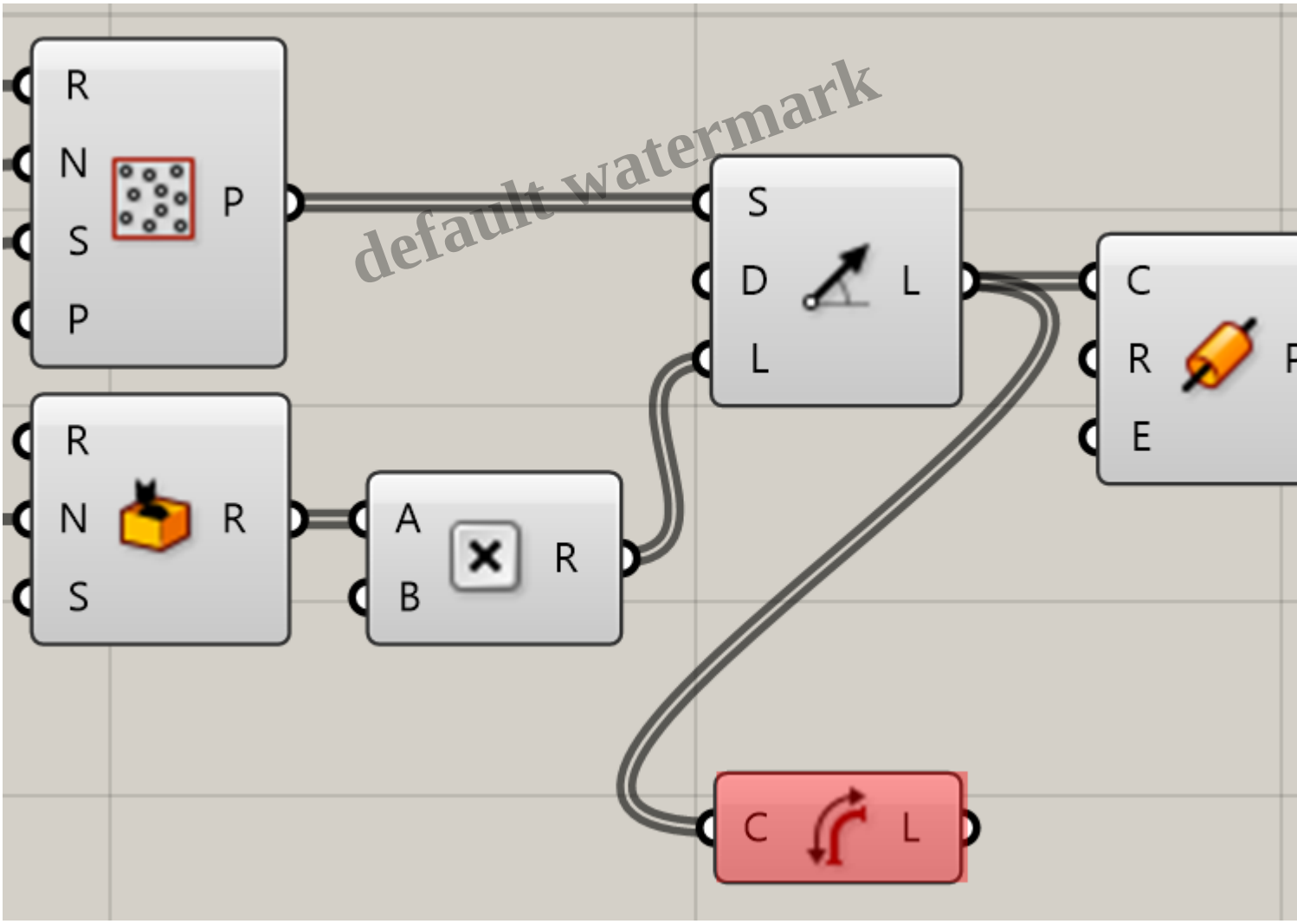


The concept of randomness still demands some work: I want to change the cylinders' radius according to their height. To be more precise, I would like to have each cylinder's radius to be *1/10* of it's height. *R* is the according input of the *Pipe* component. Now what to plug into it?

First of all I need each cylinder's height. The height is represented by our *Line SDL* component. To retrieve it's value I need a *Length* component:

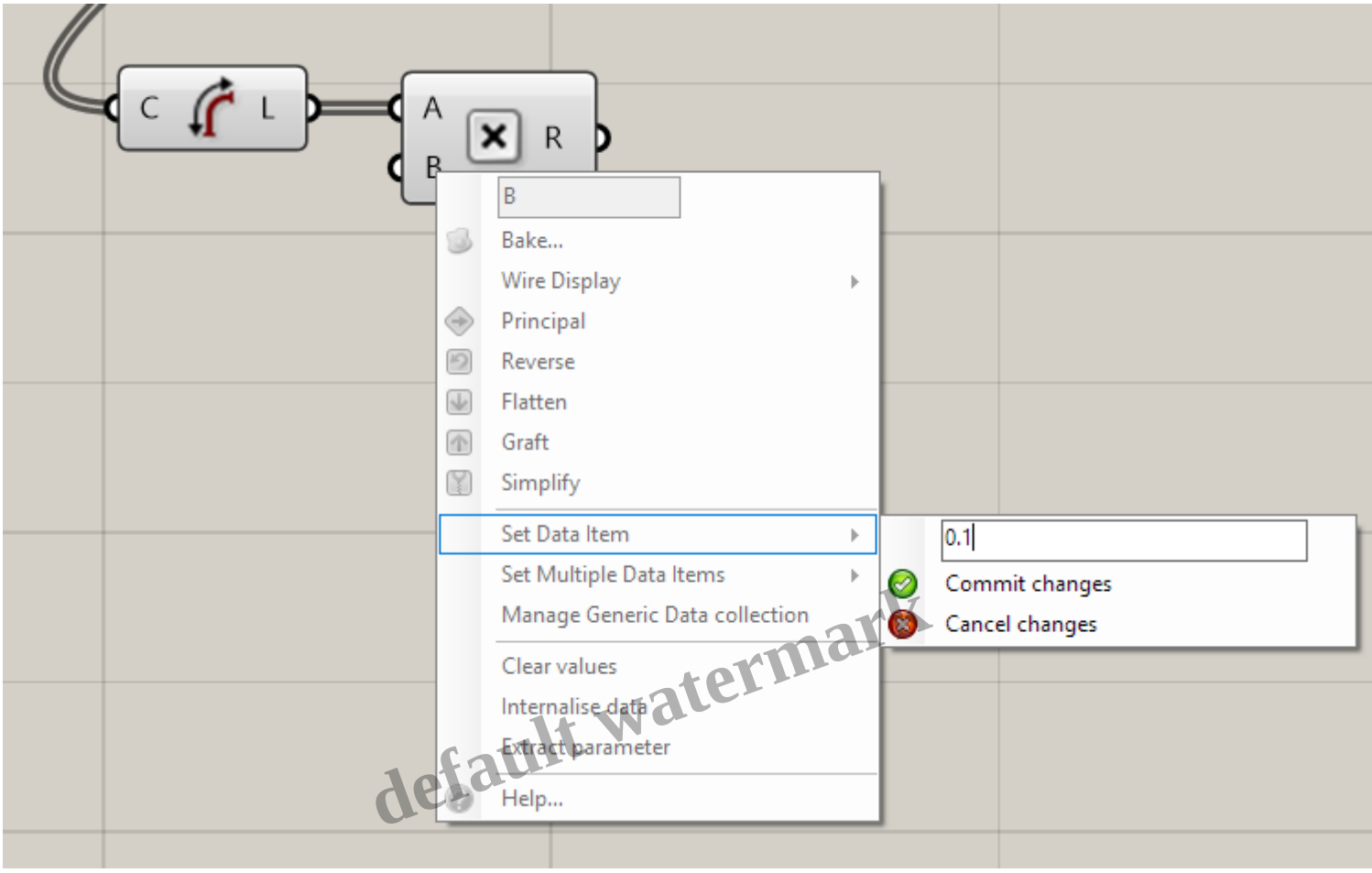


Now plug the *Length* input to the *Line SDL* output:



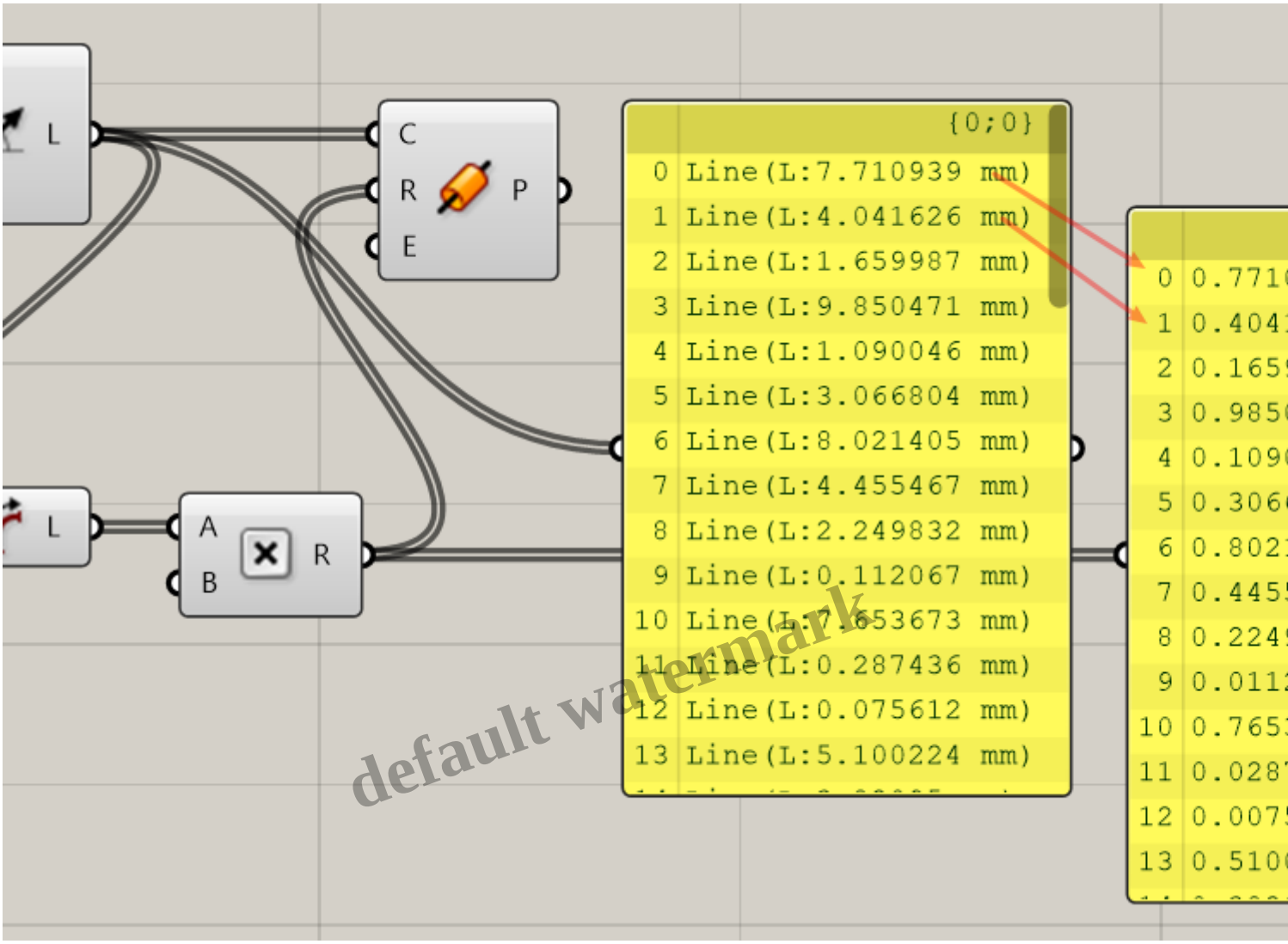
When each cylinder's radius is supposed to be 1/10 of it's height, then we have to divide *Length* by *10*. Or better (at least in my opinion): We use a *Multiplication* again. So produce another *Multiplication*

operator and connect the *Length* output to it's *A* input. Set *B* to *0.1* (right-click – *Set Data Item*):

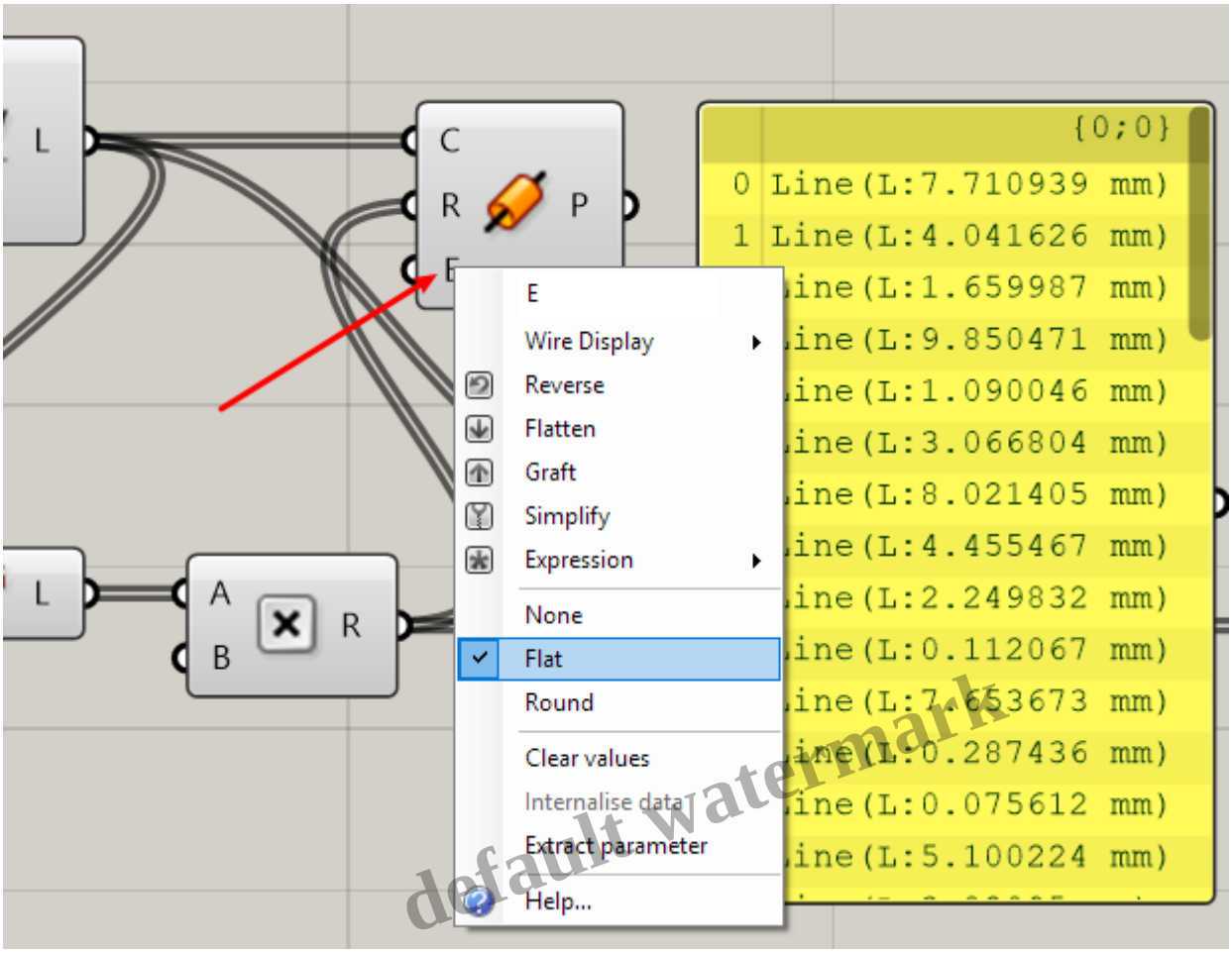


Now when you connect the *Multiplication* output to *Pipe's R* input you see the cylinders' thickness change. For a test, play around with your sliders to see how everything changes accordingly.

To show you the relation between *Line SDL's* output and *Pipe's Radius* input (*10:1*) I added two *Panels* to compare the resulting values:



So everything is fine, just one last thing: The *Pipe* component allows for closing the cylinder surface, via the *E (Caps)* input. For now it's fine to choose *Flat* via right-click:



We could do some more random stuff like slanting the cylinders. For this we would have to deal with the *Line SDL's D* input. To keep things simple and leave something for you to find out yourself however we'll stopp here.

Roundup

There's more to come. Just for now I want you to keep practising. Check also my other article on good Grassshopper learning resources. Feel free to comment!

Category

1. Rhino/Grasshoppper

Tags

1. BIM Model
2. Parametric Modeling

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October 2018
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hsondermanncom