

SmartSpaceAnalyser Help Documentation

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SmartSpaceAnalyser is a highly intuitive tool to perform spatial analysis on a building or urban scale. It allows you to perform distance mapping, visibility analysis and connectivity analysis in seconds. As a Grasshopper plug-in for Rhino, SmartSpaceAnalyser provides real-time interaction in the modelling environment to quickly test a range of scenarios with instant visual feedback.

The component offers functionality in the form of five different analysers:

Distance To - How far away is everything from one or more key locations?

Average Distance - What is the average distance to all locations from all locations?

Visibility - What can I see from my current location?

Field of View - What is directly visible from my current location? What is in my peripheral vision?

Walkability – Where are the most likely pinch points?

Specific details on how to use each of these tools can be found in the separate 'SmartSpaceAnalyser Examples' documentation. More general help on using the SmartSpaceAnalyser tool can be found in this document.

Getting Started

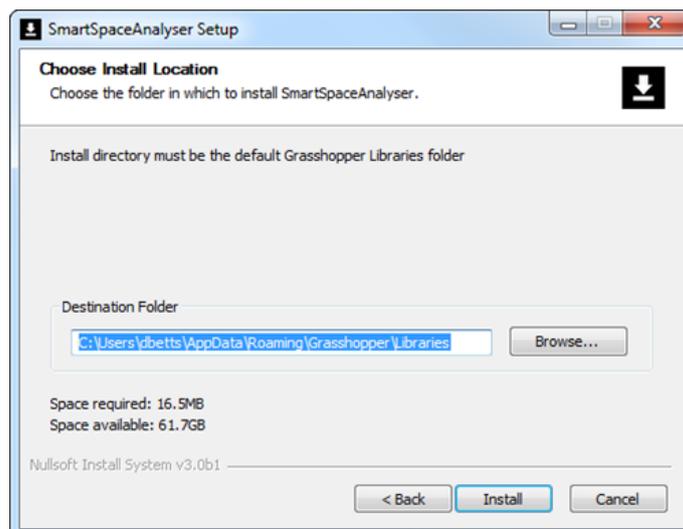
To use SmartSpaceAnalyser, you will need to have Rhino 5 and Grasshopper installed.

Installation

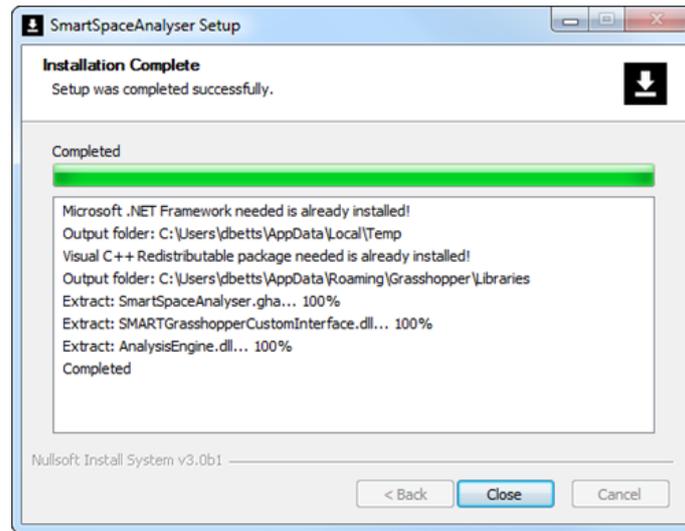
1. Download the SmartSpaceAnalyser (SSA) installer and extract the executable file.
2. Double click the SSA_Intaller_v1.0.exe icon. You may be prompted to accept changes from this publisher, click **Yes**.
3. A window welcoming you to the SSA installer will open. At this point, you will be prompted to close both Rhino 5 and Grasshopper before proceeding with the installation.



4. If both Rhino 5 and Grasshopper are closed, click **Next**.
5. You will be prompted to choose in which folder to install SSA. The default location is the Grasshopper Components folder and should not be changed. Simply click **Install** to begin the installation.

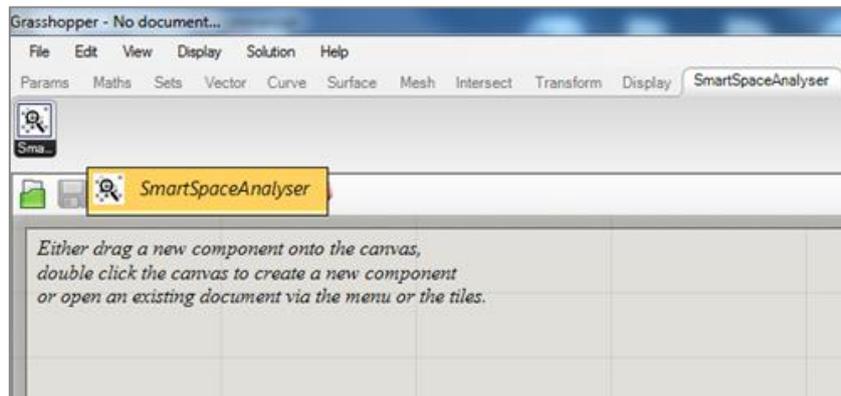


6. If you do not have the correct Microsoft .NET Framework you will be prompted to install it.
7. If you do not have the correct Visual C++ Redistributable Package you will be prompted to install it.
8. You have now completed Installation. If setup was completed successfully, you can view details of the installation process. Click **Close** to exit the installer.



9. Open Rhino 5

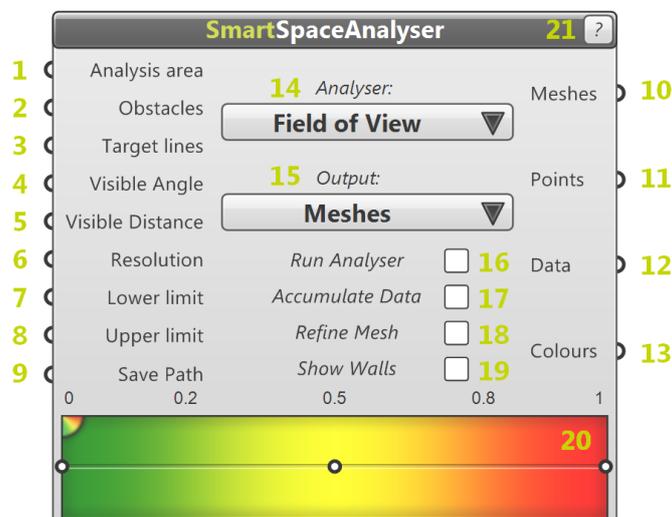
10. Load Grasshopper by typing 'Grasshopper' in the Rhino command line. You should now see the SSA tab in Grasshopper.



You are now ready to start using SmartSpaceAnalyser.

The Component

The inputs required to run SmartSpaceAnalyser and the outputs produced vary depending on the analyser type being used. Below are the definitions of all inputs, outputs and analyser settings.



Inputs

1. Analysis area

Analysis area is an input required by all analysers and defines the area you wish to analyse. The input can be any kind of closed planar curve. Multiple **Analysis areas** can be used simultaneously but each must have its own **Target point / Target line** (see Input 3). All **Analysis areas** must be completely enclosed by an **Obstacle** (see Input 2). This enclosing obstacle can either be the same geometry as the **Analysis area** or a separate set of geometry.

2. Obstacles

Obstacles is an input required by all analysers and is the set of geometry representing all obstacles or objects (e.g. walls, buildings, desks) within your **Analysis area**. The input can be any kind of planar curve. Note that using curved lines will reduce the speed of the analysers – curved lines will be automatically converted to short straight line segments resulting in a higher computational cost for all analysers. Note also that one or more **Obstacles** must enclose your **Analysis area**.

3. Target lines / Target points

The **Target lines / Target points** input will change automatically depending on the **Analyser** type (see Option 14) selected and is needed for all analysers.

Target lines is required for the **Field of view** analyser only and is a straight line or set of lines where the first point of each line represents the position of the observer and the second point defines the direction of view. All **Target lines** must be placed within the **Analysis area**.

Target points is required for all analysers except for **Field of view** and is a point geometry or set of points where each point represents the location of an observer. All **Target points** must be placed within the **Analysis area**.

Top Tip: When multiple targets are added, the analysis result will be calculated for all targets simultaneously to produce a single colour map. To produce a set of images (one for each target) the set of targets must be input as a tree rather than a list. This is done by 'Grafting' the geometry component. Right click on the geometry or point component containing multiple targets and click Graft. The output is now passed as a tree.

4. Visible angle / -

The **Visible angle** input is an optional input that is only available for the **Field of view** analyser. The input is a number in degrees which defines the extent of the observer's view, i.e. a value of 45 would define a field of view of 45 degrees to either side of the **Target line**. The default value is set to 90 degrees and will be used if no input is connected.

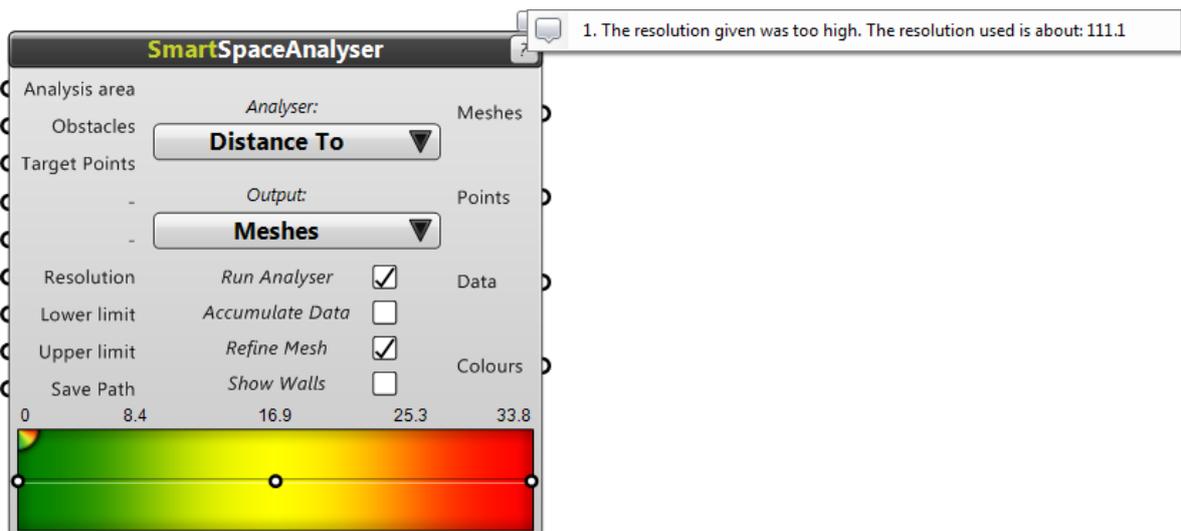
5. Visible distance/ -

The **Visible distance** input is an optional input that is only available for the **Visibility to** and **Field of view** analysers. The input is a number in the units selected for your open Rhino file, defining the extent of the observer's view. By default there is no maximum distance unless specified by the user.

6. Resolution

Resolution is an optional input for all analysers. This adjusts the number of measure points used (measure points per unit area) and therefore the quality of the output colour map. The default value is set to 1 measure point per unit area and will be used if no input is connected.

Top Tip: There is a limit to the number of measure points allowed in any analysis (~100,000). If the combination of **Analysis area** size and **Resolution** would result in greater than 100,000 measure points, **Resolution** is automatically reduced to the highest possible value and a notification is displayed to inform the user of the change in settings.



7. Lower limit

Lower limit is a numerical input defining the lower value of the colour gradient. If no input is provided the lowest value from the data output is used to set the gradient **Lower limit**.

8. Upper limit

Upper limit is a numerical input defining the upper value of the colour gradient. If no input is provided the highest value from the data output is used to set the gradient **Upper limit**.

9. Save path

Save path is an optional input available for all analysers. If a save path is provided the component will save a capture of the active viewport in Rhino for every new output created. The captures will be saved in the folder of your choice. The input is text, for example from a panel component, containing the full path of the destination folder, e.g. C:\Users\\Desktop\Frames".

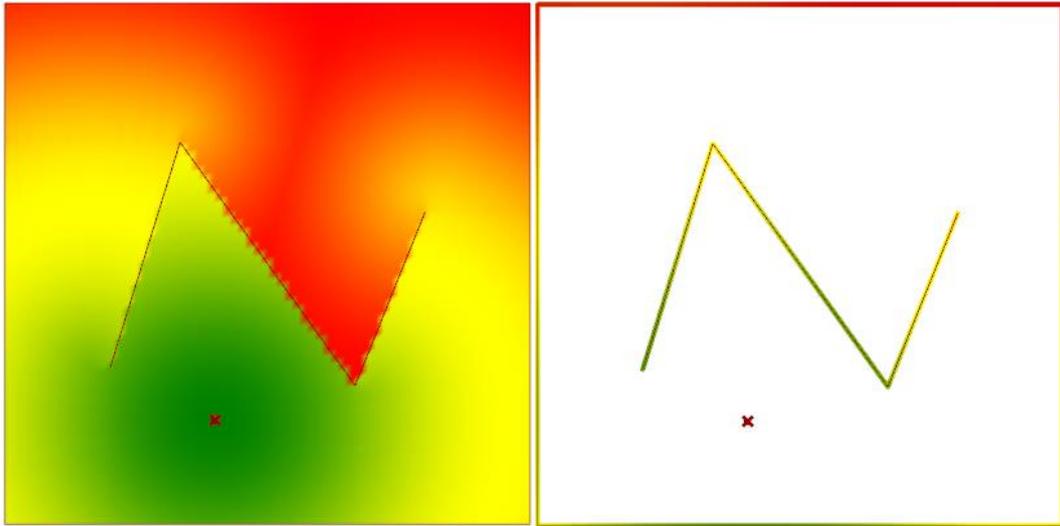
Outputs

10. Meshes / Obstacles

The geometry output is dependent on the specified **Output** type.

If **Meshes** is selected as the **Output** type, a single mesh will be provided as the output. The mesh will be coloured by the vertices to produce a smooth continuous colour map.

If **Obstacles** (D) is selected as the **Output** type, a list of line segments will be provided as the output representing the set of obstacles that are to be coloured.



11. Points

Points provides a list of the $[x, y, z]$ coordinates of all the measure points used for the analysis. For each point there will be a corresponding data value (**Data**) and colour (**Colours**).

12. Data

Data provides a list of data values for all the measure points used for the analysis. For each **Data** value there will be a corresponding coordinate (**Points**) and colour (**Colours**).

13. Colours

Colours provides a list of colours for all the measure points used for the analysis. For each **Colours** value there will be a corresponding coordinate (**Points**) and data value (**Colours**).

Options

14. Analyser

Select the analysis type to be run using the **Analyser** drop-down menu – **Distance to**, **Distance average**, **Visibility to**, **Field of view** or **Walkability**. See the individual sections of Examples documentation for details of each analyser.

When changing between **Analyser** types, the **Run Analyser** check box will automatically be unchecked to avoid unwanted analysis from starting. When changing between **Field of view** and any other **Analyser** type, be aware that the **Angle** and **Target point / Target line** inputs will change type.

15. Output

Select the type of geometry to be output using the **Output** drop down menu – **Meshes** or **Obstacles**. For details on the different output geometries see Output 10.

16. Run analyser

When the **Run Analyser** check box is un-ticked, changes can be made to the model and component inputs without analysis being recomputed. When the box becomes ticked the analysis begins. While the box remains ticked, any changes to the component inputs will restart the analysis.

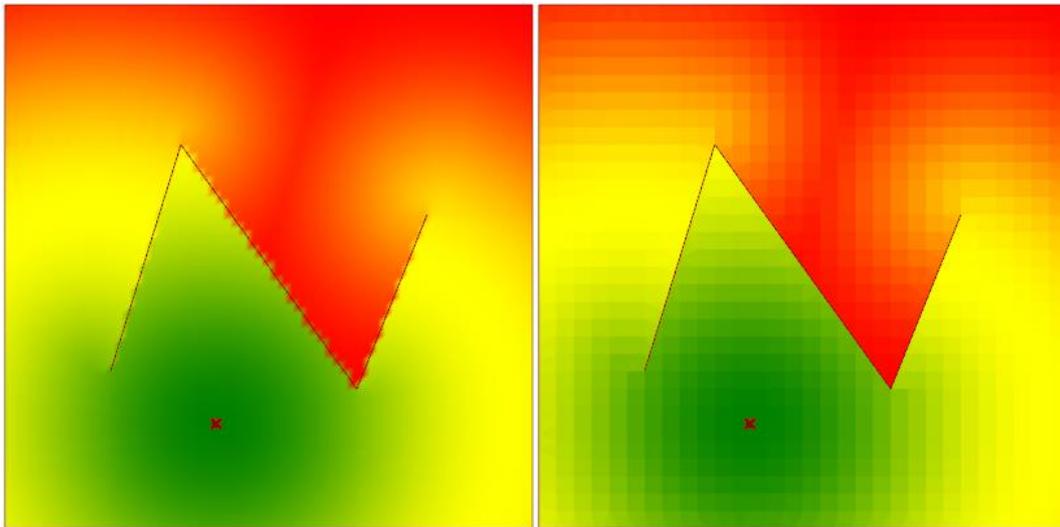
Top tip: If you start an analysis which you decide you would like to stop before completion, press escape at any time during the computation.

17. Accumulate Data

Multiple target points/lines can be specified (see Input 3) which can either be treated as multiple targets for one single analysis or as a list of targets to be considered one after the other in a series of analysis runs. In the latter case, if **Accumulate Data** is unticked, each new result will replace the previous result. If **Accumulate Data** is ticked then each new result will be added to the previous result. For example, for a **Visibility to** analysis, the final result with multiple target points using **Accumulate Data** would be an image showing areas coloured based on whether they were visible during any of the analysis runs.

18. Refine Mesh

When using the Output type Surfaces, the refine mesh button can be used to improve the quality of the mesh along boundaries and obstacles. When **Refine Mesh** is unticked the colour map will be displayed as a uniform grid of individually coloured squares (left below), when **Refine mesh** is ticked the colour map will be displayed using a mesh which matches the shape of obstacles (right below). While this option does improve the quality of the output, it will also increase computation time.



19. Show Walls

The **Show Walls** option provide a clear visual in the Rhino viewport (green line) of the set of obstacles.

20. Gradient

The **Gradient** tool makes use of an existing Grasshopper gradient component. The **Lower limit** and **Upper limit** for the colour gradient are controlled by Inputs 7 and 8. Double clicking one of the 'grips' at either end of the gradient allows you to change the colour to the left or right of the gradient range – this can be particularly useful for setting the colour for inaccessible sections of a model. Many other features for the colour gradient can be controlled using the following Grasshopper documentation tips:

- You can activate the Gradient Editor by double clicking on a Gradient control. The Gradient Editor allows you to alter the colours and position of each grip.
- By default, colours between grips are interpolated smoothly. If you change the Gradient type to Linear, the colour transitions across grips will become sharp.
- If you lock a gradient, you will no longer be able to drag the grips. If you want to change a locked gradient, you can either unlock it temporarily or use the Gradient Editor, which is never locked.
- You can alter the position of a grip without the Gradient Editor by dragging it along the Gradient rail.
- You can alter the colour of a grip without the Gradient Editor by right clicking on the grip.
- You can add new grips by clicking and dragging from the spectrum icon in the upper left corner. New grips are assigned a random colour, but once you place it on the rail, a colour menu will pop up automatically.
- You can remove grips by dragging them off the gradient area.

21. Info Button

Further information can be accessed by clicking on the info button at the top of the component.

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